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MINES BRANCH
EUGENE HAANEL, PH.D., DIRECTOR

THE
PRODUCTION OF COPPER, GOLD, LEAD, NICKEL
SILVER, ZINC, AND OTHER METALS

IN
CANADA

During the Calendar Year

1917
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*Advance Chapter of the Annual Report on the
Mineral Production of Canada, 1917*



OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1919



LETTER OF TRANSMITTAL.

Dr. EUGENE HAANEL,
Director, Mines Branch,
Department of Mines,
Ottawa.

SIR,—The accompanying report on “the production of Copper, Gold, Lead, Nickel, Silver, Zinc, and other metals in Canada during the Calendar Year 1917,” which is submitted for publication as an advance chapter of the Annual Report on the Mineral Production of Canada, 1917, has been compiled, under direction, by Arthur Buisson, B.Sc., Assistant Mining Engineer in this Division.

I have the honour to be, Sir,

Your obedient servant,
(Signed) **John McLeish.**

Division of Mineral Resources and Statistics.
1918.

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**ADVANCE CHAPTER OF THE ANNUAL REPORT ON THE MINERAL
PRODUCTION OF CANADA, DURING THE
CALENDAR YEAR 1917.**

*(Tons used throughout this report are short tons of 2,000 pounds, except where
otherwise stated.)*



ALUMINIUM.

No commercial ores of aluminium have as yet been found in Canada. Aluminium is, however, made in extensive works at Shawinigan Falls, Quebec, from bauxite ores imported from France, the United States, and also formerly from Germany, by the Northern Aluminium Company. A wire mill for the manufacture of aluminium wire and cables is also operated by the same firm.

There being but one firm engaged in the manufacture of aluminium we are precluded from publishing statistics of production.

Imports of alumina, probably including bauxite, and exports of aluminium are, however, published in the reports of the Department of Customs.

During the twelve months ending December 31, 1917, the imports of alumina were 174,307,800 pounds, or 87,154 tons valued at \$1,866,240, as against 53,819,000 pounds, or 26,910 tons valued at \$1,114,061 in 1916.

The imports of aluminium in ingots, bars, tubes, etc., were in 1917, 702,952 pounds, or 351.5 tons, valued at \$319,680, besides manufactures of aluminium valued at \$240,801 or a total value of \$560,481, compared with 1,355,503 pounds, or 678 tons, valued at \$526,646, besides manufactures of aluminium valued at \$144,452, or a total of \$671,098 in 1916.

The exports of aluminium in ingots, bars, tubes, etc., in 1917, amounted to 22,324,600 pounds or 11,162 tons valued at \$7,620,953, together with manufactures of aluminium valued at \$17,165, as against 18,425,300 pounds, or 9,213 tons valued at \$5,201,066, and manufactures valued at \$26,780 in 1916.

Annual Imports of "Alumina" and Exports of Aluminium.

| Calendar Year. | Imports of Alumina. | | Exports of Aluminium. | | |
|----------------|---------------------|------------|-----------------------|------------|---------------|
| | Pounds. | Value. | Ingots, Bars, etc. | | Manufactures. |
| | | | Pounds. | Value. | Value. |
| 1905 | 5,360,800 | \$ 138,735 | 2,535,386 | \$ 508,219 | \$ 1,588 |
| 1906 | 8,975,400 | 239,136 | 4,521,486 | 899,113 | 2,244 |
| 1907 | 12,705,300 | 268,502 | 5,473,203 | 1,109,353 | 1,499 |
| 1908 | 1,485,500 | 29,752 | 1,713,800 | 399,785 | 1,727 |
| 1909 | 11,794,100 | 234,544 | 6,134,500 | 918,195 | 3,453 |
| 1910 | 19,464,400 | 403,283 | 7,722,400 | 1,160,242 | 3,741 |
| 1911 | 18,607,200 | 372,009 | 4,990,100 | 747,557 | 1,555 |
| 1912 | 22,400,500 | 448,061 | 18,285,700 | 2,092,363 | 10,898 |
| 1913 | 30,704,200 | 614,713 | 13,015,000 | 1,762,211 | 8,203 |
| 1914 | 28,557,000 | 571,419 | 14,510,800 | 2,364,907 | 5,671 |
| 1915 | 35,016,200 | 892,634 | 18,680,800 | 3,333,726 | 620,562 |
| 1916 | 53,819,000 | 1,114,061 | 18,425,300 | 5,201,066 | 26,780 |
| 1917 | 174,307,800 | 1,866,240 | 22,324,600 | 7,620,953 | 17,165 |

Annual Imports of Aluminium.

| Year. | Ingots, Blooms, Bars. | | Tubing. | | Manufac- tures. | Leaf or foil (a). | Total value. |
|-------|-----------------------|------------|---------|----------|--------------------|-------------------------|-----------------|
| | Pounds. | Value. | Pounds. | Value. | | | |
| 1910 | 3,180,250 | \$ 674,683 | 10,019 | \$ 4,203 | \$ 77,664 | \$ 756,550 | |
| 1911 | 2,527,120 | 551,273 | 3,594 | 1,495 | 115,228 | 648,046 | |
| 1912 | 2,396,375 | 410,022 | 11,624 | 3,654 | 120,029 | 533,705 | |
| 1913 | 3,455,636 | 604,582 | 19,856 | 9,174 | 131,938 | 745,694 | |
| 1914 | 3,796,353 | 745,855 | 15,775 | 6,898 | 103,143 | \$ 4,455 | |
| 1915 | 2,661,117 | 630,504 | 6,238 | 2,998 | 83,281 | 5,452 | |
| 1916 | 1,350,445 | 523,564 | 5,018 | 3,082 | 95,408 | 49,044 | |
| 1917 | 698,046 | 316,591 | 4,906 | 3,089 | 137,636 | 103,165 | |

(a) Not given separately, previous to 1914.

Prices.—The price of aluminium ingot No. 1 grade was around 37 cents per pound in the first quarter and around 38 cents for the balance of the year. Spot sales by scrap dealers, or re-sales in small quantities were generally made at a price ranging from 55 to 60 cents per pound. In March 1918, the War Industries Board of the United States of America fixed the price at a maximum base price of 32 cents per pound.

Average Monthly Prices of Ingot Aluminium. ¹

(At New York in cents per pound.)

| | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|----------------|-------|-------|-------|-------|-------|-------|
| January..... | 19.13 | 26.31 | 18.81 | 19.08 | 55.00 | 60.77 |
| February..... | 19.44 | 26.04 | 18.81 | 19.22 | 58.00 | 59.00 |
| March..... | 19.58 | 27.05 | 18.50 | 19.00 | 60.25 | 59.00 |
| April..... | 20.38 | 27.03 | 18.16 | 18.88 | 59.50 | 59.92 |
| May..... | 21.69 | 26.44 | 17.95 | 22.03 | 59.00 | 59.84 |
| June..... | 22.83 | 24.68 | 17.75 | 30.00 | 61.50 | 60.00 |
| July..... | 23.50 | 23.38 | 17.66 | 32.38 | 60.20 | 55.48 |
| August..... | 24.38 | 22.70 | 19.88 | 34.50 | 60.00 | 48.88 |
| September..... | 25.13 | 21.69 | 19.94 | 47.75 | 61.88 | 43.64 |
| October..... | 26.25 | 20.13 | 18.50 | 50.00 | 65.05 | 38.90 |
| November..... | 26.56 | 19.35 | 18.00 | 57.75 | 65.12 | 37.22 |
| December..... | 25.75 | 18.88 | 18.96 | 57.13 | 63.00 | 36.40 |
| | 22.01 | 23.64 | 18.63 | 33.98 | 60.71 | 51.59 |

These quotations of prices reflect transactions in the market for uncontracted supplies, which is mainly in metal offered for re-sale, including ingots remelted for scrap. The bulk of the aluminium production enters consumption on long terms contracts. Previous to the war the differences between the contractual and the open markets were not very great, but since the beginning of the war they have been very large.

¹ From the *Engineering and Mining Journal*, January 12, 1918.

Prices.—Early in 1917 the price slowly advanced, reaching a maximum of 36 cents per pound on March 29th, then it receded gradually to a minimum of 13½ cents on November 13th.

The collapse of Russia as a fighting force was a great factor in reducing the price by cutting down the production of shrapnel bullets, which were in much demand on the Russian front.

In 1916, Canada, as reported by the "Engineering and Mining Journal", used a large quantity of antimony but there had been no demand from Canada for some time. Indeed during the last few months antimony bought by Canadian munition makers for their own requirements was found to be unnecessary, and some of it crossed into the United States.

Average Prices of Antimony.*

(In cents per pound.)

| | 1914. | | | 1915. | | 1916. | 1917. |
|-----------------|------------|-------------------|---------------------------|------------|---------------------------|---------------------------|---------------------------|
| | Cookson's. | U.S. ¹ | Ordin-aries. ² | Cookson's. | Ordin-aries. ² | Ordin-aries. ² | Ordin-aries. ² |
| January | 7.388 | 7.110 | 6.125 | 17.90 | 15.85 | 42.45 | 17.29 |
| February | 7.250 | 7.057 | 6.100 | 21.25 | 18.21 | 44.31 | 29.80 |
| March | 7.315 | 7.073 | 6.053 | 28.75 | 22.13 | 44.75 | 32.89 |
| April | 7.363 | 7.048 | 6.006 | 31.88 | 24.88 | 42.06 | 34.04 |
| May | 7.365 | 7.020 | 6.845 | 42.70 | 35.30 | 31.60 | 25.20 |
| June | 7.250 | 7.000 | 5.825 | 47.50 | 37.69 | 20.05 | 19.51 |
| July | 7.210 | 6.940 | 5.638 | 50.44 | 38.13 | 14.70 | 15.83 |
| August | 17.250 | 15.800 | 13.800 | 48.00 | 33.00 | 11.53 | 15.06 |
| September | 11.830 | | 9.940 | 44.56 | 28.63 | 11.81 | 14.94 |
| October | 14.680 | | 12.060 | 45.50 | 31.45 | 12.70 | 14.75 |
| November | 17.750 | | 14.450 | 47.25 | 38.88 | 13.84 | 13.91 |
| December | 16.130 | | 13.310 | 55.00 | 39.25 | 14.59 | 15.06 |
| | 10.732 | | 8.763 | 40.06 | 30.28 | 25.37 | 20.69 |

¹ United States brands.

² Hungarian, Chinese, or other "Foreign" brands.

* As given by the "Engineering and Mining Journal."

Antimony is reported¹ smelted in the United States by the following firms:—

Magnolia Metal Co., 115 Bank St., New York City, Smelter at Matawan, N.J.

The Pennsylvania Smelting Co., Pittsburg, Pa.

Great Western Smelting and Refining Co., Chicago, Ill.

Western Metals Co., 625 Security Bldg., Los Angeles, California.

Chapman Smelting Co., 409 Battery St., San Francisco, California.

International Smelting Co., Wm. Wrait, Mgr., Salt Lake City, Utah.

Besides these the American Star Antimony Co. is extracting antimony electrically, at Gilham, Ark.; the Hoyt Metal Co., St. Louis, Mo., smelts more or less antimony ores in conjunction with lead ores to make antimony lead; and the John Finn Metal Works, San Francisco, Cal., has also treated some antimony ores.

¹ From the "Mining Congress Journal," January, 1917.

ANTIMONY.

Shipments of both antimony ore and concentrates and of refined antimony were made from Canadian properties intermittently during the last ten years. Refined antimony has been produced at the smelter of the Consolidated Mining and Smelting Company at Trail, B.C., recovered from the residues of the lead refinery; and at the works, at Lake George, New Brunswick, of the New Brunswick Metals, Limited, the latter property having been formerly operated by the Canadian Antimony Company.

The shipments of antimony ore and concentrates in 1917, were reported as 361 tons valued at \$22,000, as against 885 tons valued at \$94,537; in 1916—no production of refined antimony was reported.

The exports of antimony ore in 1917 amounted to 774 tons valued at \$50,476, as against 794 tons valued at \$48,158 in 1916.

The imports of antimony were 344,429 pounds valued at \$68,027 as against 838,713 pounds valued at \$222,341 in 1916.

Annual Shipments of Antimony Ore.

| Calendar Year. | Antimony ore. | | Refined regulus. | |
|----------------|---------------|-----------|------------------|----------|
| | Tons. | Value. | Pounds. | Value |
| 1886 | 665 | \$ 31,490 | | |
| 1887 | 584 | 10,860 | | |
| 1888 | 345 | 3,696 | | |
| 1889 | 55 | 1,100 | | |
| 1890 | 26½ | 625 | | |
| 1891 | 10 | 60 | | |
| 1892 to 1897 | | | | |
| 1898 | 1,344 | 20,000 | | |
| 1899 to 1904 | | | | |
| 1905 (a) | 527 | | | |
| 1906 (a) | 782 | | | |
| 1907 | 2,016 | 65,000 | 63,850 | \$ 5,108 |
| 1908 (b) | 148 | 5,443 | | |
| 1909 | 35 | 1,575 | 61,207 | 4,285 |
| 1910 | 364 | 13,906 | | |
| 1911-1914 | | | | |
| 1915 | 1,341 | 81,283 | 59,440 | 11,888 |
| 1916 | 885 | 94,537 | 107,185 | 41,823 |
| 1917 | 361 | 22,000 | | |

(a) As recorded by the Nova Scotia Department of Mines; no value given.

(b) Exports.

Exports and Imports of Antimony.

| Calendar Year. | Exports of antimony ore. | | Imports | | | | | |
|----------------|--------------------------|-----------|-------------------------|-----------|-----------------|-----------|----------------|-----------|
| | | | Antimony or regulus of. | | Antimony salts. | | Total imports. | |
| | Tons. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1907 | 1,327 | \$ 37,807 | 416,512 | \$ 69,447 | 117,592 | \$ 19,083 | 534,104 | \$ 88,530 |
| 1908 | 148 | 5,443 | 396,904 | 28,509 | 29,832 | 2,452 | 426,736 | 30,961 |
| 1909 | 4 | 120 | 551,354 | 37,362 | 40,176 | 4,369 | 591,530 | 41,731 |
| 1910 | 239 | 14,095 | 388,952 | 25,296 | 94,330 | 9,152 | 483,282 | 34,448 |
| 1911 | 57 | 4,946 | 561,046 | 36,405 | 18,420 | 2,418 | 579,466 | 38,823 |
| 1912 | | | 998,045 | 60,456 | 55,683 | 7,197 | 1,053,728 | 67,653 |
| 1913 | | | 667,050 | 49,408 | 23,649 | 2,421 | 690,699 | 51,829 |
| 1914 | | | 648,516 | 47,498 | 45,634 | 10,217 | 694,150 | 57,715 |
| 1915 | 1,149 | 82,990 | 1,962,194 | 344,918 | 67,956 | 10,320 | 2,030,150 | 355,238 |
| 1916 | 794 | 48,158 | 796,728 | 208,450 | 41,985 | 13,891 | 838,713 | 222,341 |
| 1917 | 774 | 50,476 | 332,137 | 61,732 | 12,292 | 6,295 | 344,429 | 68,027 |

Under the provision of the "Metal Refining Bounty Act", passed by the Ontario Legislature, in 1907, bounties amounting to \$26,774.75 were paid to refineries on cobalt oxide, and \$10,280.28 on nickel oxide in 1914, while in 1915, \$19,029.22 were paid on cobalt metal and cobalt oxide and \$6,521.69 on nickel metal and nickel oxide; and in 1916 the bounties were \$29,999.84 on cobalt metal, cobalt oxide and salts of cobalt, and \$8,558.52 on nickel metal, nickel oxide and nickel sulphate.

The bounty was at the rate of six cents per pound on the metallic contents of the oxides. The "Act", which expired in April 1917 and was not re-enacted, was quoted in the Annual Report on Mineral Production of Canada during the Calendar Year 1914, and previous reports of this Division.

The results of researches on cobalt and cobalt alloys, undertaken for the Mines Branch, by Dr. H. T. Kalmus, at Queen's University, have been published in five parts.¹

¹ Mines Branch No. 259, "Preparation of Metallic Cobalt by Reduction of the Oxide." Report on, by H. T. Kalmus, B.Sc., Ph.D.

Mines Branch No. 334, "Electro-plating with Cobalt." Report on, by H. T. Kalmus, B.Sc., Ph.D., 1915.

Mines Branch No. 309, "The Physical Properties of the Metal Cobalt." Report on, by H. T. Kalmus, B.Sc., Ph.D.

Mines Branch No. 411, "Cobalt Alloys with Non-Corrosive Properties." Report on, by H. T. Kalmus, B.Sc., Ph.D.

Mines Branch No. 413 "Magnetic Properties of Cobalt and of Fe₂Co." Report on, by H. T. Kalmus, B.Sc., Ph.D.

COBALT.

The silver-cobalt-nickel arsenides of Coleman and adjacent townships, more familiarly known as the Cobalt district, in the Province of Ontario, are now the principal sources of the world's supply of cobalt.

The recovery of this metal in Canada had been in the form of cobalt oxide and mixed oxides of cobalt and nickel, produced by the smelters treating the above ores, together with cobalt residues produced at the high grade mill of the Nipissing Mining Company. Formerly these residues have been chiefly exported, but they are now being shipped mainly to Canadian smelters.

In addition to the oxide of cobalt, there is now being recovered metallic cobalt, cobalt sulphate, cobalt carbonate, cobalt hydroxide, unseparated oxides, and stellite (the cobalt alloy used for high speed tool metal).

The total production of cobalt contained in smelter products recovered and in cobalt residues exported during 1917, amounted to 1,079,572 pounds, which if valued at \$1.60 per pound, would be worth \$1,727,315, as against 840,536 pounds, which at \$1.10 per pound, were valued at \$924,590.

This production included in 1917, 393,773 pounds of metallic cobalt valued by the producers at \$616,633; 802,448 pounds of cobalt oxide valued at \$1,104,500; together with other cobalt compounds, such as stellite and cobalt sulphate, amounting to 214,785 pounds valued at \$740,032, making a total valuation of \$2,461,165.

The 1916 production included 215,215 pounds of metallic cobalt valued at \$200,888; 670,760 pounds of cobalt oxide valued at \$542,341; together with smaller quantities of cobalt sulphate, cobalt carbonate, cobalt hydroxide, unseparable oxides, stellite and cobalt residues.

Some of the cobalt residues from the Nipissing mill were shipped to smelter works in Great Britain in 1916 and in 1917.

The total cobalt ores and residues treated in 1917 amounted to 7,770 tons with a cobalt content of 866,327 pounds, as against 8,127 tons with a cobalt content of 1,254,953 pounds in 1916.

Production of Cobalt and Cobalt-Oxides.

| Year. | Metallic cobalt. | | Cobalt-oxide. | | Mixed oxides of cobalt and nickel and other cobalt material. | |
|------------|------------------|------------|---------------|------------|--|------------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1912 | | | 257,077 | \$ 128,843 | 1,285,280 | \$ 163,988 |
| 1913 | | | 660,079 | 525,028 | 3,216,000 | 90,266 |
| 1914 | | | 899,027 | 571,710 | 2,079,001 | 79,995 |
| 1915 | 211,610 | \$ 197,994 | 423,717 | 338,273 | | (a).... |
| 1916 | 215,215 | 200,888 | 670,760 | 542,341 | | (a).... |
| 1917 | 393,773 | 616,633 | 802,448 | 1,104,500 | | 740,032 |

(a) Value not given in 1915 and 1916.

Prior to the war the principal demand for cobalt was for colouring in the ceramic industry. A small demand for cobalt metal now exists for use in making high speed tools, such as "stellite", an alloy of cobalt, chrome, and tungsten, or molybdenum. A small amount is used for plating and for making salts, such as cobalt sulphate and cobalt carbonate, and also for making cobalt hydroxide.

Prices.—The market for cobalt was very poor in 1915, but improved somewhat in 1916 and 1917. The price of cobalt as quoted in New York in 1916, ranged from \$1.25 to \$1.50 per pound. In 1917 the price of cobalt was around \$1.70 per pound.

COPPER.

The total production of copper in 1917, estimated on the basis of smelter recovery from ores treated, was 109,227,332 pounds, which at the average price of copper for the year in New York, 27.180 cents per pound, would be worth \$29,687,989, as against 117,150,028 pounds valued at \$31,867,150 in 1916, that is a decrease of 6.7 per cent in quantity and 6.5 per cent in value, but the production remains higher than that of any other preceding year with the exception of 1916.

Annual Production of Copper.

| Calendar year. | Pounds. | Value. | Cents per pound. | Calendar year. | Pounds. | Value. | Cents per pound. |
|----------------|------------|------------|------------------|----------------|-------------|-------------|------------------|
| 1886..... | 3,505,000 | \$ 385,550 | 11.00 | 1902..... | 38,804,259 | \$4,511,383 | 11.626 |
| 1887..... | 3,260,424 | 366,798 | 11.25 | 1903..... | 42,684,454 | 5,649,487 | 13.235 |
| 1888..... | 5,562,864 | 927,107 | 16.66 | 1904..... | 41,383,722 | 5,306,635 | 12.823 |
| 1889..... | 6,809,752 | 936,341 | 13.75 | 1905..... | 48,092,753 | 7,497,660 | 15.590 |
| 1890..... | 6,013,671 | 947,153 | 15.75 | 1906..... | 55,609,888 | 10,720,474 | 19.278 |
| 1891..... | 9,529,401 | 1,226,703 | 12.87 | 1907..... | 56,979,205 | 11,398,120 | 20.004 |
| 1892..... | 7,087,275 | 818,580 | 11.55 | 1908..... | 63,702,873 | 8,413,876 | 13.208 |
| 1893..... | 8,109,856 | 871,809 | 10.75 | 1909*..... | 52,493,863 | 6,814,754 | 12.982 |
| 1894..... | 7,708,789 | 736,960 | 9.56 | 1910..... | 55,692,369 | 7,094,094 | 12.738 |
| 1895..... | 7,771,639 | 836,228 | 10.76 | 1911..... | 55,648,011 | 6,886,998 | 12.376 |
| 1896..... | 9,393,012 | 1,021,960 | 10.88 | 1912..... | 77,832,127 | 12,718,548 | 16.341 |
| 1897..... | 13,300,802 | 1,501,660 | 11.29 | 1913..... | 76,976,925 | 11,753,606 | 15.269 |
| 1898..... | 17,747,136 | 2,134,980 | 12.03 | 1914..... | 75,735,900 | 10,301,606 | 13.602 |
| 1899..... | 15,078,475 | 2,655,319 | 17.61 | 1915..... | 100,785,150 | 17,410,635 | 17.275 |
| 1900..... | 18,937,138 | 3,065,922 | 16.19 | 1916..... | 117,150,028 | 31,867,150 | 27.202 |
| 1901..... | 37,827,019 | 6,096,581 | 16.117 | 1917..... | 109,227,332 | 29,687,989 | 27.180 |

*The decrease is not as large as the figures would indicate because of the calculation of part of the 1909 production on a different basis from previous years.

The production in 1917 included 30,425 pounds recovered in copper sulphate; 43,964,733 pounds contained in blister copper partly exported for refining, and partly refined at Trail, B.C.; 42,392,588 pounds contained in nickel-copper matte exported for refining; and 22,839,586 pounds in ore and concentrates, after allowing for smelter losses, exported for smelting and refining (including a small amount of copper matte from Ladysmith).

The production of copper in 1916 included 32,611 pounds recovered in copper sulphate; 43,615,868 pounds contained in blister copper exported for refining; 49,115,124 pounds contained in matte, chiefly nickel-copper matte exported for refining (including small amount of copper refined at Trail); and 24,386,425 pounds in ore, after allowing for smelter losses, exported for smelting and refining.

The production by provinces was as follows: British Columbia contributed 52.8 per cent of the total, as against 54.3 per cent in 1916; Ontario 39.2 per cent, as against 38.4 per cent in 1916; Quebec 4.6 per cent as against 4.9 per cent in 1916; the Yukon territory 2.2 per cent as against 2.4 per cent in 1916; and the balance 1.2 per cent was contributed by Manitoba, Alberta, and New Brunswick.

Production of Copper by Provinces, 1915, 1916, and 1917.

| Province. | 1915. | | 1916. | | 1917. | |
|-----------------------|-------------|------------|-------------|--------------|-------------|--------------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| Quebec..... | 4,197,482 | \$ 725,115 | 5,703,347 | \$ 1,551,424 | 5,015,560 | \$ 1,363,229 |
| Ontario..... | 39,361,464 | 6,799,693 | 41,997,035 | 12,240,094 | 42,867,774 | 11,651,461 |
| British Columbia..... | 56,692,988 | 9,793,714 | 63,642,559 | 17,312,046 | 57,730,959 | 15,691,275 |
| Yukon..... | 533,216 | 92,113 | 2,807,096 | 763,586 | 2,460,079 | 668,650 |
| Others (a)..... | | | | | 1,152,960 | 313,374 |
| Total..... | 100,785,150 | 17,410,635 | 117,150,028 | 31,867,150 | 109,227,332 | 29,687,989 |

(a) Includes Manitoba, Alberta, and New Brunswick.

Prices.—The price of copper which had been on the decline in the latter part of 1916 was down to 28½ cents early in January, 1917, declining further to 26½ cents by January 10th, then rallied up to 30½ cents by January 15th. During February and March the prices varied from 32 to 34 cents. On March 31st, the U.S. Government contracted for 45,000,000 pounds at 16½ cents deliveries extending over 12 months from April 1st. The price remained fairly well around 30 cents per pound until late in June when the U.S. Government was reported to have contracted for 60,000,000 pounds at 25 cents delivery extending over the ensuing 12 months. In fact the Government agreed to advance to the copper producers 22½ cents leaving the difference between that price and 25 cents to be settled after the receipt of the report of the Federal Trade Commission. On September 6th. the War Industries Board bought about 77,000,000 pounds for the Allies at 25 cents, and on September 21st, the U.S. Government fixed the price at 23½ cents f. o. b. New York for four months from that date.

Monthly Average Prices of Electrolytic Copper in New York.

(In cents per pound.)

| Months. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|---------------------|--------|--------|--------|--------|--------|--------|
| January..... | 14 094 | 16 488 | 14 223 | 13 641 | 24 008 | 28 673 |
| February..... | 14 084 | 14 971 | 14 491 | 14 394 | 26 440 | 31 750 |
| March..... | 14 698 | 14 713 | 14 131 | 14 787 | 26 310 | 31 481 |
| April..... | 15 741 | 15 291 | 14 211 | 16 811 | 27 895 | 27 935 |
| May..... | 16 031 | 15 436 | 13 996 | 18 506 | 28 625 | 28 788 |
| June..... | 17 234 | 14 672 | 13 603 | 19 477 | 26 601 | 29 962 |
| July..... | 17 190 | 14 190 | 13 223 | 18 796 | 23 865 | 26 620 |
| August..... | 17 498 | 15 400 | * | 16 941 | 26 120 | 25 330 |
| September..... | 17 508 | 16 328 | * | 17 502 | 26 855 | 25 073 |
| October..... | 17 314 | 16 337 | * | 17 686 | 27 193 | 23 500 |
| November..... | 17 326 | 15 182 | 11 730 | 18 627 | 30 625 | 23 500 |
| December..... | 17 376 | 14 224 | 12 801 | 20 133 | 31 890 | 23 500 |
| Yearly average..... | 16 341 | 15 269 | 13 602 | 17 275 | 27 202 | 27 180 |

*No quotations.

Monthly Average Prices of Standard Copper in London.

(In £ Sterling per ton of 2,240 pounds.)

| Months: | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|---------------------|--------|--------|--------|--------|---------|---------|
| January..... | 62·760 | 71·741 | 64·304 | 60·756 | 88·033 | 131·621 |
| February..... | 62·893 | 65·519 | 65·259 | 63·494 | 102·667 | 137·895 |
| March..... | 65·884 | 65·329 | 64·276 | 66·152 | 107·714 | 136·750 |
| April..... | 70·294 | 68·111 | 64·747 | 75·096 | 124·319 | 133·842 |
| May..... | 72·352 | 68·807 | 63·182 | 77·600 | 135·457 | 130·000 |
| June..... | 78·259 | 67·140 | 61·335 | 82·574 | 112·432 | 130·000 |
| July..... | 76·636 | 64·166 | 60·540 | 76·011 | 95·119 | 128·409 |
| August..... | 78·670 | 69·200 | * | 68·673 | 110·233 | 122·391 |
| September..... | 78·762 | 73·125 | * | 68·915 | 113·905 | 117·500 |
| October..... | 76·239 | 73·333 | * | 72·601 | 122·760 | 110·000 |
| November..... | 76·890 | 68·275 | 53·227 | 77·744 | 134·659 | 110·000 |
| December..... | 75·616 | 65·223 | 56·841 | 80·773 | 145·316 | 110·000 |
| Yearly average..... | 72·942 | 68·335 | 61·524 | 72·532 | 116·059 | 124·892 |

*No quotations.

Exports and Imports.—With the exception of a small output of copper sulphate and 3,901 tons of refined copper produced at Trail, B.C., the copper production of Canada is exported for refining.

The exports of copper in ore, matte, regulus, etc., during the calendar year 1917, were 86,556,900 pounds valued at \$14,183,264 as against 124,942,400 pounds valued at \$20,776,536 in 1916. The exports of copper black, or coarse and in pigs, etc., were 17,570,600 pounds valued at \$4,776,025 as against 2,430,400 pounds valued at \$581,268 in 1916. The exports of "old and scrap" copper amounted to 15,793,900 pounds valued at \$4,296,989, as against 5,846,600 pounds valued at \$1,284,895.

The total exports of copper in 1917 were 119,921,400 pounds valued at \$23,256,278 as against 133,219,400 pounds valued at \$22,642,699 in 1916.

Exports of Copper, 1910 to 1917.

| Year. | Fine in ore, matte, regulus, etc. | | Black or coarse and in pigs, bars, sheets, etc. | | Old and Scrap. | | Total. | |
|-------|-----------------------------------|--------------|---|-----------|----------------|------------|-------------|--------------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1910. | 56,964,127 | \$ 5,840,553 | ..... | ..... | ..... | ..... | 56,964,127 | \$ 5,840,553 |
| 1911. | 55,208,054 | 5,459,770 | 79,656 | \$ 7,955 | ..... | ..... | 55,287,710 | 5,467,725 |
| 1912. | 76,542,643 | 8,800,237 | 1,945,921 | 236,212 | ..... | ..... | 78,488,564 | 9,036,479 |
| 1913. | 81,879,080 | 9,479,480 | 771,230 | 123,431 | 24,972 | \$ 324,903 | 85,147,560 | 9,927,814 |
| 1914. | 68,830,059 | 7,130,778 | 6,581,564 | 908,201 | 1,987,100 | 231,710 | 77,398,723 | 8,270,689 |
| 1915. | 81,437,063 | 8,671,641 | 21,292,516 | 3,783,715 | 4,161,600 | 616,553 | 106,891,179 | 13,076,909 |
| 1916. | 124,942,400 | 20,776,536 | 2,430,400 | 581,268 | 5,846,600 | 1,284,895 | 133,219,400 | 22,642,699 |
| 1917. | 86,556,900 | 14,183,264 | 17,570,600 | 4,776,025 | 15,793,900 | 4,296,989 | 119,921,400 | 23,256,278 |

The total recorded imports of copper during the calendar year 1917 were valued at \$10,015,561 and included: crude and manufactured copper, 29,942,394 pounds valued at \$9,384,586; copper sulphate 3,155,924 pounds valued at \$314,785; and the manufactures of copper valued at \$316,190. In 1916 the total imports were valued at \$7,566,080 and included: crude and manufactured copper 25,594,029 pounds valued at \$7,133,117; copper sulphate 1,803,655 valued at \$193,542; and the manufactures of copper valued at \$234,421.

Unfortunately the above record does not represent the total copper imports during 1916 and 1917 because of the fact that large quantities of copper, imported for the use of the Imperial Government have been, for Customs Records purposes, entered with many other products under one item.

There are also imports of copper in the form of brass. The recorded imports of brass in 1917 included 3,962,957 pounds of metal in crude and manufactured form (see chapter on zinc), valued at \$1,277,249, and containing possibly 2,774,070 pounds of copper; and also manufactures of brass, quantity not recorded, valued at \$4,051,410; while in 1916 the imports of brass included 2,974,676 pounds of metal in crude and manufactured form, valued at \$923,523, and containing probably 2,082,273 pounds of copper; and also manufactures of brass, quantity not recorded, valued at \$3,752,851.

Imports of Copper, 1916 and 1917.

| | 1916. | | 1917. | |
|--|------------|-----------|------------|------------|
| | Pounds. | Value. | Pounds. | Value. |
| Copper, old scrap | 96,700 | \$ 20,777 | 116,900 | \$ 28,867 |
| Copper in pigs, ingots or in blocks | 3,446,300 | 904,505 | 5,917,500 | 1,771,901 |
| Copper in bars, and rods, in coils, or otherwise, in lengths, not less than 6 feet, unmanufactured.... | 18,460,600 | 5,062,854 | 20,714,700 | 6,277,115 |
| Copper, in strips, sheets or plates, not planished or coated, etc. | 2,650,700 | 792,400 | 2,026,500 | 778,558 |
| Copper tubing in lengths not less than 6 feet and not polished, bent or otherwise manufactured..... | 873,944 | 335,339 | 1,063,306 | 467,260 |
| Copper rollers, for use in calico printing..... | | 727 | | |
| Copper and manufactures of:— | | | | |
| Nails, tacks, rivets and burrs or washers..... | | 3,593 | | 15,277 |
| Wire, plain, tinned or plated..... | 55,843 | 16,523 | 81,588 | 39,133 |
| Wire cloth, etc..... | | 2,926 | | 5,308 |
| All other manufactures of, n.o.p..... | | 227,175 | | 295,605 |
| Copper, precipitate of, crude..... | 9,942 | 719 | 21,900 | 1,752 |
| Copper sulphate (blue vitriol)..... | 1,803,655 | 198,542 | 3,155,924 | 314,785 |
| Total value..... | | 7,566,080 | | 10,015,561 |

Imports of Copper, 1907 to 1917, inclusive.

51720-2

| Year. | Pigs, ingots or in blocks. | | Old and Scrap. | | Manufactures of Copper. | | | Crude Precipitate. | | Copper Sulphate. | | Total. |
|----------|----------------------------|------------|----------------|-----------|------------------------------------|--------------|---------------------|--------------------|----------|------------------|------------|--------------|
| | Pounds. | Value. | Pounds. | Value. | Bars, Rods, Sheets, Tube and Wire. | | Other Manufactures. | Pounds. | Value. | Pounds. | Value. | Value. |
| | | | | | Pounds. | Value. | | | | | | |
| 1907.... | 3,456,900 | \$ 699,388 | 196,300 | \$ 37,787 | 13,499,130 | \$ 3,138,283 | \$ 108,057 | 7,397 | \$ 1,340 | 2,299,674 | \$ 142,948 | \$ 4,127,803 |
| 1908.... | 2,360,900 | 353,301 | 127,700 | 12,821 | 12,150,850 | 1,765,415 | 88,715 | 4,209 | 557 | 2,768,123 | 131,057 | 2,351,866 |
| 1909.... | 4,200,100 | 554,273 | 132,600 | 14,447 | 16,208,978 | 2,340,464 | 126,769 | 1,990 | 257 | 1,634,751 | 66,459 | 3,102,669 |
| 1910.... | 4,640,500 | 669,111 | 273,700 | 31,070 | 25,322,906 | 3,579,270 | 150,322 | 4,847 | 595 | 1,925,557 | 77,782 | 4,448,150 |
| 1911.... | 5,650,400 | 705,598 | 265,300 | 28,748 | 29,244,210 | 3,898,416 | 215,239 | 2,608 | 299 | 2,191,899 | 88,419 | 4,936,769 |
| 1912.... | 5,121,800 | 806,705 | 400,500 | 56,748 | 35,198,208 | 5,776,003 | 305,630 | 5,703 | 570 | 2,105,419 | 101,650 | 7,047,356 |
| 1913.... | 5,314,200 | 845,095 | 596,700 | 87,790 | 35,101,061 | 6,002,937 | 370,313 | 4,743 | 515 | 2,037,714 | 107,960 | 7,414,610 |
| 1914.... | 3,733,300 | 507,499 | 127,800 | 15,717 | 22,419,715 | 3,460,106 | 219,449 | 2,017 | 328 | 1,143,039 | 53,802 | 4,256,901 |
| 1915.... | 4,771,200 | 777,533 | 68,500 | 8,281 | 15,405,520 | 2,807,969 | 264,670 | 187 | 35 | 1,854,850 | 99,282 | 3,957,770 |
| 1916.... | 3,446,300 | 904,505 | 96,700 | 20,777 | 22,041,087 | 6,207,116 | 234,421 | 9,942 | 719 | 1,803,655 | 198,542 | 7,566,080 |
| 1917.... | 5,917,500 | 1,771,901 | 116,900 | 28,867 | 23,886,094 | 7,582,066 | 316,190 | 21,900 | 1,572 | 3,155,924 | 314,785 | 10,015,561 |

Consumption.—In view of the large import of manufactured copper and brass for which no quantity is recorded, it is difficult to estimate closely the consumption of copper. The imports in 1916 amounted to at least 51,000,000 pounds on the basis of the United States record, and allowing 5,000,000 pounds for metal contained in other manufactures of copper and brass. Domestic production was practically all exported together with 6,000,000 pounds of copper "old and scrap," which, if deducted from the imports, gives an estimated consumption of 45,000,000 pounds, or 22,500 tons.

In 1917 the United States trade records report 49,871,919 pounds of refined copper in ingots, bars, etc., as being exported to Canada. If we allow about 10,000,000 pounds for copper in unrefined block, blister and converter copper, and in manufactures of copper and brass, we get a total of about 59,871,919 pounds, or 29,936 tons. Domestic production amounted to 54,614 tons and the exports were 59,961 tons, giving a difference of 5,347 tons, which, if deducted from the imports gives an estimated consumption of 24,589 tons. But information from other sources would bring the consumption to 39,000 tons in 1917.

Quebec.

The production of copper in Quebec in 1917 was derived mostly, as in the past, from the Eustis and Weedon mines in the Eastern Townships and amounted to 5,015,560 pounds valued at \$1,363,229, representing the estimated recovery from 122,882 tons of ore and concentrates with a metal content of 7,440,711 pounds of copper, as against 5,703,347 pounds valued at \$1,551,424 representing the estimated recovery from 130,492 tons of ore and concentrates with a metal content of 8,215,085 pounds of copper in 1916.

Quebec: Production of Copper.

| Year. | Pounds. | Value. | Year. | Pounds. | Value. | Year. | Pounds. | Value. |
|-----------|-----------|------------|-----------|-----------|------------|-------------|------------|------------|
| 1886..... | 3,340,000 | \$ 367,400 | 1897..... | 2,474,970 | \$ 279,424 | 1908..... | 1,282,024 | \$ 169,330 |
| 1887..... | 2,937,900 | 330,514 | 1898..... | 2,100,235 | 252,658 | 1909..... | 1,088,212 | 141,272 |
| 1888..... | 5,562,864 | 927,107 | 1899..... | 1,632,560 | 287,494 | 1910..... | 877,347 | 111,757 |
| 1889..... | 5,315,000 | 730,813 | 1900..... | 2,220,000 | 359,418 | 1911..... | 2,436,190 | 301,503 |
| 1890..... | 4,710,606 | 741,920 | 1901..... | 1,527,442 | 246,178 | 1912..... | 3,282,210 | 536,346 |
| 1891..... | 5,401,704 | 695,469 | 1902..... | 1,640,000 | 190,666 | 1913..... | 3,455,887 | 527,679 |
| 1892..... | 4,883,480 | 564,042 | 1903..... | 1,152,000 | 152,497 | 1914..... | 4,201,497 | 571,488 |
| 1893..... | 4,468,352 | 490,348 | 1904..... | 760,000 | 97,455 | 1915..... | 4,197,482 | 725,115 |
| 1894..... | 2,176,430 | 208,067 | 1905..... | 1,621,243 | 252,752 | 1916..... | 5,703,347 | 1,551,424 |
| 1895..... | 2,242,462 | 241,288 | 1906..... | 1,981,169 | 381,930 | 1917..... | 5,015,560 | 1,363,229 |
| 1896..... | 2,407,200 | 261,903 | 1907..... | 1,517,990 | 303,659 | Total | 83,613,363 | 14,352,115 |

Ontario.

The copper production of Ontario comes mainly from the nickel-copper ores of Sudbury district. The chief companies are:—

The Canadian Copper Co., Ltd., shipping from the Creighton and adjoining properties.

The Mond Nickel Co., Ltd., operating at Coniston.

The Alexo Mining Co., operating near Porquis Junction, and shipping to the Coniston smelter.

The British American Nickel Corporation, which carried on active development and construction work but did not ship during 1917.

A few small shipments were also made from the following:—

- The Bruce Mine, near Bruce Mines, Algoma.
- The Cheney Mine, near Thessalon, Algoma.
- The Hudson Copper Co., Ltd., near Havilah, Algoma.
- The Kenyon Copper Mines, Ltd., (formerly known as the Sable River Copper Co.) near Massey, Sudbury.
- The Tip Top Mine, near Port Arthur, Thunder Bay.
- The Hewitson Mine, operated by the Port Arthur Copper Co., Ltd., (formerly known as the Mine Centre Copper Co.) near Shoal Lake, Rainy River.

The copper production from Ontario in 1917 amounted to 42,867,774 pounds valued at \$11,651,461, equivalent to 39.2 per cent of the production of Canada.

Details of the production of copper from the nickel-copper ores are given in the article on "Nickel". The production from the copper mines and Cobalt district amounts to a little over one per cent of the total.

The Ontario government offered a bounty on copper over 95 per cent pure metal, and on copper sulphate produced from ore mined and refined in the Province but no bounties have ever been obtained or earned. The Metal Refining Bounty Act expired 10th of April, 1917, and was not re-enacted. The text of the "Act" was quoted in the Annual Report on Mineral Production of Canada, 1914, p. 60.

Ontario: Production of Copper.

| Year. | Pounds. | Value. | Year. | Pounds. | Value. | Year. | Pounds. | Value. |
|-----------|-----------|-----------|-----------|------------|------------|------------|-------------|--------------|
| 1886..... | 165,000 | \$ 18,150 | 1897..... | 5,500,652 | \$ 621,023 | 1908..... | 15,005,171 | \$ 1,981,883 |
| 1887..... | 322,524 | 36,284 | 1898..... | 8,375,223 | 1,007,539 | 1909..... | 15,746,699 | 2,044,237 |
| 1888..... | | | 1899..... | 5,723,324 | 1,007,877 | 1910..... | 19,259,016 | 2,453,213 |
| 1889..... | 1,466,752 | 201,678 | 1900..... | 6,740,053 | 1,091,215 | 1911..... | 17,932,263 | 2,219,297 |
| 1890..... | 1,303,065 | 205,233 | 1901..... | 8,695,331 | 1,401,507 | 1912..... | 22,250,601 | 3,635,971 |
| 1891..... | 4,127,697 | 531,234 | 1902..... | 7,403,202 | 861,278 | 1913..... | 25,385,929 | 3,952,522 |
| 1892..... | 2,203,795 | 254,538 | 1903..... | 7,172,533 | 949,285 | 1914..... | 28,943,211 | 3,937,536 |
| 1893..... | 3,641,504 | 391,461 | 1904..... | 4,913,594 | 630,070 | 1915..... | 39,361,464 | 6,799,693 |
| 1894..... | 5,207,679 | 497,854 | 1905..... | 8,779,259 | 1,368,686 | 1916..... | 44,997,035 | 12,240,094 |
| 1895..... | 4,576,337 | 492,414 | 1906..... | 10,638,231 | 2,050,838 | 1917..... | 42,867,774 | 11,651,461 |
| 1896..... | 3,167,256 | 344,598 | 1907..... | 14,104,337 | 2,821,432 | Total..... | 386,487,774 | 67,700,101 |

Manitoba.

The first production of copper from Manitoba ever recorded was that of 1917 and amounted to over one million pounds—the estimated recovery from the ores shipped by the Mandy Mining Company operating near Schist lake, in the new Pas district, northern Manitoba. Much development has been carried on during the last few years and this district will soon be an important producer. A special report by Dr. Louis Bruce will soon be ready for distribution.

British Columbia.

The total quantity of copper contained in matte, blister, and copper-sulphate produced in British Columbia in 1917, and including an estimate of smelter recovery from copper ores exported was 57,730,959 pounds, after deducting the amount of copper produced from foreign ores, as against 63,642,550 pounds in 1916, a decrease of about 9.3 per cent in quantity and 9.4 in value.

Since 1909 the method of compilation of statistics of copper production by the Provincial Bureau of Mines of British Columbia, which is based upon ore shipments from mines, provides for a deduction of five pounds of copper per ton of ore shipped on account of smelter losses, a method which gives a result closely approximating that obtained by this Branch.

British Columbia: Production of Copper.

| Year. | Pounds. | Value. | Year. | Pounds. | Value. | Year. | Pounds. | Value. |
|-------|------------|-----------|-----------|------------|--------------|-----------|------------|--------------|
| 1894* | 324,680 | \$ 31,039 | 1902* | 29,636,057 | \$ 3,445,488 | 1910..... | 35,270,006 | \$ 4,492,693 |
| 1895* | 952,840 | 102,526 | 1903* | 34,359,921 | 4,547,735 | 1911..... | 35,279,558 | 4,366,198 |
| 1896* | 3,818,556 | 415,459 | 1904* | 35,710,128 | 4,579,110 | 1912..... | 50,526,656 | 8,256,561 |
| 1897* | 5,325,180 | 601,213 | 1905* | 37,692,251 | 5,876,222 | 1913..... | 45,791,579 | 6,991,916 |
| 1898* | 7,271,678 | 874,783 | 1906* | 42,990,488 | 8,287,706 | 1914..... | 41,219,202 | 5,606,636 |
| 1899* | 7,722,591 | 1,359,948 | 1907* | 40,832,720 | 8,168,177 | 1915..... | 56,602,988 | 9,793,714 |
| 1900* | 9,977,080 | 1,615,289 | 1908..... | 37,041,115 | 4,892,390 | 1916..... | 63,642,550 | 17,312,046 |
| 1901* | 27,603,746 | 4,448,896 | 1909..... | 35,658,952 | 4,629,245 | 1917..... | 57,730,959 | 15,691,275 |

* Metal contents of ores shipped as published by the Provincial Bureau of Mines.

British Columbia: Production of Copper by Districts.*

(In pounds.)

| | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Cariboo—Omineca..... | | | | 1,838 | 6,000 | 2,831,279 | 1,646,072 | 852,373 |
| Cassiar—Skeena, etc..... | | 19,151 | 88,403 | 1,336 | 11,123,376 | 21,915,481 | 24,065,995 | 27,978,015 |
| East Kootenay— Fort Steele..... | | | | | | | 5,654 | 9,679 |
| Windermere..... | | | | | | | 3,400 | 12,640 |
| West Kootenay— Nelson..... | 231,936 | | 26,257 | 815,126 | 586,764 | 30,240 | 176,383 | 50,946 |
| Trail Creek..... | 3,577,745 | 3,429,702 | 2,539,900 | 2,538,661 | 3,779,830 | 4,651,681 | 4,200,745 | 1,730,088 |
| Yale— Boundary..... | 31,354,985 | 22,327,359 | 33,372,199 | 28,621,973 | 16,428,959 | 17,402,662 | 17,626,623 | 10,329,765 |
| Ashcroft & Kamloops..... | 1,178 | 152,723 | | 29,505 | 14,525 | 295,164 | 636,594 | 700,199 |
| Similkameen..... | | | | 8,073 | | 21,701 | 182,633 | 87,326 |
| Coast districts..... | 3,078,090 | 10,998,721 | 15,429,778 | 14,443,793 | 13,070,245 | 9,770,197 | 16,835,265 | 17,256,534 |
| Total's..... | 38,248,934 | 36,927,656 | 51,456,537 | 46,460,305 | 45,009,699 | 56,918,405 | 65,379,364 | 59,007,565 |

* As published by British Columbia Bureau of Mines.

Copper mining is now by far the most important form of mining in the Province; in 1917 it formed nearly 60 per cent of the total value of the metalliferous mines, while in 1916 it was about 57 per cent.

In the Boundary the production was mainly from the mines of the three large smelting companies: The Granby Consolidated Mining, Smelting & Power Co., Ltd., The Mother Lode and Sunset Mines of the British Columbia Copper Co. Ltd., and the Emma Mine of the Consolidated Mining & Smelting Co.

These companies operate their own smelters and convert their matte to blister copper. The low grade ores of this district are self-fluxing and very uniform in character, averaging a little over one per cent in copper, and from \$1 to \$2 in gold and silver.

The British Columbia Copper Company have been steadily developing their properties at Princess camp in the Similkameen, employing a large number of men and

will probably be an important producer in 1918. Some properties were producing during 1917 and we may look forward to the eventual establishment in that part of the country of another important copper producing centre.

Much development and some shipments are reported from the Ashcroft and Nicola divisions, the principal operators being the Highland Valley Mining & Development Co., and the Aberdeen Mines Syndicate.

In the interior the main shippers were, at Rossland: the Centre Star and Le Roi groups, owned by the Consolidated Mining and Smelting Co., and the Le Roi II (Josie) mine.

The Consolidated Mining & Smelting Co. operates its own smelter, converts its matte to blister copper, and, since 1916, produces refined copper. It treats also in its refinery blister copper from the other smelters.

Shipments were also made from the Nelson district by the Eureka mine and a few other properties.

In the Kamloops division the Iron Mask mine is the only important shipper.

Much development work was done in the neighbourhood of New Hazelton in the Omineca mining division, and the Rocher Déboulé mine after a couple of years of extensive development, has become an important producer.

There was noted in 1915 a large increase in the production of the Coast and Cassiar districts which more than offset the falling off in the Boundary district. The increase was still more remarkable in 1916 and 1917 and was due mostly to the Hidden Creek mines on Observatory inlet, the Britannia mines on Howe sound, and the Marble Bay mines on Texada island.

Yukon.

The production from the Yukon Territory has been from the Whitehorse district. The mines in this district had been more or less idle for the past few years, but the high price of copper during 1916 and 1917 was the cause of much activity. The production in 1916 amounted to 2,807,096 pounds, valued at \$763,586; while in 1917 the production was 2,460,079 pounds valued at \$668,650.

The principal shippers by order of importance were: The Pueblo, operated by the Yukon Copper Co., Ltd., the War Eagle, Grafton, Copper King, and Anaconda.

Yukon: Production of Copper.

| Year. | Pounds. | Value. | Year. | Pounds. | Value. |
|--------------------------|---------|-----------|------------|------------|------------|
| 1906 (and previous)..... | 156,000 | \$ 23,400 | 1912..... | 1,772,660 | \$ 289,670 |
| 1907..... | 511,838 | 102,388 | 1913..... | 1,843,530 | 281,489 |
| 1908..... | 112,264 | 14,828 | 1914..... | 1,367,050 | 185,946 |
| 1909..... | | | 1915..... | 533,216 | 92,113 |
| 1910..... | 286,000 | 36,431 | 1916..... | 2,807,096 | 763,586 |
| 1911..... | | | 1917..... | 2,460,079 | 668,650 |
| | | | Total..... | 11,849,733 | 2,458,501 |

GOLD.

The production of gold in Canada in 1917 amounted to 738,831 fine ounces, valued at \$15,272,992, and was made up as follows: (a) gold derived from alluvial workings \$4,145,571, or 27.1 per cent of the total; (b) gold obtained from the crushing of free milling quartz ores, i.e., stamp mill bullion \$9,248,020, or 60.6 per cent; and (c) gold obtained from ores and concentrates sent to the copper and lead smelters \$1,879,401, or 12.3 per cent of the total production.

The production in 1916 amounted to 930,492 fine ounces, valued at \$19,234,976, and was made up as follows: (a) gold derived from alluvial workings \$4,964,831 or 25.8 per cent of the total; (b) gold obtained from the crushing of free milling ores, i.e., stamp mill bullion, \$10,480,661 or 54.5 per cent of the total; and (c) gold obtained from ores and concentrates sent to the copper and lead smelters, \$3,789,484 or 19.7 per cent of the total production.

Gold was first discovered in various provinces about 1858, and the production gradually increased to over four million dollars in 1863, but fell again to \$907,601 in 1892. The discovery of gold in the Yukon and other discoveries in 1896 gave the mining industry a new impetus, resulting in a rapid increase in the gold production which, in 1900, reached the high mark of nearly twenty-eight million dollars. From this maximum it decreased again to a little over eight million dollars in 1907. With the discovery and development of the Porcupine mines in Ontario, gold production has rapidly increased again. The falling off in 1917 is due to the great increase in the cost of supplies, and difficulty in securing the necessary equipment. Another important factor was the scarcity of labor and especially in gold camps, as the miners are induced to other camps due to the high wages which depend on a sliding scale regulated by the price of metals, gold being the only metal not to benefit by enhanced market price.

Annual Production of Gold in Canada 1858-1917.

| Year. | Fine ounces † | Value. | Year. | Fine ounces † | Value. | Year. | Fine ounces † | Value. |
|-------|---------------|------------|-------|---------------|--------------|-------|---------------|--------------|
| 1858 | 34,104 | \$ 705,000 | 1878 | 74,420 | \$ 1,538,304 | 1898 | 666,886 | \$13,775,420 |
| 1859 | 78,129 | 1,615,072 | 1879 | 76,547 | 1,582,358 | 1899 | 1,028,529 | 21,261,584 |
| 1860 | 107,806 | 2,228,543 | 1880 | 63,121 | 1,304,821 | 1900 | 1,350,057 | 27,908,153 |
| 1861 | 128,973 | 2,666,118 | 1881 | 1,313,153 | 63,524 | 1901 | 1,167,216 | 24,128,503 |
| 1862 | 135,391 | 2,798,774 | 1882 | 60,288 | 1,246,268 | 1902 | 1,032,161 | 21,336,667 |
| 1863 | 202,498 | 4,116,011 | 1883 | 53,853 | 1,113,246 | 1903 | 911,559 | 18,843,590 |
| 1864 | 199,605 | 4,126,199 | 1884 | 51,202 | 1,058,439 | 1904 | 796,374 | 16,462,517 |
| 1865 | 192,898 | 3,987,562 | 1885 | 55,575 | 1,148,829 | 1905 | 684,951 | 14,159,195 |
| 1866 | 152,553 | 3,153,597 | 1886 | 70,782 | 1,463,196 | 1906 | 556,415 | 11,502,120 |
| 1867 | 145,775 | 3,013,431 | 1887 | 57,460 | 1,187,804 | 1907 | 405,517 | 8,382,780 |
| 1868 | 134,169 | 2,773,527 | 1888 | 53,145 | 1,098,610 | 1908 | 476,112 | 9,842,105 |
| 1869 | 102,720 | 2,123,405 | 1889 | 62,653 | 1,295,159 | 1909 | 453,865 | 9,382,230 |
| 1870 | 83,415 | 1,724,348 | 1890 | 55,620 | 1,149,776 | 1910 | 493,707 | 10,205,835 |
| 1871 | 105,187 | 2,174,412 | 1891 | 45,018 | 930,614 | 1911 | 473,159 | 9,781,677 |
| 1872 | 90,283 | 1,866,321 | 1892 | 43,905 | 907,601 | 1912 | 611,885 | 12,648,794 |
| 1873 | 74,346 | 1,536,871 | 1893 | 47,243 | 976,603 | 1913 | 802,973 | 16,598,923 |
| 1874 | 97,856 | 2,022,862 | 1894 | 54,600 | 1,128,688 | 1914 | 773,178 | 15,933,007 |
| 1875 | 130,300 | 2,693,533 | 1895 | 100,798 | 2,083,674 | 1915 | 918,056 | 18,977,901 |
| 1876 | 97,729 | 2,020,233 | 1896 | 133,262 | 2,754,774 | 1916 | 930,492 | 19,234,976 |
| 1877 | 94,304 | 1,949,444 | 1897 | 291,557 | 6,027,016 | 1917 | 738,831 | 15,272,992 |

† Calculated from the value: one dollar=0.043375 oz.

The Dominion Assay Office, in Vancouver, operated in connexion with this Department, receives, assays, and purchases crude bullion, amalgam, nuggets, and dust, the resultant bullion being resold. The total quantity of bullion thus received during the twelve months ending December 31st, 1917, was 191,626.04, ounces, which after melting was reduced to 187,884.48 ounces and valued at \$3,257,220.71 after deducting office charges. The loss by melting was 1,953 ounces per cwt. The receipts were from British Columbia and the Yukon, with also a few ounces from Alaska.

Receipts at Dominion Assay Office, Vancouver.

| Year. | Weight before melting. | Weight after melting. | Net value. | Year. | Weight before melting. | Weight after melting. | Net value. |
|---------------|------------------------|-----------------------|-----------------|-------------|------------------------|-----------------------|-----------------|
| | ounces. | ounces. | | | | | |
| 1908 (a)..... | 90,175.48 | 89,117.76 | \$ 1,478,894.00 | 1913 (b)... | 111,479.94 | 109,920.49 | \$ 1,448,625.37 |
| 1909..... | 48,478.58 | 47,576.27 | 789,267.94 | 1914..... | 166,148.83 | 163,523.61 | 2,029,251.31 |
| 1910..... | 46,064.31 | 45,228.92 | 746,101.92 | 1915..... | 183,924.49 | 179,751.68 | 2,736,302.31 |
| 1911..... | 39,784.70 | 39,069.31 | 647,416.38 | 1916..... | 180,292.83 | 175,393.10 | 2,828,239.65 |
| 1912..... | 59,068.82 | 57,951.98 | 974,077.14 | 1917..... | 191,626.04 | 187,884.48 | 3,257,220.71 |

(a) For 9 months only. (b) The removal of the assay charge in January, 1913, accounts for the large increase.

Refined Metal: There are two refineries producing fine gold in Canada; the Royal Mint at Ottawa, which receives shipments of gold from various provinces in the Dominion; and that of the Consolidated Mining and Smelting Co. of Canada, Ltd., at Trail, B.C., where gold is mainly recovered from the gold ores with also recoveries from the high grade silver-lead and the "dry" ores shipped to the smelter.

The production of gold by provinces is given in the following table in which it will be seen that Ontario, since the discovery of the Porcupine camp, has gradually increased its production, and to such extent that in 1917 it produced 57.3 per cent of the total, as against 52.9 per cent in 1916, 44.3 per cent in 1915, and 14.1 per cent in 1912, when Porcupine came into prominence.

Production of Gold by Provinces, 1915, 1916, and 1917.

| | 1915. | | 1916. | | 1917. | |
|--|---------------|------------|---------------|------------|---------------|------------|
| | Fine ounces † | Value. | Fine ounces † | Value. | Fine ounces † | Value. |
| Nova Scotia..... | 6,636 | \$ 137,180 | 4,562 | \$ 94,305 | 2,210 | \$ 45,685 |
| Quebec..... | 1,099 | 22,720 | 1,034 | 21,375 | 1,511 | 31,235 |
| Ontario..... | 406,577 | 8,404,693 | 492,481 | 10,180,485 | 423,261 | 8,749,581 |
| Manitoba..... | | | | | 440 | 9,095 |
| Alberta..... | 195 | 4,026 | 82 | 1,695 | | |
| British Columbia (a)..... | 273,376 | 5,651,184 | 219,633 | 4,540,216 | 133,742 | 2,764,693 |
| Yukon..... | 230,173 | 4,758,098 | 212,700 | 4,396,900 | 177,667 | 3,672,703 |
| Totals..... | 918,056 | 18,977,901 | 930,492 | 19,234,979 | 738,831 | 15,272,992 |
| | | 1915. | | 1916. | | 1917. |
| (a) As follows: Gold from placer mining..... | | \$ 770,000 | | \$ 580,500 | | \$ 496,000 |
| Gold from vein mining..... | | 4,881,184 | | 3,959,716 | | 2,264,693 |
| | | 5,651,184 | | 4,540,216 | | 2,764,693 |

† The exact value of fine gold is $\frac{322}{1000}$ dollars per ounce equivalent to \$20.671834. (United States Standard.)

In most cases, statistics of gold production are stated as crude bullion with value thereof. The fine ounces given in the tables in this report are calculated from the values by multiplying these by $\frac{322}{1000}$ or 0.048375.

Exports and Imports: The exports of gold in dust, nuggets, etc., during 1917 were valued at \$15,929,051, as against \$18,382,903 in 1915.

The imports during 1917 were: gold bullion valued at \$1,631,708; gold coins \$12,743,812; gold fringe \$4,857; and manufactures of gold and silver, valued at \$221,554.

Imports of Gold and Silver.

| | Gold. | | | Silver. | | | Manufactures of Gold and Silver. | | | |
|-----------|-----------------------------|---------------|----------|-----------------------------|--------|------------|----------------------------------|------------|----------------------|----------------------|
| | Bullion in bars and blocks. | Coins. | Fringe. | Bullion in bars and blocks. | Coins. | Sterling. | Leaf. | Sweepings. | Manufactures, n.o.p. | Electro-plated ware. |
| 1911..... | \$ 924,233 | \$ 20,437,799 | \$ 8,049 | \$ 847,..... | ..... | \$232, 792 | \$63,454 | \$ 279 | \$ 44,402 | \$467,491 |
| 1912..... | 1,360,735 | 7,496,492 | 18,212 | 1,100,344 | ..... | 240,235 | 70,651 | 10,107 | 103,879 | 737,857 |
| 1913..... | 840,435 | 12,495,028 | 6,993 | 840,245 | ..... | 393,925 | 80,772 | 12,788 | 58,738 | 522,402 |
| 1914..... | 14,534,482 | 117,700,824 | 5,582 | 629,279 | ..... | 244,376 | 53,715 | 4,794 | 14,914 | 301,038 |
| 1915..... | 1,028,405 | 19,910,229 | 7,577 | 337,254 | \$ 94 | 110,683 | 63,631 | 2,199 | 8,433 | 281,547 |
| 1916..... | 18,648,770 | 17,828,695 | 4,882 | 875,157 | 35 | 123,774 | 42,152 | 2,778 | 24,167 | 302,268 |
| 1917..... | 1,631,708 | 12,743,812 | 4,857 | 959,153 | 519 | 103,746 | 34,743 | 3,603 | 19,042 | 164,166 |

Nova Scotia.

The gold production of Nova Scotia which was 6,863 fine ounces in 1862, reached a maximum of 30,348 fine ounces in 1902; then decreased gradually, reaching in 1913 a minimum of 2,174 fine ounces. It is interesting to note that the production in 1915 is nearly identical to that of 1862, the first year returns were reported by the Provincial Mines Department.

The production is derived almost entirely from quartz ores and in 1917 amounted to 2,210 fine ounces, valued at \$45,685, as compared with 4,562 fine ounces valued at \$94,305 in 1916. The production in 1917 is very close to the minimum of 1913 and the great falling off is due mostly, as in other gold districts, to the high cost of supplies and labour.

Nova Scotia: Annual Production of Gold.

| Year. | Tons treated | Fine ounces. | Value. | Yield of gold per ton. | Year. | Tons treated. | Fine ounces. | Value. | Yield of gold per ton. |
|-----------|--------------|--------------|------------|------------------------|----------|---------------|--------------|-----------|------------------------|
| 1862 ... | 6,473 | 6,863 | \$141,871 | \$21.91 | 1890 ... | 42,749 | 22,978 | \$474,990 | \$11.11 |
| 1863 ... | 17,000 | 13,180 | 272,448 | 16.02 | 1891 ... | 36,351 | 21,841 | 451,503 | 12.42 |
| 1864 ... | 21,431 | 18,883 | 390,349 | 18.21 | 1892 ... | 32,552 | 18,865 | 389,965 | 11.98 |
| 1865 ... | 24,421 | 24,011 | 496,357 | 20.32 | 1893 ... | 42,354 | 18,436 | 381,095 | 8.99 |
| 1866 ... | 32,157 | 23,776 | 491,491 | 15.28 | 1894 ... | 55,357 | 18,834 | 389,338 | 7.04 |
| 1867 ... | 31,384 | 25,763 | 532,563 | 16.96 | 1895 ... | 60,600 | 21,919 | 453,119 | 7.47 |
| 1868 ... | 32,259 | 19,377 | 400,555 | 12.41 | 1896 ... | 69,169 | 23,876 | 493,568 | 7.13 |
| 1869 ... | 35,144 | 16,855 | 343,427 | 19.91 | 1897 ... | 73,192 | 27,195 | 562,165 | 7.68 |
| 1870 ... | 30,824 | 18,740 | 387,392 | 12.56 | 1898 ... | 82,747 | 26,054 | 533,590 | 6.50 |
| 1871 ... | 30,787 | 18,139 | 374,972 | 12.17 | 1899 ... | 112,226 | 29,876 | 617,604 | 5.50 |
| 1872 ... | 17,089 | 12,352 | 255,349 | 14.94 | 1900 ... | 87,390 | 28,955 | 593,553 | 6.85 |
| 1873 ... | 17,708 | 11,180 | 231,122 | 13.05 | 1901 ... | 91,948 | 26,459 | 546,963 | 5.32 |
| 1874 ... | 13,844 | 8,623 | 178,244 | 12.87 | 1902 ... | 93,042 | 30,348 | 627,357 | 6.68 |
| 1875 ... | 14,810 | 10,576 | 213,629 | 14.76 | 1903 ... | 103,556 | 25,533 | 527,806 | 5.08 |
| 1876 ... | 15,490 | 11,300 | 233,585 | 15.08 | 1904 ... | 45,436 | 10,362 | 214,209 | 4.71 |
| 1877 ... | 17,369 | 15,925 | 329,205 | 18.95 | 1905 ... | 57,774 | 13,707 | 283,353 | 4.90 |
| 1878 ... | 17,989 | 11,864 | 245,253 | 13.63 | 1906 ... | 66,059 | 12,223 | 252,676 | 3.82 |
| 1879 ... | 15,936 | 12,980 | 268,323 | 16.83 | 1907 ... | 58,550 | 13,675 | 282,686 | 4.82 |
| 1880 ... | 13,997 | 12,472 | 257,823 | 18.42 | 1908 ... | 61,536 | 11,842 | 244,799 | 3.97 |
| 1881 ... | 16,556 | 10,147 | 209,755 | 12.66 | 1909 ... | 56,790 | 10,193 | 210,711 | 3.71 |
| 1882 ... | 21,081 | 13,307 | 275,090 | 13.04 | 1910 ... | 43,006 | 7,928 | 163,891 | 3.81 |
| 1883 ... | 25,954 | 14,571 | 301,207 | 11.60 | 1911 ... | 18,328 | 7,781 | 160,854 | 8.78 |
| 1884 ... | 25,186 | 15,163 | 313,554 | 12.44 | 1912 ... | 14,360 | 4,385 | 90,638 | 6.51 |
| 1885 ... | 28,890 | 20,945 | 432,971 | 14.98 | 1913 ... | 7,324 | 2,174 | 44,935 | 6.13 |
| 1886 ... | 29,010 | 22,038 | 455,564 | 15.70 | 1914 ... | 13,156 | 2,904 | 60,031 | 4.56 |
| 1887 ... | 32,280 | 20,009 | 413,631 | 12.81 | 1915 ... | 25,204 | 6,636 | 137,180 | 5.44 |
| 1888 ... | 36,178 | 21,137 | 436,939 | 12.08 | 1916 ... | 17,497 | 4,562 | 94,305 | 5.38 |
| 1889 ... | 39,160 | 24,673 | 510,029 | 13.02 | 1917 ... | 5,916 | 2,210 | 45,685 | 7.72 |
| Total ... | 2,186,736 | 906,605 | 18,741,272 | 8.57 | | | | | |

Quebec.

The gold production in Quebec during 1917 amounted to 1,511 fine ounces, valued at \$31,235, as against 1,034 fine ounces valued at \$21,375 in 1916.

This production is derived partly from the pyritic mines of the Eastern Townships which are worked chiefly for the sulphur and copper contents of the ore, and partly for the zinc-lead ores of Notre-Dame-des-Anges, Portneuf county. No alluvial production has been reported for a number of years.

Much development is being done at the head-waters of the Harricanaw river, south of Amos station on the Government Transcontinental Railway, and bullion was produced and shipped in the spring of 1918 by the Martin Gold Mining Company, which is operating a two stamp mill.

Quebec: Annual Production of Gold.

| Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. |
|-----------|----------------|----------|-----------|----------------|----------|------------|----------------|----------|
| 1877..... | 583 | \$12,057 | 1891..... | 87 | \$ 1,800 | 1905..... | 191 | \$ 3,940 |
| 1878..... | 868 | 17,937 | 1892..... | 628 | 12,987 | 1906..... | 165 | 3,412 |
| 1879..... | 1,160 | 23,972 | 1893..... | 759 | 15,696 | 1907..... | | |
| 1880..... | 1,605 | 33,174 | 1894..... | 1,412 | 29,196 | 1908..... | | |
| 1881..... | 2,741 | 56,661 | 1895..... | 62 | 1,281 | 1909..... | 193 | 3,990 |
| 1882..... | 327 | 17,093 | 1896..... | 145 | 3,000 | 1910..... | 124 | 2,565 |
| 1883..... | 860 | 17,787 | 1897..... | 44 | 900 | 1911..... | 613 | 12,672 |
| 1884..... | 422 | 8,720 | 1898..... | 295 | 6,089 | 1912..... | 642 | 13,270 |
| 1885..... | 103 | 2,120 | 1899..... | 238 | 4,916 | 1913..... | 701 | 14,491 |
| 1886..... | 193 | 3,981 | 1900..... | | | 1914..... | 1,292 | 26,708 |
| 1887..... | 78 | 1,604 | 1901..... | 145 | 3,000 | 1915..... | 1,099 | 22,720 |
| 1888..... | 181 | 3,740 | 1902..... | 301 | 8,073 | 1916..... | 1,034 | 21,375 |
| 1889..... | 58 | 1,207 | 1903..... | 180 | 3,712 | 1917..... | 1,511 | 31,235 |
| 1890..... | 65 | 1,350 | 1904..... | 140 | 2,900 | Total..... | 21,835 | 431,331 |

‡ Calculated from the value: one dollar = 0.048375 ounce.

Ontario.

The gold production in Ontario, which in 1913 had exceeded the total of all the other years since 1886, more than doubled that figure in 1916, but showed a decrease in 1917 of 14.0 per cent as compared with the production of 1916. The 1917 production which was 57.3 per cent of the total production for Canada, amounted to 423,261 fine ounces valued at \$8,749,581, as against 492,481 fine ounces valued at \$10,180,485 in 1916.

Since 1914 Ontario has become by far the largest producer of gold in Canada, and this remarkable increase was brought about by the successful development of the Porcupine district and by the extension of milling facilities in that camp.

Ontario: Annual Production of Gold.

| Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. |
|-----------|----------------|----------|-----------|----------------|-----------|------------|----------------|------------|
| 1887..... | 327 | \$ 6,760 | 1898..... | 12,863 | \$265,889 | 1909..... | 1,569 | \$ 52,425 |
| 1888..... | | | 1899..... | 20,394 | 421,591 | 1910..... | 3,089 | 63,849 |
| 1889..... | | | 1900..... | 14,391 | 297,495 | 1911..... | 2,062 | 42,625 |
| 1890..... | | | 1901..... | 11,844 | 244,837 | 1912..... | 86,523 | 1,788,596 |
| 1891..... | 97 | 2,000 | 1902..... | 11,118 | 229,828 | 1913..... | 219,801 | 4,543,690 |
| 1892..... | 344 | 7,115 | 1903..... | 9,096 | 188,036 | 1914..... | 268,264 | 5,545,509 |
| 1893..... | 708 | 14,637 | 1904..... | 1,935 | 40,000 | 1915..... | 406,577 | 8,404,693 |
| 1894..... | 1,917 | 39,624 | 1905..... | 4,402 | 91,000 | 1916..... | 492,481 | 10,180,485 |
| 1895..... | 3,015 | 62,320 | 1906..... | 3,202 | 66,193 | 1917..... | 423,261 | 8,749,581 |
| 1896..... | 5,563 | 115,000 | 1907..... | 3,212 | 66,399 | Total..... | 2,020,424 | 41,765,363 |
| 1897..... | 9,157 | 189,294 | 1908..... | 3,212 | 66,389 | | | |

‡ Calculated from the value: one dollar = 0.048375 ounce.

The Porcupine district in Timiskaming, has, since its development in 1912, been the main producer. The principal shippers, by order of importance, were the following: Hollinger, Dome, McIntyre, Porcupine, Crown, Vipond, Schumacher and Dome Lake.

The Kirkland Lake district, also in Timiskaming, has become an important producer, with the Tough Oakes and Teck-Hughes mines as shippers, and the Lake Shore and Kirkland Lake as probable shippers in 1918.

The most spectacular find probably ever made was that of August, 1915, in Munro township, Timiskaming, on the Dobie-Leyson property, now called the Croesus Mine. Specimens from this property have been reported to run from 2,000 to 3,000 ounces in gold. The mine was producing in 1917.

In the Boston Creek district, Timiskaming, the promising development work on several properties attracted many prospectors to this area and resulted in new discoveries in this district. The Provincial Bureau of Mines had a report made on this district, and published in 1916.¹ The Miller Independence Mines, Ltd., is the principal operator in this district.

Much prospecting and development have been done in the adjoining district of Goodfish lake.

The recent discoveries in the Fort Matachewan district, justified an examination by A. G. Burrows, of the Ontario Bureau of Mines.² The principal operators in this new field are: The Mining Corporation of Canada, operating the Davidson property, and the Colorado Ontario Development Company, operating the Otisse claim.

The latest rush is to the Lightning River district, near Abittibi lake.

A good deal of exploration work has been done in the Kowkash district, Thunder Bay, which is reported on by Mr. P. E. Hopkins of the Ontario Bureau of Mines.³

Other gold discoveries were subsequently made in the surrounding district, the most important being at Tashota, 22 miles west of Kowkash, where gold and telluride were discovered.

The St. Anthony mine, operated by the Thunder Mining Company, at Sturgeon lake, Thunder Bay, was producing on a small scale during 1917.

In the Kenora district much interest has been caused by the report of rich gold findings on the Rognon property, near Contact Bay, Wabigoon lake, and a small production was reported in 1917. The Provincial Bureau of Mines describes this district in the 1916 Annual Report.⁴

Operations were also carried on at the Ore Chimney mine, in Frontenac county and the Cordova mine in Peterborough county.

The principal producers in Ontario during 1917 were:—

Table of Operators.

| Operator. | Mine. | District. |
|------------------------------------|-----------------------|----------------------|
| Ore Chimney Mines Co., Ltd. | Ore Chimney..... | Frontenac county. |
| Cordova Mines, Ltd., | Cordova..... | Peterborough county. |
| Dome Mines Co., Ltd. | Dome..... | Timiskaming:— |
| Dome Lake Mines, Ltd. | Dome Lake..... | Porcupine. |
| Hollinger Consol. Gold Mines, Ltd. | Hollinger..... | " |
| McIntyre Porcupine Mines, Ltd. | McIntyre..... | " |
| Newray Mines, Ltd. | Newray..... | " |
| Porcupine Crown Mines, Ltd. | Porcupine Crown..... | " |
| Porcupine Vipond Mines Co., Ltd. | Porcupine Vipond..... | " |
| Wm. C. Offer et al., | Porphyry Hill..... | " |
| Schumacher Gold Mines, Ltd. | Schumacher..... | " |
| Miller Independence Mines, Ltd. | McDonough..... | Boston Creek. |
| Teck Hughes Gold Mines, Ltd. | Teck Hughes..... | Kirkland Lake. |
| Tough Oakes Gold Mines, Ltd., | Tough Oakes..... | " " |
| Croesus Gold Mines, Ltd. | Croesus..... | Munro. |
| Thunder Mining Co. | St. Anthony..... | Thunder Bay:— |
| Rognon Gold Mines, Ltd. | Rognon..... | Sturgeon Lake. |
| | | Kenora:— |
| | | Wabigoon Lake. |

¹ Bulletin No. 29 of the Ontario Bureau of Mines, on Boston Creek and Goodfish Lake gold areas.

² Matachewan Gold Area. Bulletin No. 34, Ontario Bureau of Mines, 1918.

³ Bulletin No. 27, 1916, and Annual Report, Vol. XXVI, pp. 190-226 of the Ontario Bureau of Mines, Kowkash gold area.

⁴ Dryden Gold Area. Annual Report of the Ontario Bureau of Mines. Vol. XXVI, pp. 163-189.

Manitoba.

The gold production in Manitoba during 1917 amounted to 440 ounces, valued at \$9,095 and was derived from the gold and copper ores of the new Pas district in northern Manitoba.

There has been no production reported previous to 1917.

About 85 miles northeast of Pas is Herb or Wekusko lake, where several companies are operating, the principal one, which made its first shipment early in 1917, being the Northern Manitoba Mining and Development Company.

A few miles southwest from Herb lake are: the Flin Flon lake, where much development has been carried on by the Great Sulphides Gold Mines, Ltd., and Schist lake near which operations are being carried on by the Mandy Mining Co., Ltd., a subsidiary company of the Tonopah Mining Company, and which has the distinction of being the first to ship from this new district early in 1917.

Dr. E. L. Bruce, of the Geological Survey, has been conducting an exploration of the Pas district for the past three years and his reports have appeared in the Summary Annual reports of the Geological Survey in 1915, 1916, and 1917. A special report prepared by Mr. Bruce will soon be ready for distribution.

Much exploration and development has been done in the last few years in the Big Rice Lake district, east of lake Winnipeg.

A report on Rice Lake, Pas, and Star Lake districts, prepared by Dr. R. O. Wallace, and Mr. J. S. Delury, acting for the Manitoba Public Utilities Commission, Winnipeg, was published early in 1917. The Gold Pan mine was operated during 1917, and in the spring of 1918 some spectacular ore was shipped from the mine, which has reached the producing stage.

Saskatchewan.

In the autumn of 1913 considerable interest was created in the reported gold discoveries at Beaver lake (Amisk lake). A number of prospectors went in with the opening of navigation. A good deal of prospecting was done during 1914, and some further work in 1915, but as yet no production has been reported. Amisk lake is the western end of the area being examined by Dr. Bruce and referred to under "Manitoba."

Alberta.

There was no gold production reported during 1917. A small recovery had been reported every year, being the recovery from the gravels of the Saskatchewan river. Operations were carried on by individuals and the returns are necessarily incomplete.

Alberta: Annual Production of Gold.

| Year. | Fine ounces. † | Value. | Year. | Fine ounces. † | Value. | Year. | Fine ounces. † | Value. |
|-----------|----------------|----------|----------|----------------|----------|-----------|----------------|---------|
| 1887..... | 102 | \$ 2,100 | 1897.... | 2,419 | \$50,000 | 1907.... | 33 | \$ 675 |
| 1888..... | 58 | 1,200 | 1898.... | 1,209 | 25,000 | 1908.... | 50 | 1,037 |
| 1889..... | 967 | 20,000 | 1899.... | 726 | 15,000 | 1909.... | 25 | 525 |
| 1890..... | 193 | 4,000 | 1900.... | 242 | 5,000 | 1910.... | 89 | 1,850 |
| 1891..... | 266 | 5,500 | 1901.... | 726 | 15,000 | 1911.... | 10 | 207 |
| 1892..... | 508 | 10,506 | 1902.... | 484 | 10,000 | 1912.... | 73 | 1,509 |
| 1893..... | 466 | 9,640 | 1903.... | 48 | 1,000 | 1913.... | | |
| 1894..... | 726 | 15,000 | 1904.... | 24 | 500 | 1914.... | 48 | 992 |
| 1895..... | 2,419 | 50,000 | 1905.... | 121 | 2,500 | 1915.... | 195 | 4,026 |
| 1896..... | 2,661 | 55,000 | 1906.... | 39 | 800 | 1916.... | 82 | 1,695 |
| | | | | | | 1917.... | | |
| | | | | | | Total.... | 15,009 | 310,262 |

† Calculated from the value: one dollar = 0.048375 oz.

British Columbia.

The gold production of British Columbia in 1917 amounted to 133,742 fine ounces, valued at \$2,764,693, and included: (a) placer gold \$496,000, or 18.0 per cent of the total; (b) bullion from mill ore \$539,762, or 19.5 per cent; and (c) smelter recoveries \$1,728,931, or 62.5 per cent of the total production.

The production in 1916 amounted to 219,633 fine ounces, valued at \$4,540,216, and comprising: (a) placer gold \$580,500 or 12.8 per cent of the total; (b) bullion from milling ores \$290,088 or 6.4 per cent of the total; and (c) smelter recoveries \$3,669,628 or 80.8 per cent.

The total production in 1917 showed a decrease of 39 per cent and is due mostly to the labour troubles and also to the high cost of supplies and high wages exacted by the miners. It amounted to 18.1 per cent of the total production of Canada.

The statistics of lode gold represented, as closely as can be ascertained, the actual gold recovery based on smelter recoveries and bullion shipments.

The record production of placer gold is given as ascertained by the Provincial Mineralogist, who, in his Annual Report in 1916 stated that:—

“Great difficulty is found in obtaining reliable figures, since the work is, in many cases, carried out by individuals or unorganized groups of men who keep no books, frequently paying wages, or for supplies, in gold-dust, which, being readily transported, is scattered, and the tax imposed thereon by law is thus evaded.”

The production of gold from lode mining as reported by the Provincial Bureau of Mines being based upon metal contents of ore shipments is naturally somewhat higher than the record of smelter recoveries.

British Columbia: Annual Production of Gold.

| Year. | Fine ounces.† | Value. | Year. | Fine ounces.† | Value. | Year. | Fine ounces.† | Value. |
|-----------|---------------|------------|-----------|---------------|-------------|----------|---------------|--------------|
| 1858..... | 34,104 | \$ 705,000 | 1878..... | 61,688 | \$1,275,204 | 1898... | 142,215 | \$ 2,939,852 |
| 1859..... | 73,129 | 1,615,072 | 1879..... | 62,407 | 1,290,058 | 1899.... | 203,295 | 4,202,473 |
| 1860..... | 107,806 | 2,228,543 | 1880..... | 49,044 | 1,613,827 | 1900.... | 228,916 | 4,732,105 |
| 1861..... | 128,973 | 2,666,118 | 1881..... | 50,636 | 1,046,737 | 1901.... | 257,292 | 5,318,703 |
| 1862..... | 128,528 | 2,656,903 | 1882..... | 46,154 | 954,085 | 1902.... | 288,383 | 5,961,409 |
| 1863..... | 189,318 | 3,913,563 | 1883..... | 33,422 | 794,252 | 1903.... | 284,103 | 5,873,036 |
| 1864..... | 180,722 | 3,735,350 | 1884..... | 35,612 | 736,165 | 1904.... | 275,975 | 5,704,908 |
| 1865..... | 168,887 | 3,491,205 | 1885..... | 34,527 | 713,738 | 1905.... | 285,529 | 5,902,402 |
| 1866..... | 128,779 | 2,662,106 | 1886..... | 43,714 | 903,651 | 1906.... | 269,386 | 5,579,039 |
| 1867..... | 129,012 | 2,480,868 | 1887..... | 33,558 | 693,709 | 1907.... | 236,216 | 4,883,020 |
| 1868..... | 114,792 | 2,372,972 | 1888..... | 29,434 | 616,731 | 1908.... | 236,858 | 5,929,380 |
| 1869..... | 85,865 | 1,774,978 | 1889..... | 23,489 | 588,923 | 1909.... | 250,320 | 5,174,579 |
| 1870..... | 64,675 | 1,336,956 | 1890..... | 23,918 | 494,436 | 1910.... | 261,386 | 5,403,318 |
| 1871..... | 87,048 | 1,790,440 | 1891..... | 20,792 | 429,811 | 1911.... | 238,496 | 4,930,145 |
| 1872..... | 77,931 | 1,610,972 | 1892..... | 19,327 | 399,525 | 1912.... | 251,815 | 5,205,485 |
| 1873..... | 63,166 | 1,305,749 | 1893..... | 18,360 | 379,535 | 1913.... | 297,459 | 6,149,027 |
| 1874..... | 89,233 | 1,844,618 | 1894..... | 25,664 | 530,530 | 1914.... | 252,730 | 5,224,393 |
| 1875..... | 119,724 | 2,474,904 | 1895..... | 61,289 | 1,266,954 | 1915.... | 273,376 | 5,651,184 |
| 1876..... | 86,429 | 1,786,648 | 1896..... | 86,504 | 1,783,206 | 1916.... | 219,633 | 4,540,216 |
| 1877..... | 77,796 | 1,608,132 | 1897..... | 131,806 | 2,724,657 | 1917.... | 133,742 | 2,764,593 |
| | | | | | | Total... | 7,970,291 | 164,781,243 |

Calculated from the value: one dollar = 0.048375 oz.

British Columbia: Production of Gold by Districts, 1916 and 1917.*

| Districts. | 1916. | | | | 1917. | | | |
|---|--------------|-----------|------------|-----------|--------------|-----------|------------|-----------|
| | GOLD PLACER. | | GOLD LODE. | | GOLD PLACER. | | GOLD LODE. | |
| | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. |
| Cariboo:— | | | | | | | | |
| Cariboo | 7,900 | \$158,000 | | | 6,750 | \$135,000 | | |
| Quesnel | 1,000 | 20,000 | | | 750 | 15,000 | | |
| Omineca | 850 | 17,000 | 1,303 | \$ 26,933 | 600 | 12,000 | 931 | \$ 9 244 |
| Cassiar:— | | | | | | | | |
| Atlin | 16,925 | 338,500 | 736 | 15,213 | 15,250 | 305,000 | 1,000 | 20,670 |
| All others | 1,100 | 22,000 | 3,806 | 78,670 | 350 | 7,000 | 9,805 | 202,669 |
| East Kootenay:— | | | | | | | | |
| Fort Steele | 200 | 4,000 | | | 100 | 2,000 | | |
| West Kootenay:— | | | | | | | | |
| Ainsworth | | | 45 | 930 | | | 1 | 20 |
| Nelson | 50 | 1,000 | 4,107 | 84,891 | 50 | 1,000 | 2,521 | 52,109 |
| Slocan | | | 64 | 1,323 | | | 18 | 372 |
| Trail creek | | | 129,790 | 2,682,759 | | | 33,290 | 688,104 |
| Others | 50 | 1,000 | 22 | 455 | 50 | 1,000 | 62 | 1,282 |
| Lillooet:— | | | | | | | | |
| Lillooet | 250 | 5,000 | 2,625 | 54,259 | 300 | 6,000 | 3,092 | 63,912 |
| Yale:— | | | | | | | | |
| Grand Forks, Greenwood and Osoyoos | 50 | 1,000 | 75,628 | 1,563,231 | 50 | 1,000 | 58,544 | 1,210,104 |
| Similkameen, Nicola and Vernon | 450 | 9,000 | 32 | 661 | 400 | 8,000 | 111 | 2,294 |
| Yale, Ashcroft and Kam- loops | 150 | 3,000 | 570 | 11,782 | 100 | 2,000 | 1,355 | 28,008 |
| Coast | 50 | 1,000 | 3,204 | 66,227 | 50 | 1,000 | 3,793 | 78,402 |
| Total | 29,025 | 580,500 | 221,932 | 4,587,334 | 24,800 | 496,000 | 114,523 | 2,367,190 |

*From Annual Report of the Minister of Mines for British Columbia.

Yukon.

The gold production of the Yukon in 1917 amounted to 177,667 fine ounces valued at \$3,672,703 and included 1,119 ounces valued at \$23,091 derived from lode mining. The production in 1916 was 212,700 ounces valued at \$4,396,900 and included 690 ounces valued at \$14,264 derived from lode mining.

The production in 1917 constituted 24.0 per cent of the total production of Canada.

The total placer production of the Yukon in 1917 is estimated at \$3,681,912 and includes 176,548 fine ounces of gold valued at \$3,649,571 and 39,723 fine ounces of silver valued at \$32,341.

The placer production of the Yukon in 1916 was estimated at 212,010 fine ounces of gold, valued at \$4,382,636, and 47,703 fine ounces of silver, valued at \$31,322, making a total valuation of \$4,413,958.

The statistics of production of gold in the Yukon district during the years between 1898 and 1906, as given in the table showing the annual production, are based primarily on the receipts of gold at the United States mints and receiving offices credited to the Canadian Yukon. Although a royalty was exacted on the gold output, it seems certain that considerable amounts of gold were produced which escaped royalty payment especially during the years of high production.

Annual Production of Gold in Yukon.

| Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. | Year. | Fine ounces. ‡ | Value. |
|------------|-------------------|------------|------------|-------------------|------------|------------|-------------------|--------------|
| 1885 } | | | 1896 . . . | 14,513 | \$ 300,000 | 1907 . . . | 152,381 | \$ 3,150,000 |
| 1886 } | 4,837 | \$ 100,000 | 1897 . . . | 120,937 | 2,500,000 | 1908 . . . | 174,150 | 3,600,000 |
| 1887 . . . | 3,386 | 70,000 | 1898 . . . | 483,750 | 10,000,000 | 1909 . . . | 191,565 | 3,960,000 |
| 1888 . . . | 1,935 | 40,000 | 1899 . . . | 774,000 | 16,000,000 | 1910 . . . | 221,091 | 4,570,362 |
| 1889 . . . | 8,466 | 175,000 | 1900 . . . | 1,077,553 | 22,275,000 | 1911 . . . | 224,197 | 4,634,574 |
| 1890 . . . | 8,466 | 175,000 | 1901 . . . | 870,750 | 18,000,000 | 1912 . . . | 268,447 | 5,549,296 |
| 1891 . . . | 1,935 | 40,000 | 1902 . . . | 701,437 | 14,500,000 | 1913 . . . | 282,838 | 5,846,780 |
| 1892 . . . | 4,233 | 87,500 | 1903 . . . | 592,594 | 12,250,000 | 1914 . . . | 247,940 | 5,125,374 |
| 1893 . . . | 8,514 | 176,000 | 1904 . . . | 507,938 | 10,500,000 | 1915 . . . | 230,173 | 4,758,093 |
| 1894 . . . | 6,047 | 125,000 | 1905 . . . | 381,001 | 7,876,000 | 1916 . . . | 212,700 | 4,396,900 |
| 1895 . . . | 12,094 | 250,000 | 1906 . . . | 270,900 | 5,600,000 | 1917 . . . | 177,667 | 3,672,703 |
| | | | | | | Total. | 8,238,435 | 170,3035 87 |

‡ Calculated from the value: one dollar = 0.048375 oz.

* Including a small production from lode mines.

Since 1906 the statistics of gold production of the Yukon have been based on the royalty of 2½ per cent which is collected by the Interior Department. For the purpose of collecting the royalty, a fixed value of \$15 per ounce is placed on the crude gold. The actual value of the deposits for a number of years, has been about \$16.50 per ounce. At the Dominion Government Assay Office at Vancouver, B.C., there was deposited during the twelve months ending December 31, 1917, 79,532.35 ounces from the Yukon, valued after all charges had been deducted, at \$1,262,207, or an average of \$15.87 per ounce, as against 95,005.82 ounces, valued at \$1,525,723.55, or an average of \$16.06 per ounce in 1916.

**Receipts from the Yukon, at the Dominion Government Assay Office,
Vancouver, B.C.**

| Year. | Weight before Melting. | Net Value. | Average Value. | Year. | Weight before Melting. | Net Value. | Average Value. |
|--------------------|------------------------------|---------------|-------------------|--------------------|------------------------------|---------------|-------------------|
| | Ounces. | | | | Ounces. | | |
| 1908 (a) | 60,132.00 | \$1,000,296 | \$16.63 | 1913 (b) | 15,235.29 | \$ 247,189 | \$16.22 |
| 1909 | 5,003.12 | 83,871 | 16.75 | 1914 | 56,564.83 | 915,914 | 16.21 |
| 1910 | 3,594.87 | 62,094 | 17.27 | 1915 | 87,040.87 | 1,418,497 | 16.28 |
| 1911 | 2,073.61 | 34,994 | 16.88 | 1916 | 95,005.82 | 1,525,724 | 16.06 |
| 1912 | 2,211.88 | 36,431 | 16.41 | 1917 | 79,532.35 | 1,262,207 | 15.87 |

(a) For nine months only.

(b) The removal in 1913 of the assay charge accounts for the great increase.

The production of crude placer gold in the Yukon district the past six years, as ascertained by the Interior Department, and upon which a royalty of 2½ per cent has been collected, is shown in the accompanying table:—

Production of Crude Gold in the Yukon District.

(Gross weight of dust, nuggets, and bullion in ounces.)

| Month. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|----------------|------------|------------|------------|------------|------------|------------|
| January..... | 5-25 | 19-30 | 136-50 | 520-69 | 3,116-18 | 2,490-11 |
| February..... | 525-29 | 56-90 | 325-50 | 40 | 566-62 | 740-73 |
| March..... | 0-60 | | 6-75 | 232-13 | 1,574-82 | 1,033-37 |
| April..... | | 1,293-09 | 1,572-65 | 277-81 | 859-56 | 1,290-64 |
| May..... | 26,158-66 | 5,557-35 | 11,668-10 | 17,553-29 | 13,099-13 | 7,586-43 |
| June..... | 54,243-03 | 67,594-39 | 67,604-85 | 57,884-87 | 38,292-47 | 33,684-56 |
| July..... | 58,233-29 | 57,873-50 | 45,067-31 | 49,478-87 | 35,598-34 | 34,339-33 |
| August..... | 56,975-55 | 63,315-92 | 49,458-17 | 41,015-41 | 47,980-26 | 41,439-50 |
| September..... | 53,225-29 | 58,641-62 | 62,744-69 | 47,055-83 | 45,883-90 | 33,652-02 |
| October..... | 61,518-01 | 66,798-37 | 63,365-22 | 59,984-89 | 62,927-73 | 57,227-13 |
| November..... | 11,648-08 | 26,565-50 | 4,308-00 | 7,248-17 | 13,168-23 | 4,184-74 |
| December..... | 7,432-72 | 5,183-50 | 3,433-43 | 6,001-77 | 1,944-64 | 3,015-97 |
| | 335,015-67 | 352,900-04 | 309,691-17 | 287,254-16 | 265,013-88 | 220,684-53 |

Since 1898 a royalty to the extent of \$4,575,217.59 has been collected on the gold production of this district. The yearly amounts collected, as well as the annual production of gold as ascertained by the Interior Department, are shown in the accompanying table. The difference between these figures and those shown in the table of annual production of the district which are based on mint receipts of Yukon gold, has already been mentioned, and is probably due to three factors: (1) the fixing of the value of the gold for royalty purposes at \$15 per ounce, (2) the probability that in the earlier years of royalty collection, considerable quantities of gold dust left the camps unrecorded and escaped royalty payments, and (3) the fact that in the last few years there has been a small but growing production from the lode mines.

Gold Production in the Yukon, the Royalty Collected.†

| Fiscal Year. | Total Gold Production. | Total Exemption. | Royalty Collected on. | Royalty Paid. |
|------------------------|------------------------|------------------|-----------------------|---------------|
| Ending June, 1898..... | \$ 3,072,773 | \$ 339,845 | \$ 2,732,928 | \$273,292-32 |
| " " 1899..... | 7,582,283 | 1,699,657 | 5,882,626 | 588,262-37 |
| " " 1900..... | 9,809,465 | 2,501,744 | 7,307,720 | 730,771-99 |
| " " 1901..... | 9,162,083 | 1,927,666 | 7,234,416 | 592,660-98 |
| " " 1902..... | 9,566,340 | 1,199,114 | 8,367,226 | 331,436-79 |
| " " 1903..... | 12,113,015 | | 12,113,015 | 302,893-48 |
| " " 1904..... | 10,790,663 | | 10,790,663 | 272,217-96 |
| " " 1905..... | 8,222,054 | | 8,222,054 | 206,760-87 |
| " " 1906..... | 6,540,007 | | 6,540,007 | 163,963-25 |
| March, 1907..... | 3,304,791 | | 3,304,791 | 82,622-42 |
| " " 1908..... | 2,820,162 | | 2,820,162 | 70,504-65 |
| " " 1909..... | 3,260,283 | | 3,260,282 | 81,507-07 |
| " " 1910..... | 3,594,251 | | 3,594,251 | 89,844-10 |
| " " 1911..... | 4,126,728 | | 4,126,728 | 103,168-19 |
| " " 1912..... | 4,024,237 | | 4,024,237 | 100,606-29 |
| " " 1913..... | 5,018,412 | | 5,018,412 | 125,460-52 |
| " " 1914..... | 5,301,508 | | 5,301,508 | 132,537-69 |
| " " 1915..... | 4,649,634 | | 4,649,634 | 116,241-04 |
| " " 1916..... | 4,458,278 | | 4,458,278 | 111,457-19 |
| " " 1917..... | 3,960,207 | | 3,960,207 | 99,007-92 |
| Total..... | 121,377,173 | | 113,709,146 | 4,575,217-59 |

† From the Report of the Yukon and Mining Lands Branch of the Department of the Interior, Fiscal Year ending March 31, 1917, p. 50.

LEAD.

The production of lead in Canada in 1917 amounted to 32,576,281 pounds, valued at \$3,628,020, as compared with 41,497,615 pounds, valued at \$3,532,692, in 1916, a decrease of 21.5 per cent in quantity but an increase of 2.7 per cent in value. In 1916 there had been a decrease of 10.4 per cent in quantity and an increase of 40.0 per cent in value.

The statistics of lead production since 1909 as given in the accompanying table represent the quantity of refined lead produced in Canada from domestic ores, together with a small quantity of lead contained in lead ore or bullion exported. The production has been mainly from British Columbia with occasional small amounts from other provinces and the Yukon Territory.

For a number of years there has been a very wide divergence between the record of lead recovery and the statements of lead contained in ores shipped from the mines. While the difference is due in part to smelter losses, there was also, during 1912 and 1913 especially, a considerable accumulation of lead ores at the Trail smelter. In 1915, however, the recovery of lead in smelters was but little less than the estimated possible recovery (on the basis of a 90 per cent recovery) from ores shipped from mines, apparently indicating a reduction in stocks of ores at the smelter, but in 1916 the estimated possible recovery from lead ores shipped from mines exceeded by far the recovery in smelter, while in 1917 the possible recovery in ore shipped exceeded only slightly the recovery of lead in smelters.

Annual Production of Lead.

| Year. | Pounds. | Cents per Pound. | Value. | Year. | Pounds. | Cents per Pound. | Value. |
|-----------|------------|------------------|-----------|-----------|------------|------------------|------------|
| 1887..... | 204,800 | 5.400 | \$ 9,216 | 1902..... | 22,956,381 | 4.069 | \$ 934,095 |
| 1888..... | 674,500 | 4.420 | 29,812 | 1903..... | 18,139,283 | 4.237 | 768,562 |
| 1889..... | 165,100 | 3.930 | 6,488 | 1904..... | 37,531,244 | 4.309 | 1,617,221 |
| 1890..... | 105,000 | 4.480 | 4,704 | 1905..... | 56,864,915 | 4.707 | 2,676,632 |
| 1891..... | 88,665 | 4.350 | 3,857 | 1906..... | 54,608,217 | 5.657 | 3,089,137 |
| 1892..... | 808,420 | 4.090 | 33,064 | 1907..... | 47,738,703 | 5.325 | 2,542,086 |
| 1893..... | 2,135,023 | 3.730 | 79,636 | 1908..... | 43,195,733 | 4.200 | 1,814,221 |
| 1894..... | 5,703,222 | 3.290 | 187,636 | 1909..... | 45,857,424 | *3.690 | 1,692,139 |
| 1895..... | 16,461,794 | 3.230 | 531,716 | 1910..... | 32,937,508 | *3.687 | 1,216,249 |
| 1896..... | 24,199,977 | 2.980 | 721,159 | 1911..... | 23,784,969 | †3.480 | 827,717 |
| 1897..... | 39,018,219 | 3.580 | 1,396,853 | 1912..... | 35,763,476 | †4.467 | 1,597,564 |
| 1898..... | 31,915,319 | 3.730 | 1,206,399 | 1913..... | 37,662,703 | †4.659 | 1,754,705 |
| 1899..... | 21,862,436 | 4.470 | 977,250 | 1914..... | 36,337,765 | †4.479 | 1,627,568 |
| 1900..... | 63,169,821 | 4.370 | 2,760,521 | 1915..... | 46,316,450 | †5.600 | 2,593,721 |
| 1901..... | 51,900,958 | 4.334 | 2,249,387 | 1916..... | 41,497,615 | †8.513 | 3,532,692 |
| | | | | 1917..... | 32,576,281 | †11.137 | 3,628,020 |

* In 1909 and 1910, average prices at Toronto as quoted by *Hardware and Metal*, in previous years average prices at New York, as quoted by *Engineering and Mining Journal*.

† Average price at Montreal. Quotations furnished by Messrs. Thos. Robertson & Co., Montreal, Que.

Ores Shipped and Metal Contents.

| Year. | Lead Ores Shipped in Tons. | Lead Contents in Pounds. | Silver Contents in Ounces. |
|-----------|----------------------------|--------------------------|----------------------------|
| 1912..... | 59,814 | 45,896,537 | 2,366,294 |
| 1913..... | 85,978 | 53,807,570 | 2,564,155 |
| 1914..... | 70,207 | 50,527,130 | 2,501,820 |
| 1915..... | 88,647 | 48,708,005 | 2,954,175 |
| 1916..... | 84,516 | 54,124,623 | 2,582,952 |
| 1917..... | 46,799 | 28,696,116 | 1,670,064 |

Previous to 1904 lead ores mined in Canada were either exported as ore or smelted in Canadian furnaces and exported in the form of base bullion to be refined abroad. A lead refinery employing the Betts electrolytic process has been in operation at Trail, B.C., since 1904, treating the base bullion produced by the lead blast furnaces.

The North American Smelting Company erected a plant at Kingston, Ont., which started operations during the latter part of 1912, treating scrap and lead dross, as well as ores from the United States, British Columbia, and Ontario. This plant closed down November 1, 1913, but operations were resumed during the latter part of 1916 by the Kingston Smelting Co., Ltd., under lease. Operations were carried on for four months in 1917.

The Estate of James Robertson, operating the Kingdon lead mine at Galetta, put in a 20-ton open-hearth lead furnace, which was operated in October and November, 1916, and also for six months in 1917.

Refined Lead Produced.

| Year. | Pounds of Refined Lead Produced. | Year. | Pounds of Refined Lead Produced. | Year. | Pounds of Refined Lead Produced. |
|-----------|----------------------------------|-----------|----------------------------------|-----------|----------------------------------|
| 1904..... | 7,519,440 | 1909..... | 41,883,614 | 1913..... | 39,663,766 |
| 1905..... | 15,804,509 | 1910..... | 32,987,508 | 1914..... | 36,443,706 |
| 1906..... | 20,471,314 | 1911..... | 23,525,050 | 1915..... | 43,518,618 |
| 1907..... | 26,607,461 | 1912..... | 37,008,490 | 1916..... | 43,100,236 |
| 1908..... | 36,549,274 | | | 1917..... | 27,886,602 |

* The refined lead reported includes also that from foreign ores.

Prices.—The price of lead at Montreal, the main Canadian market, has been higher than the New York and London values for the past five years. The average price of lead at Montreal in 1917 was 11.137 cents per pound, as against 6.626 cents in London, 8.787 cents in New York, and 8.721 cents in St. Louis.

The Toronto price in winter is about the same as that at Montreal, but the latter falls during the period of summer freight rates about 10 cents per 100 pounds below the former.

The price of soft lead on the London market in 1917 was fixed at £30, as compared with an average of £30 19s. 6d. in 1916.

Yearly Average Prices of Lead in Montreal, London, New York, and St. Louis.

(Values in cents per pound.)

| | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|----------------|-------|-------|-------|-------|-------|-------|-------|--------|
| Montreal..... | 3.246 | 3.480 | 4.467 | 4.659 | 4.479 | 5.600 | 8.513 | 11.137 |
| London..... | 2.775 | 2.992 | 3.921 | 4.072 | 4.146 | 4.979 | 6.715 | 6.626 |
| New York..... | 4.446 | 4.420 | 4.471 | 4.370 | 3.862 | 4.673 | 6.858 | 8.787 |
| St. Louis..... | 4.312 | 4.236 | 4.360 | 4.238 | 3.737 | 4.567 | 6.777 | 8.721 |

Monthly Average Prices of Pig-Lead at Montreal.*

(Values in cents per pound.)

| Month. | 1907. | 1908. | 1909. | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| January..... | 4·94 | 3·67 | 3·35 | 3·48 | 3·31 | 3·93 | 4·32 | 4·78 | 4·27 | 7·29 | 9·50 |
| February..... | 4·88 | 3·60 | 3·38 | 3·40 | 3·32 | 3·97 | 4·18 | 4·73 | 4·58 | 7·73 | 11·35 |
| March..... | 4·92 | 3·54 | 3·42 | 3·34 | 3·34 | 4·08 | 4·05 | 4·57 | 5·04 | 9·25 | 11·77 |
| April..... | 4·92 | 3·44 | 3·35 | 3·21 | 3·26 | 4·10 | 4·42 | 4·41 | 5·21 | 9·60 | 11·54 |
| May..... | 4·84 | 3·21 | 3·26 | 3·13 | 3·20 | 4·08 | 4·66 | 4·54 | 5·26 | 9·10 | 13·19 |
| June..... | 4·93 | 3·11 | 3·23 | 3·15 | 3·27 | 4·34 | 4·98 | 4·55 | 6·53 | 8·48 | 14·62 |
| July..... | 4·98 | 3·17 | 3·12 | 3·13 | 3·33 | 4·57 | 4·93 | 4·49 | 6·35 | 7·79 | 13·26 |
| August..... | 4·69 | 3·31 | 3·08 | 3·11 | 3·45 | 4·84 | 5·02 | 4·48 | 5·62 | 7·76 | 13·14 |
| September..... | 4·85 | 3·24 | 3·14 | 3·11 | 3·63 | 5·47 | 5·02 | 4·42 | 5·63 | 8·41 | 10·93 |
| October..... | 4·56 | 3·29 | 3·26 | 3·23 | 3·77 | 5·07 | 4·99 | 4·07 | 5·71 | 8·61 | 8·46 |
| November..... | 4·25 | 3·42 | 3·28 | 3·31 | 3·93 | 4·53 | 4·32 | 4·29 | 6·39 | 8·72 | 7·92 |
| December..... | 3·65 | 3·37 | 3·34 | 3·35 | 3·95 | 4·55 | 4·52 | 4·41 | 6·61 | 9·42 | 7·92 |
| Average..... | 4·701 | 3·364 | 3·268 | 3·246 | 3·480 | 4·467 | 4·659 | 4·479 | 5·600 | 8·513 | 11·137 |

*Producers' prices for car-load quantities ex-cars Montreal as furnished by Messrs. Thos. Robertson Co., Ltd., of Montreal.

Monthly Average Prices of Lead in New York.†

(Values in cents per pound.)

| Month. | 1906. | 1907. | 1908. | 1909. | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| January..... | 5·690 | 6·000 | 3·691 | 4·175 | 4·700 | 4·483 | 4·435 | 4·321 | 4·111 | 3·729 | 5·921 | 7·626 |
| February..... | 5·465 | 6·000 | 3·725 | 4·018 | 4·613 | 4·440 | 4·026 | 4·325 | 4·048 | 3·827 | 6·246 | 8·636 |
| March..... | 5·350 | 6·000 | 3·838 | 3·986 | 4·359 | 4·394 | 4·073 | 4·327 | 3·970 | 4·053 | 7·136 | 9·199 |
| April..... | 5·404 | 6·000 | 3·993 | 4·168 | 4·376 | 4·412 | 4·200 | 4·381 | 3·810 | 4·221 | 7·630 | 9·288 |
| May..... | 5·685 | 6·000 | 4·253 | 4·287 | 4·315 | 4·373 | 4·194 | 4·342 | 3·900 | 4·274 | 7·463 | 10·207 |
| June..... | 5·750 | 5·760 | 4·466 | 4·350 | 4·343 | 4·435 | 4·392 | 4·325 | 3·900 | 5·932 | 6·936 | 11·171 |
| July..... | 5·750 | 5·288 | 4·447 | 4·321 | 4·404 | 4·499 | 4·720 | 4·353 | 3·891 | 5·659 | 6·352 | 10·710 |
| August..... | 5·750 | 5·250 | 4·580 | 4·363 | 4·400 | 4·500 | 4·569 | 4·624 | 3·875 | 4·656 | 6·244 | 10·594 |
| September..... | 5·750 | 4·813 | 4·515 | 4·342 | 4·400 | 4·485 | 5·048 | 4·698 | 3·828 | 4·610 | 6·810 | 8·680 |
| October..... | 5·750 | 4·750 | 4·351 | 4·341 | 4·400 | 4·265 | 5·071 | 4·402 | 3·528 | 4·600 | 7·000 | 6·710 |
| November..... | 5·750 | 4·376 | 4·330 | 4·370 | 4·442 | 4·298 | 4·615 | 4·298 | 3·683 | 5·155 | 7·042 | 6·249 |
| December..... | 5·900 | 3·658 | 4·213 | 4·560 | 4·500 | 4·450 | 4·303 | 4·047 | 3·800 | 5·355 | 7·513 | 6·375 |
| Average..... | 5·657 | 5·325 | 4·200 | 4·273 | 4·446 | 4·420 | 4·471 | 4·370 | 3·862 | 4·673 | 6·858 | 8·787 |

†From the *Engineering and Mining Journal*.

Monthly Average Prices of Lead in London.‡

(In £ Sterling per ton of 2,240 pounds.)

| Month. | 1908. | 1909. | 1910. | 1911. | 1912. |
|---------------------|----------|----------|----------|----------|----------|
| January..... | 14 10 6 | 13 3 6 | 13 3 11 | 13 0 8 | 15 11 3 |
| February..... | 14 5 6 | 13 5 5 | 13 7 3 | 13 1 11 | 15 13 9 |
| March..... | 14 1 4 | 13 8 8½ | 13 2 9 | 13 2 11 | 15 19 8 |
| April..... | 13 15 10 | 13 7 0 | 12 13 9 | 12 18 5 | 16 6 6 |
| May..... | 13 2 7 | 13 5 3 | 12 11 8 | 12 19 2 | 16 10 2 |
| June..... | 12 15 7 | 13 2 4 | 12 13 9 | 13 5 5 | 17 11 8 |
| July..... | 12 19 6 | 12 13 3 | 12 11 8 | 13 10 11 | 18 8 9 |
| August..... | 13 9 10½ | 12 10 6 | 12 10 10 | 14 1 4 | 19 5 8 |
| September..... | 13 3 6 | 12 15 3 | 12 12 6 | 14 15 1 | 21 9 0 |
| October..... | 13 7 3 | 13 4 4 | 13 2 0 | 15 6 1 | 20 8 0 |
| November..... | 13 12 2 | 13 1 4½ | 13 4 6 | 15 15 5 | 18 4 7 |
| December..... | 13 3 6 | 13 2 11½ | 13 3 9 | 15 13 4 | 18 1 6 |
| Yearly average..... | 13 10 5 | 13 1 8 | 12 19 0 | 13 19 3 | 17 15 11 |

| Month. | 1913. | 1914. | 1915. | 1916. | 1917. |
|---------------------|----------|----------|----------|---------|--------|
| January..... | 17 1 11 | 18 19 10 | 18 12 0 | 30 17 5 | 30 0 0 |
| February..... | 16 8 5 | 19 2 8 | 19 3 7 | 31 18 9 | 30 0 0 |
| March..... | 15 19 8 | 19 2 3 | 21 17 8 | 34 7 8 | 30 0 0 |
| April..... | 17 8 10 | 17 19 8 | 21 2 1 | 34 8 0 | 30 0 0 |
| May..... | 18 14 3 | 18 4 8 | 20 9 2 | 32 19 5 | 30 0 0 |
| June..... | 19 10 8 | 18 13 11 | 25 4 1 | 30 14 0 | 30 0 0 |
| July..... | 19 7 10 | 18 8 6 | 24 12 3 | 27 8 11 | 30 0 0 |
| August..... | 19 15 8 | 20 9 9 | 21 18 11 | 29 2 7 | 30 0 0 |
| September..... | 19 14 10 | 18 16 3 | 23 3 0 | 29 17 4 | 30 0 0 |
| October..... | 19 9 5 | 17 9 8 | 23 19 9 | 30 0 0 | 30 0 0 |
| November..... | 18 13 9 | 17 19 9 | 26 2 9 | 30 0 0 | 30 0 0 |
| December..... | 17 8 8 | 18 18 6 | 28 8 8 | 30 0 0 | 30 0 0 |
| Yearly average..... | 18 6 2 | 18 13 9 | 22 17 10 | 30 19 6 | 30 0 0 |

‡ As published by the Metal Information Bureau, London.

Exports and Imports.—The exports of lead in 1917 amounted to 14,414,900 pounds, valued at \$987,509, and consisted of lead in ores, concentrates, bullion, etc., 13,410,400 pounds, valued at \$925,056, and pig-lead 1,004,500 pounds, valued at \$62,453. The exports in 1916 amounted to 9,160,500 pounds, valued at \$565,890, and consisted of lead in ores, concentrates, bullion, etc., 9,043,400 pounds, valued at \$558,180, and pig-lead 112,100 pounds, valued at \$7,710.

The large increase in the exports for 1916 and 1917 is due to the fact that a few thousand tons of base bullion were exported from Trail, B.C., for refining in the United States.

The imports of lead in 1917 were 8,432 tons, valued at \$1,732,428, and included certain manufactures of lead valued at \$190,091 for which no equivalent quantity is given. In 1916, the imports were 13,580 tons, valued at \$2,077,896, and included manufactures of lead valued at \$155,278.

Exports of Lead, 1910 to 1917.

| | Lead in Ore Concentrates, etc. | | Pig Lead. | | Total. | |
|-----------|-----------------------------------|----------|-----------|-----------|------------|-----------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1910..... | 46,800 | \$ 1,308 | 7,712,253 | \$248,174 | 7,759,053 | \$249,482 |
| 1911..... | 65,100 | 1,826 | 71,961 | 2,806 | 137,061 | 4,632 |
| 1912..... | 290,240 | 8,193 | | | 290,240 | 8,193 |
| 1913..... | 329,968 | 9,136 | | | 329,960 | 9,136 |
| 1914..... | 246,100 | 2,681 | 510,573 | 19,507 | 756,673 | 22,188 |
| 1915..... | 1,845,100 | 40,273 | 2,066,929 | 79,067 | 3,912,029 | 119,340 |
| 1916..... | 9,048,400 | 558,180 | 112,100 | 7,710 | 9,160,500 | 565,890 |
| 1917..... | 13,410,400 | 925,056 | 1,004,500 | 62,453 | 14,414,900 | 987,509 |

Imports of Lead, 1915, 1916, and 1917.

| | 1915. | | 1916. | | 1917. | |
|---|--------|-------------|--------|-------------|-------|-----------|
| | Tons. | Value. | Tons. | Value. | Tons. | Value. |
| Old scrap, pig and block..... | 21,308 | \$2,010,006 | 9,933 | \$1,258,284 | 5,755 | \$958,402 |
| Bars and sheets..... | 456 | 56,331 | 492 | 85,686 | 523 | 111,002 |
| Pipe..... | 73 | 8,708 | 109 | 21,450 | 139 | 29,502 |
| Shot and bullets..... | 543 | 51,890 | 39 | 6,390 | 13 | 2,163 |
| Manufactures of lead (a)..... | | 102,439 | | 155,278 | | 190,091 |
| Tea lead..... | 480 | 67,652 | 1,073 | 193,541 | 245 | 59,231 |
| Litharge..... | 790 | 89,232 | 1,384 | 211,359 | 1,404 | 275,919 |
| Total..... | 23,650 | 2,386,258 | 13,030 | 1,936,988 | 8,079 | 1,626,310 |
| Metallic lead contained in imported lead pigments..... | 719 | 96,658 | 550 | 140,908 | 353 | 106,118 |
| | 24,369 | 2,482,916 | 13,580 | 2,077,896 | 8,432 | 1,732,428 |

(a) Includes nitrate and acetate of lead in 1915, 250,921 pounds valued at \$23,269; and in 1916, 224,648 pounds valued at \$30,445.

Imports of Lead in Pigs, Bars, Sheets, etc., and Manufactures.

| Fiscal Year. | Old Scrap, Pig and Blocks. | | | Bars and Sheets. | | | Litharge. | | |
|--------------|-------------------------------|------------|-------------------|------------------|-----------|-------------------|-----------|-----------|-------------------|
| | Cwt. | Value. | Average price. | Cwt. | Value. | Average price. | Cwt. | Value. | Average price. |
| 1907..... | 79,673 | \$ 363,655 | \$4.66 | 19,177 | \$ 86,338 | 4.50 | 17,546 | \$ 85,557 | \$4.88 |
| 1908..... | 49,825 | 155,513 | 3.12 | 14,402 | 49,527 | 3.44 | 15,524 | 57,929 | 3.73 |
| 1909..... | 112,980 | 184,572 | 1.63 | 13,412 | 44,071 | 3.29 | 17,049 | 58,100 | 3.41 |
| 1910..... | 120,591 | 346,516 | 2.87 | 17,697 | 45,674 | 2.68 | 15,541 | 56,049 | 3.61 |
| 1911..... | 199,774 | 495,923 | 2.48 | 30,837 | 55,458 | 1.80 | 17,979 | 65,743 | 3.66 |
| 1912..... | 281,787 | 940,533 | 3.34 | 19,212 | 93,702 | 4.88 | 25,925 | 113,941 | 4.40 |
| 1913..... | 111,995 | 404,117 | 4.14 | 14,944 | 62,527 | 4.18 | 10,009 | 50,734 | 5.07 |
| 1914..... | 154,141 | 590,557 | 3.82 | 9,615 | 41,244 | 4.29 | 10,863 | 52,525 | 4.84 |
| 1915..... | 426,162 | 2,010,006 | 4.72 | 9,125 | 56,331 | 6.17 | 15,798 | 89,232 | 5.68 |
| 1916..... | 198,658 | 1,258,284 | 6.33 | 9,850 | 85,686 | 8.70 | 27,672 | 211,359 | 7.64 |
| 1917..... | 115,104 | 958,402 | 8.33 | 10,458 | 111,002 | 10.61 | 28,079 | 275,919 | 9.83 |

Imports of Lead in Pigs, Bars, Sheets, etc., and Manufactures—*Concluded.*

| Calendar Year. | Pipe Lead. | | | Shot and Bullets. | | | Tea Lead. | | | Other Manufactures of Lead. (a). |
|----------------|------------|-----------|------------------|-------------------|--------|------------------|-----------|-----------|------------------|----------------------------------|
| | Pounds. | Value. | Cents per pound. | Pounds. | Value. | Cents per pound. | Pounds. | Value. | Cents per pound. | Value. |
| 1910. | 403,012 | \$ 15,365 | 3.81 | 6,903 | \$ 311 | 4.55 | 2,371,136 | \$117,399 | 4.95 | \$ 107,688 |
| 1911. | 512,737 | 19,426 | 3.79 | 8,912 | 1,053 | 11.82 | 2,688,211 | 134,160 | 4.99 | 108,012 |
| 1912. | 688,333 | 32,423 | 4.70 | 477,047 | 23,163 | 4.86 | 3,212,861 | 167,716 | 5.22 | 144,571 |
| 1913. | 466,753 | 21,679 | 4.64 | 429,656 | 19,582 | 4.56 | 3,475,171 | 217,009 | 6.24 | 155,178 |
| 1914. | 565,762 | 26,282 | 4.63 | 180,639 | 10,542 | 5.84 | 1,687,029 | 108,097 | 6.41 | 99,285 |
| 1915. | 145,953 | 8,708 | 5.97 | 1,085,196 | 51,890 | 4.78 | 959,189 | 67,652 | 7.05 | 102,439 |
| 1916. | 217,905 | 21,450 | 9.84 | 78,474 | 6,390 | 8.14 | 2,145,854 | 198,541 | 9.25 | 124,333 |
| 1917. | 278,207 | 29,502 | 10.60 | 25,147 | 2,163 | 8.60 | 490,364 | 59,231 | 12.08 | 165,764 |

(a) Does not include nitrate and acetate of lead in 1915, 250,921 pounds, valued at \$23,269; in 1916, 224,648 pounds, valued at \$30,445; and in 1917, 188,068 pounds, valued at \$24,327.

Imports of Dry White and Red Lead and Orange Mineral, and White Lead Ground in Oil.

| Calendar Year. | Dry White Lead. | | Dry White Lead, Ground in Oil. | | Dry Red Lead and Orange mineral. | | Total Imports. | | Cents. per pound. |
|----------------|-----------------|-----------|--------------------------------|-----------|----------------------------------|-----------|----------------|-----------|-------------------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | |
| 1907. | 7,560,185 | \$403,941 | 512,473 | \$ 29,063 | 443,905 | \$ 30,203 | 8,516,563 | \$463,207 | 5.44 |
| 1908. | 2,913,799 | 119,860 | 415,606 | 18,429 | 633,518 | 25,367 | 3,967,923 | 163,656 | 4.12 |
| 1909. | 2,690,575 | 95,894 | 730,001 | 32,678 | 516,032 | 25,341 | 3,936,608 | 153,913 | 3.91 |
| 1910. | 2,076,629 | 75,463 | 811,510 | 37,475 | 881,788 | 31,803 | 3,769,927 | 144,741 | 3.84 |
| 1911. | 1,467,193 | 58,335 | 1,033,732 | 46,986 | 1,571,508 | 64,180 | 4,072,433 | 169,501 | 4.16 |
| 1912. | 2,499,725 | 138,627 | 714,362 | 37,916 | 2,539,767 | 113,579 | 5,753,854 | 290,122 | 5.04 |
| 1913. | 1,162,082 | 61,424 | 1,057,683 | 59,444 | 2,389,460 | 103,739 | 4,609,225 | 224,607 | 4.87 |
| 1914. | 363,136 | 20,279 | 546,961 | 31,654 | 1,451,264 | 62,073 | 2,361,361 | 114,006 | 4.83 |
| 1915. | 418,920 | 23,393 | 169,095 | 9,590 | 1,091,120 | 63,675 | 1,709,135 | 99,658 | 5.66 |
| 1916. | 200,256 | 15,746 | 59,601 | 5,203 | 1,423,351 | 119,959 | 1,683,208 | 140,908 | 8.37 |
| 1917. | 200,832 | 19,229 | 67,383 | 6,321 | 833,603 | 80,568 | 1,081,580 | 106,188 | 9.63 |

Consumption.—The production of lead, as already stated, was in 1917, 16,288 tons, while the exports were 7,207 tons, leaving a balance of 9,081 tons, by adding to this amount the 8,432 tons of imports and the manufactures, we get a total consumption for Canada of about 18,000 tons, as against 30,000 tons in 1916, and 46,000 in 1915.

This estimate of consumption for 1916 is probably incomplete because of the fact that very large quantities of materials chiefly for munitions, and no doubt including lead, have been imported for the use of the Imperial Government. These imports for record purposes have been entered under one general item and not separately classified. Information received from other sources shows that the total consumption in 1916 and also in 1917 amounted to at least 55,000 tons.

Estimated Consumption of Lead.

| Year. | Tons. | Year. | Tons. | Year. | Tons. |
|------------|--------|------------|--------|------------|--------|
| 1908. | 22,000 | 1911. | 28,000 | 1914. | 29,000 |
| 1909. | 25,000 | 1912. | 39,000 | 1915. | 46,000 |
| 1910. | 24,000 | 1913. | 30,300 | 1916. | 55,000 |
| | | | | 1917. | 55,000 |

Quebec.

The production of lead in Quebec during 1917 amounted to 1,378,001 pounds, valued at \$153,468, as against 698,760 pounds, valued at \$59,485 in 1916; and 40,401 pounds, valued at \$2,262, in 1915. This production was wholly from the zinc-lead deposits of Notre-Dame-des-Anges.

Ontario.

The Ontario production of lead in 1917 was 1,586,711 pounds, valued at \$176,712, as against 685,932 pounds, valued at \$58,393, in 1916, and 88,985 pounds, valued at \$4,983, in 1915.

The principal producer was the property of the James Robertson estate at Galetta, with also shipments from the Frontenac mine, Perth road, and the North Victoria mine, Victoria county.

British Columbia.

The production of refined lead together with lead in ores exported amounted in 1917 to 29,483,725 pounds, valued at \$3,283,602, as against 39,157,701 pounds, valued at \$3,333,496, in 1916, a decrease of 24.2 per cent in quantity and 1.5 per cent in value.

Almost all of the lead ore mined in British Columbia is smelted and refined at Trail, B.C. In 1915 and 1916, however, the Surprise mine shipped its total output, amounting to a considerable tonnage to the United States, but in 1917 only a small amount was shipped to the United States, most of the shipments going to Trail, B.C.

According to the Provincial Department of Mines, 37,307,465 pounds of lead were contained in the lead ores shipped to the smelters for which returns had been received during 1917.

The record given in the following table represents the recovery of lead at smelter or refinery as distinguished from the figures given in the table next succeeding, which indicate the quantities of lead contained in ore sent to the smelters.

A study of the table of production by districts, shows that in 1917 the Fort Steele district produced 35.9 per cent of the total, the Slocan 31.7 per cent, and the Ainsworth 17.1 per cent; while in 1916 the production was 49.6 per cent for Fort Steele, 29.6 per cent for Slocan, and 16.1 per cent for Ainsworth.

British Columbia: Production of Lead.

| Year. | Pounds. | Value. | Cents per pound | Year. | Pounds. | Value. | Cents per pound. |
|-----------|------------|-----------|-----------------|-----------|------------|------------|------------------|
| 1887..... | 204,800 | \$ 9,216 | 4.40 | 1902..... | 22,536,381 | \$ 917,005 | 4.069 |
| 1888..... | 674,500 | 29,813 | 4.42 | 1903..... | 18,089,283 | 766,443 | 4.237 |
| 1889..... | 165,100 | 6,488 | 3.93 | 1904..... | 36,646,244 | 1,579,086 | 4.309 |
| 1890..... | | | | 1905..... | 56,680,703 | 2,663,254 | 4.707 |
| 1891..... | | | | 1906..... | 52,408,217 | 2,964,733 | 5.657 |
| 1892..... | 808,420 | 33,064 | 4.09 | 1907..... | 47,738,703 | 2,542,086 | 5.325 |
| 1893..... | 2,151,092 | 79,490 | 3.73 | 1908..... | 43,195,733 | 1,814,221 | 4.200 |
| 1894..... | 5,703,222 | 187,636 | 3.29 | 1909..... | 45,857,424 | 1,692,131 | *3.690 |
| 1895..... | 16,461,794 | 531,716 | 3.23 | 1910..... | 32,987,508 | 1,216,249 | *3.687 |
| 1896..... | 24,199,977 | 721,159 | 2.98 | 1911..... | 23,784,969 | 827,717 | 13.480 |
| 1897..... | 38,841,135 | 1,390,513 | 3.58 | 1912..... | 35,763,476 | 1,597,554 | 14.467 |
| 1898..... | 31,693,559 | 1,198,017 | 3.78 | 1913..... | 37,626,899 | 1,753,037 | 14.659 |
| 1899..... | 21,862,436 | 977,250 | 4.47 | 1914..... | 36,289,845 | 1,625,422 | 14.479 |
| 1900..... | 62,158,621 | 2,760,031 | 4.37 | 1915..... | 45,377,064 | 2,541,116 | 15.600 |
| 1901..... | 51,532,906 | 2,285,603 | 4.334 | 1916..... | 39,157,701 | 3,333,496 | 18.513 |
| | | | | 1917..... | 29,483,725 | 3,283,602 | 11.187 |

*Average prices at Toronto for years 1909 and 1910. For previous years average prices at New York.
†Average price at Montreal. Quotations furnished by Messrs. Thos. Robertson & Co., Montreal, Que

British Columbia: Production of Lead by Districts.*

(Lead contained in Ore shipped from Mines, in pounds.)

| District. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|-----------------------|------------|------------|------------|------------|------------|------------|------------|
| Cassiar— | | | | | | | |
| Atlin..... | | | | | | 7,260 | |
| Skeena, etc. | 233,578 | 41,512 | 6,579 | | 30,462 | 1,077 | |
| East Kootenay— | | | | | | | |
| Fort Steele..... | 17,158,069 | 18,238,238 | 18,525,033 | 24,863,105 | 26,532,050 | 24,156,143 | 13,996,640 |
| Windermere, etc..... | | 2,249,237 | 2,495,355 | | 216,327 | 571,244 | 1,774,649 |
| West Kootenay— | | | | | | | |
| Ainsworth..... | 289,009 | 4,863,894 | 9,027,861 | 8,069,525 | 3,436,184 | 7,841,869 | 6,395,350 |
| Nelson..... | 1,928,836 | 2,293,000 | 1,936,418 | 2,004,436 | 967,775 | 1,240,784 | 2,605,666 |
| Slocan..... | 6,705,571 | 16,944,811 | 22,648,766 | 15,233,910 | 14,925,345 | 14,415,645 | 11,808,019 |
| Revelstoke, etc..... | 522,615 | 240,762 | 521,771 | 128,912 | 89,041 | 206,741 | 395,321 |
| Yale— | | | | | | | |
| Yale—Kamloops..... | | | | | | 47,380 | 12,690 |
| Similkameen, etc..... | | | | | | | 10,697 |
| Grand Forks, etc..... | 29,719 | | 45,982 | 1,678 | 7,127 | 14,922 | 36,548 |
| Cariboo— | | | | | | | |
| Omineca..... | | | 156,862 | 323,482 | 249,279 | 224,451 | 271,885 |
| | 26,872,397 | 44,871,464 | 55,364,677 | 50,625,048 | 46,503,590 | 48,727,516 | 37,307,465 |

*From the Report of the Minister of Mines, B.C.

Yukon.

During the last few years several properties have been developed and have shipped occasionally, but they have been handicapped by the high cost of development and supplies, and by the heavy transportation charges.

The most important operations being conducted during 1916 and 1917 were in what is known as the "Mayo" area, north of the Stewart river. About 1,500 tons of very rich silver-lead ore were shipped in 1916 from the Silver King property on Galena creek to the Selby smelter at San Francisco. Shipments were rather small during 1917. This area is one of the most important placer-gold producing districts of Yukon Territory, but valuable lode deposits have also been discovered.

Bounties.—In 1901, and again in 1903, the Dominion Government, to encourage the lead industry, authorized the payment of a bounty on the production of lead. The Act of 1903 provided for the payment, under certain restrictions, of 75 cents per hundred pounds of lead contained in ore mined and smelted in Canada, provided that when the standard price of pig-lead in London, England, exceeded £12 10s. per ton of 2,240 pounds, such bounty should be reduced proportionately by the amount of such excess. Thus, when the price of lead in London rose to £16, or over, per long ton, the bounty ceased. As the price of lead exceeded £16 sterling on the London market for a considerable period during 1906 and 1907 the bounty paid during those years was comparatively small.

The Act of 1903 provided that payment of bounty should cease on June 30, 1908, and as only a portion of the funds provided had been used, a new Act was passed in the latter year providing for further bounty payments at the rate of 75 cents per hundred pounds, or approximately £3 10s. per ton of 2,240 pounds, subject to the restriction that when the price of lead in London exceeds £12 10s. the bounty shall be reduced by such excess.

The Act of 1908 expired in 1913, and a new Act was passed extending the bounty for a further period of five years, with the same provisions. The text of this Act and of the regulations under which the Act is administered may be consulted in the "Annual Report on Mineral Production for 1914," and previous years.

There was no bounty paid on lead during the fiscal years ending March 31, 1917, and March 31, 1918.

Statement of Bounties Paid on Lead during the Fiscal Years 1899 to 1918.

| Year ending. | Bounty paid. | Year ending. | Bounty paid. | Year ending. | Bounty paid. |
|--------------------|--------------|---------------------|--------------|---------------------|--------------|
| June 30, 1899..... | \$ 76,665 | June 30, 1906..... | \$ 90,196 | March 31, 1913..... | \$ 68,065 |
| " 30, 1900..... | 43,335 | March 31, 1907..... | 1,995 | " 31, 1914..... | 8,179 |
| " 30, 1901..... | 30,000 | " 31, 1908..... | 51,001 | " 31, 1915..... | 3,217 |
| " 30, 1902..... | | " 31, 1909..... | 307,433 | " 31, 1916..... | 59 |
| " 30, 1903..... | 4,380 | " 31, 1910..... | 340,542 | " 31, 1917..... | |
| " 30, 1904..... | 195,627 | " 31, 1911..... | 248,534 | " 31, 1918..... | |
| " 30, 1905..... | 330,645 | " 31, 1912..... | 179,288 | | |
| | | | | Total..... | 1,979,164 |

MERCURY.

There has been no production of mercury since 1897. The small production reported in 1895 and 1897 was derived from the deposits at the western end of Kamloops lake, B.C. These deposits consist of quartz veins containing pockets of cinnabar in a zone of decomposed Tertiary volcanic rocks.

Elsewhere in Canada mercury has been reported as also occurring in ores of the Cobalt district, and in the neighbourhood of Field, B.C., and Sechart, on the west coast of Vancouver Island.

The imports of mercury during 1917 were, 71,608 pounds, valued at \$76,332, as against 79,204 pounds, valued at \$74,461 in 1916.

Production of Mercury.

| Calendar Year. | Flasks.* | Price per flask. | Value. |
|----------------|----------|------------------|----------|
| 1895..... | 71 | \$ 33.00 | \$ 2,343 |
| 1896..... | 58 | 33.44 | 1,940 |
| 1897..... | 9 | 36.00 | 324 |

* Seventy-six and one-half (76½) pounds each.

Imports of Mercury.

| Calendar Year. | Pounds. | Value. | Calendar Year. | Pounds. | Value. |
|----------------|---------|-----------|----------------|---------|------------|
| 1907..... | 189,841 | \$ 82,873 | 1913..... | 219,442 | \$ 109,493 |
| 1908..... | 87,620 | 44,030 | 1914..... | 204,229 | 97,449 |
| 1909..... | 285,958 | 147,625 | 1915..... | 184,432 | 159,184 |
| 1910..... | 107,888 | 63,450 | 1916..... | 79,204 | 74,461 |
| 1911..... | 118,336 | 67,416 | 1917*..... | 71,608 | 76,322 |
| 1912..... | 137,474 | 72,171 | | | |

* Duty free.

Average Monthly Price of Mercury.

(Per flask of 75 pounds.)

| Month. | 1916. | | | 1917. | | |
|----------------|-----------|----------------|---------|-----------|----------------|---------|
| | New York. | San Francisco. | London. | New York. | San Francisco. | London. |
| January..... | \$ 231.50 | \$ 200.50 | £ 16.75 | \$ 81.04 | \$ 80.20 | £ |
| February..... | 283.50 | 300.63 | 17.88 | 120.90 | 116.25 | ..... |
| March..... | 213.75 | 223.75 | 19.00 | 113.30 | 112.50 | ..... |
| April..... | 140.78 | 147.50 | 17.75 | 115.64 | 115.00 | ..... |
| May..... | 95.10 | 97.50 | 16.50 | 105.98 | 105.00 | ..... |
| June..... | 73.00 | 73.81 | 16.50 | 84.34 | 86.20 | ..... |
| July..... | 79.80 | 79.90 | 17.30 | 107.80 | 102.18 | ..... |
| August..... | 74.75 | 75.00 | 17.50 | 115.00 | 111.10 | ..... |
| September..... | 75.50 | 75.06 | 17.50 | 112.21 | 110.90 | ..... |
| October..... | 79.40 | 75.80 | 19.50 | 100.94 | 100.62 | ..... |
| November..... | 79.25 | 75.50 | 18.25 | 102.50 | 100.75 | ..... |
| December..... | 80.00 | 78.00 | 18.63 | 115.90 | 111.65 | ..... |
| Year..... | 125.49 | 125.25 | 17.75 | 106.30 | 104.36 | ..... |

MOLYBDENUM.

The total production in 1917, representing the quantity paid for of the MoS_2 contents of the concentrates produced, amounted to 288,705 pounds, which at \$1.00 per pound, the approximate equivalent at Ottawa of the British price, would be worth \$288,705. The total production in 1916, representing the MoS_2 contents of the concentrates produced was 156,461 pounds, which at \$1.00 per pound, would have a total value of \$156,461, while in 1915 the production was 29,210 pounds valued at \$28,450; and in 1914, 3,814 pounds valued at \$2,063.

In 1917, the total shipments of ores and concentrates as stated by the producers were 1,544.3 tons valued at \$320,006 and there were 22,605 tons of ore treated at the concentrating plants; in 1916, the total shipments were 6,539 tons valued at \$59,816 and 9,106 tons of ore were concentrated; in 1915, the shipments were 216 tons valued at \$28,450, and in 1914, 16.5 tons valued at \$2,063. Some small shipments were made previously in 1902 and 1903.

The ore produced has been chiefly low grade material carrying less than 2 per cent MoS_2 but included small quantities of ore running from 2 to 15 per cent MoS_2 and some higher grade hand picked material.

All the ore produced was concentrated in Canadian mills erected for the purpose, and marketed either as concentrates, molybdic acid, or ammonia molybdate, or as ferromolybdenum for the manufacture of which two electric furnace plants have been established: the plant of the Orillia Molybdenum Company at Orillia, and that of the Tivani Electric Steel Company, at Belleville, both in Ontario.

The concentrating plants are as follows:—¹

- American Molybdenite Co., Haliburton Co., Ont.
- Dominion Molybdenite Co., Ltd., at Quyon, Que.
- International Molybdenum Co., at Renfrew, Ont.
- Mines Branch Plant, Ottawa, Ont.
- Renfrew Molybdenum Mines, Ltd., at Mt. St. Patrick, Renfrew Co., Ont.

The world's production of molybdenum ores in 1917 was much greater than that of any previous year, the production for Canada as stated above, being over 144 tons, while the production for Australia and Norway is estimated at..... tons each.

In 1916 the Canadian production was over 78 tons, while Australia was credited with 123 tons and Norway with approximately 112 tons.

The Canadian Munitions Resources Commission in its first annual report, recently issued, has published very interesting information *re* the molybdenite industry as is shown in the following extracts:—

“In 1911 the world's production came mostly from Australia, which in that year was credited with 121 tons. Norway produced $2\frac{1}{2}$ tons and Canada practically nothing. In 1914 the Department of Mines again took up the subject, and made experiments in its Ore Dressing Laboratories on the concentration of molybdenum ores. In the spring of 1915 the Department was in a position to offer its services to the Imperial Munitions Board to obtain supplies of this mineral should they be required by the Imperial authorities. The desirability of encouraging Canadian production was for several months impressed upon the Imperial authorities, but it was not until early in 1916 that the Imperial Munitions Board was authorized to purchase any considerable quantity of molybdenite in Canada.”

“The situation at that time was that only a very few of the known localities had been developed to the point of production, and because no facilities existed for milling and concentrating, the Imperial Munitions Board looked to the Department of Mines

¹ The American Molybdenite Co.'s plant was ready for operation only early in 1918. The International Molybdenite Co.'s plant treats customs ore as well as its own, and the Mines Branch plant treats customs ore only.

for assistance. The department responded by turning over its Ore Testing Laboratory into practically a small commercial mill and, during 1916, from nearly 2,300 tons of ore received from various localities, produced 40.5 tons of molybdenite concentrate which was turned over to the Imperial Munitions Board at the official British price of \$1.00 per pound of pure molybdenite, f.o.b. Ottawa. During 1917 the department milled 1,600 tons of crude ore, producing 31.4 tons of molybdenite in the form of concentrates."

"From the beginning of the war until the end of 1917, molybdenite, metallic molybdenum, its alloys and salts, were under an embargo in Canada, which prohibited their export to any other country outside the British Empire. All sales of ores from the British Empire made to the Imperial authorities were based on the official price of 105 shippings per unit (1 per cent of a long ton) of the pure mineral, delivered f.o.b. Liverpool."

"The prices in countries outside the Empire were always higher than the official British quotations. The open market price in the United States during 1917 was approximately \$2.25 per pound of pure mineral delivered at buyer's works. Canadian producers contended that this difference in price unduly favoured production outside the Empire. The British Government, was, however, securing practically all its requirements within the Empire, and the higher price in the United States was chiefly due to the inadequate supply in that country."

"The establishment of the new ferro-alloy industry in Canada is important. Canada, with her abundant hydro-electric power, should take an important position in the electric furnace production of all classes of ferro-alloys

"Some difficulty was experienced in persuading the Imperial authorities to accept ferro-molybdenum instead of the raw material. It was contended that English smelters were equipped to handle the ores and therefore a duplication of these facilities in Canada was unnecessary. This objection was met by pointing out the desirability of manufacturing the ferro-alloy in this country because it allowed the Canadian producer a larger profit on his undertaking."

In 1910 metallic molybdenum sold for about \$1.50 per pound while the present price of molybdenum containing 50 to 70 per cent molybdenum is valued at \$4.00 per pound of molybdenum content.

"In the peaceful arts the metal has found application as a constituent of tool steels, although its rival tungsten, because of an established production, has been preferred for this purpose. Molybdenum steels are being used in automobile construction and it is expected that the attention of the steel workers will be directed towards more extensive application of these special alloys. Molybdenum wire is used in the manufacture of electric lamps and to a more limited extent in the scientific instruments trades. Salts of molybdenum form valuable chemical reagents and are also used for colouring pottery."

"At the present time the principal Canadian producers are: The Dominion Molybdenum Company, Limited, Quyon, Quebec,¹ which disposed of the greater part of its product up to the end of 1917 to the Imperial Munitions Board; and the Renfrew Molybdenum Mines, Limited, Mount St. Patrick, Ont., which exports its total production to France. The Dominion Molybdenite Company, sold its product to the Imperial Munitions Board in the form of ferro-molybdenum made in electric furnaces at smelter plants situated at Orillia and Belleville, Ont."

"Another property, not developed to the point of either the Dominion or Renfrew mines, is that owned by the Wood Molybdenite Company, Limited, situated at Squaw Lake, Pontiac county, Quebec, some 30 miles north of Shawville. This promises to be a producer before the end of the present year."

"There are properties in British Columbia, Ontario, Quebec, and Nova Scotia, some of which have produced a little ore while others are merely prospects. Amongst

¹ Report on the Molybdenite Deposits of the Moss mine, Quyon, Que." By Charles Camsell. Summary Report, Geol. Sur., 1916, p. 207, and "Report on the Molybdenite Deposits of Quyon district, Que." By Dr. M. E. Wilson, Canadian Mining Journal, March, 1918, pp. 78, 79.

these may be mentioned that of the Molybdenum Mining and Reduction Co., Ltd., on Alice arm, Observatory Inlet; the Moly mine, on Lost creek, and the Swanson property on Gray creek, Nelson mining division; the Index mine,¹ Lilloet mining division, all in British Columbia. Other less important discoveries have been made at Stave lake, Pitt river, and Grand Prairie. In Ontario small producers are the Spain mine, Renfrew county; the Chisholm mine, Addington county; the Lilloic-Burrows mine, Haliburton county; the Horscroft mine, Victoria county; the O'Brien mine, Renfrew county, and some others. In Quebec there are Chaput and Hughes, the Davis, the Chabot, and the Chatelane, all in Pontiac county. In Nova Scotia properties have been developed at New Ross, Lunenburg county, and at Gabarus bay, Cape Breton, and small shipments made. Attention has recently been directed to certain deposits in Manitoba, more particularly to those in the vicinity of Falcon lake."²

Subsequent to the decision of the Canadian Government that exports of molybdenite and tungsten be licensed for shipment to France and the United States, the testing laboratories of the Department of Mines have been requested to undertake the custom milling of molybdenite ores for various private interests, but shipments will be received only until the 31st. July, 1918, in order that the operators may have an opportunity of taking advantage of the market in the United States and France, while undertaking the construction of their own concentrating mills.

Customs ores will be purchased on the basis of the following prices:—

Schedule of Prices.

Governing the milling of molybdenite ores and concentrates delivered f.o.b. Dominion Government Testing Plant, Ottawa.

Concentrates will be made upon the following terms:—

- (1) On assay returns from samples dried at 212° F.
- (2) Moisture will be deducted.
- (3) The treatment charge to be \$5.65 per ton of 2,000 pounds of crude ore.
- (4) Credit will be given for molybdenite only. No allowance will be made for molybditite or wulfenite.

(5) Recoveries of molybdenite per ton of 2,000 pounds dry ore delivered railway siding, Mines Branch Testing Laboratories, Ottawa:—

For molybdenite ores containing:—

| | | | |
|-----|----------------------------|----------|-----------------------------------|
| (a) | Between 0.5% and 1.0% inc. | for 70% | of the total Molybdenite content. |
| (b) | " 1.1% " | " 1.5% " | " 78% " " " " |
| (c) | " 1.51% " | " 2.0% " | " 84% " " " " |
| (d) | " 2.1% " | " 2.5% " | " 87% " " " " |
| (e) | " 2.61% " | " 3.0% " | " 90% " " " " |
| (f) | " 3.0% " | " .. " | " 92% " " " " |

Estimated World's Production of Molybdenum Ores, 1915.*

| Country. | Ore Mineral. | Quantity (short tons). | Estimated per cent of molybdenum. | Weight of molybdenum, (short tons). |
|----------------------|-----------------------------|------------------------|-----------------------------------|-------------------------------------|
| Canada..... | Molybdenite..... | 14.3 | 50 | 7.2 |
| New South Wales..... | "..... | 35.5 | 54 | 19.2 |
| Norway..... | "..... | 87.0 | 45 | 39.1 |
| Peru..... | "..... | 3.0 | 49 | 1.5 |
| Queensland..... | "..... | 109.0 | 54 | 58.8 |
| Spain..... | Wulfenite..... | 29.0 | 20 | 5.8 |
| United States..... | Molybdenite and wulfenite.. | 3,498.0 | 2.6 | 91.0 |
| | | | | 222.6 |

* Estimated by Frank L. Hess of the United States Geological Survey, Mineral Resources, United States 1915, p. 810.

¹ "Report on the Index Molybdenite mine, Lilloet, B.C." By Dr. C. W. Drysdale. Summary Report of the Geol. Sur., 1916, p. 54.

² "Report on the Molybdenite Deposits at Falcon lake, Eastern Manitoba." By J. S. Delury. Canadian Mining Journal, December 1, 1917.

NICKEL.

The production of nickel in 1917 amounted to 84,330,280 pounds, valued at \$33,732,112, as compared with 82,958,564 pounds, valued at \$29,035,497 in 1916, an increase of 1.6 per cent, while in 1916 there had been an increase of 21.4 per cent over that of 1915.

There were mined in 1917, 1,509,841 tons of ore, and smelted 1,453,661 tons from which were produced 78,897 tons of Bessemer matte carrying approximately 41,887 tons of nickel and 21,196 tons of copper. The net value of the matte as reported by the operators, was \$12,004,141 which is based on an average price of 7.15 cents per pound for the copper, and 10.71 cents for the nickel. The average metal recovery in matte from the ores treated was 2.881 per cent nickel and 1.458 per cent copper, as against 2.714 per cent nickel and 1.474 per cent copper in 1916, and 2.675 per cent nickel and 1.541 per cent copper in 1915.

Production of Nickel.

| | 1913. | 1914. | 1915. | 1916. | 1917. |
|-------------------------------------|-------------|-------------|--------------|--------------|--------------|
| Ore mined..... Short tons. | 781,697 | 1,000,964 | 1,364,048 | 1,566,333 | |
| Ore smelted..... " | 823,403 | 947,053 | 1,272,233 | 1,521,689 | 1,453,661 |
| Bessemer matte produced.... " | 47,150 | 46,396 | 67,703 | 80,011 | 78,897 |
| Copper content of matte..... " | 12,938 | 14,448 | 19,608 | 22,430 | 21,196 |
| Nickel content of matte..... " | 24,838 | 22,759 | 34,039 | 41,298 | 41,887 |
| Spot value of matte..... | \$7,076,945 | \$7,189,031 | \$10,352,344 | \$12,116,333 | \$12,004,141 |
| Wages paid miners and smelters..... | \$3,291,956 | \$3,096,911 | \$3,555,912 | \$4,841,662 | \$5,438,830 |
| Men employed..... | 3,486 | 3,379 | 4,033 | 4,656 | 4,517 |

Annual Production of Nickel.

| Calendar Year. | Pounds of nickel in matte shipped. | Cents per pound. | Value. | Calendar Year. | Pounds of nickel in matte shipped. | Cents per pound. | Value. |
|----------------|------------------------------------|------------------|------------|----------------|------------------------------------|------------------|--------------|
| 1889 (a)..... | 830,477 | 60 | \$ 498,286 | 1904..... | 10,547,883 | 40 | \$ 4,219,153 |
| 1890..... | 1,435,742 | 65 | 933,232 | 1905..... | 18,876,315 | 40 | 7,550,526 |
| 1891..... | 4,035,347 | 60 | 2,421,208 | 1906..... | 21,490,955 | 42 | 8,948,834 |
| 1892..... | 2,413,717 | 58 | 1,399,956 | 1907..... | 21,189,793 | 45 | 9,535,407 |
| 1893..... | 3,982,982 | 52 | 2,071,151 | 1908..... | 19,143,111 | 43 | 8,231,538 |
| 1894..... | 4,907,430 | 33½ | 1,870,958 | 1909..... | 26,232,991 | 36 | 9,461,877 |
| 1895..... | 3,888,525 | 35 | 1,369,984 | 1910..... | 37,271,033 | 30 | 11,181,310 |
| 1896..... | 3,397,113 | 35 | 1,183,990 | 1911..... | 34,098,744 | 30 | 10,229,623 |
| 1897..... | 3,997,647 | 35 | 1,399,176 | 1912..... | 44,841,542 | 30 | 13,452,463 |
| 1898..... | 5,517,690 | 33 | 1,820,838 | 1913..... | 49,676,772 | 30 | 14,903,032 |
| 1899..... | 5,744,000 | 36 | 2,067,840 | 1914..... | 45,517,937 | 30 | 13,655,381 |
| 1900..... | 7,080,227 | 47 | 3,327,707 | 1915..... | 68,308,657 | 30 | 20,492,597 |
| 1901..... | 9,189,047 | 50 | 4,594,523 | 1916..... | 82,958,564 | 35 | 29,035,497 |
| 1902..... | 10,693,410 | 47 | 5,025,903 | 1917..... | 84,330,280 | 40 | 33,732,112 |
| 1903..... | 12,505,510 | 40 | 5,002,204 | | | | |

(a) Calculated from shipments made by rail.

The nickel-copper ore is reduced in smelters and converters to a Bessemer matte, containing from 77 to 82 per cent of the combined metals; in 1917 it averaged 50.6 per cent nickel and 26.9 per cent copper, as against 51.6 per cent nickel and 28.0 per cent copper in 1916; 50.3 per cent nickel and 29.0 per cent copper in 1915; 49.0 and 31.1 respectively in 1914; and 52.7 and 27.4 respectively in 1913.

For the production of monel metal a special matte is produced with contents of about 22 per cent copper, and 58 per cent nickel, which is included in the total given. Monel metal is produced directly from this matte without the intermediate refining of either the nickel or the copper.

A paper on the "Manufactures of Nickel-Copper Alloy, Steel or Nicu Steel," by G. M. Colvocoresses, was read at the Annual Meeting of the Canadian Mining Institute in March, 1918. Practical tests of the processes are said to be carried on at present near Sudbury.

The industry based on the mining and metallurgical treatment of the nickel-copper ores of the Sudbury district, Ontario, ranks among the most important of Canada. Not only is there a considerable production of copper, but the nickel, which is the important product, supplies a very large proportion of the world's consumption of the metal.

The past few years development has very largely increased the known ore reserves of the district. These nickel-copper deposits have been the subject of special reports of the Mines Branch and Geological Survey at Ottawa, by the Ontario Bureau of Mines, Toronto, and recently by the Royal Ontario Nickel Commission.¹

Refined metallic nickel is now being recovered in Canadian refineries but only in small quantities and as a by-product in the smelting and refining of the silver-cobalt-nickel ores, nickel-oxide having been recovered in these smelters for several years. The recovery of nickel-sulphate was also reported for the first time, in 1915.¹ A considerable amount of nickel is probably contained in ores exported for smelting, for which no payment is received by the mines shipping and the amount finally recovered is impossible to ascertain.

The total estimated nickel content of the recoveries from silver-cobalt-nickel ores was in 1917, 556,961 pounds, as against 361,702 pounds in 1916, and 231,634 pounds in 1915.

The production of metallic nickel during the year was reported as 108,334 pounds valued by the operators at \$265,896, as against 79,360 pounds valued at \$31,538 in 1916; that of nickel-oxide and nickel sulphate was 657,549 pounds valued at \$122,963, as against 555,368 pounds valued at \$101,358 in 1916.

The companies engaged in mining and smelting nickel ores are:—

The Canadian Copper Company, subsidiary to the International Nickel Company, with smelter at Copper Cliff, Ontario, and refinery at Bayonne, New Jersey. This Company is completing the erection of a new refining plant at Port Colborne, Ontario, which will probably be in operation in July, 1918.

The Mond Nickel Company of London, England, with smelter at Coniston, Ontario, and refinery at Clydach, Swansea, Wales.

The British American Nickel Corporation, Ltd., which started erecting a smelter at the Murray mine, late in 1916, and early in 1918 a refinery near Lake Deschenes, Hull county, Que., although not shipping during the year, development was actively carried on.

The Alexo Mining Company, Ltd., which operated its mine at Porquiss Junction on the Porcupine branch of the Timiskaming and Northern Ontario Railway, shipping nickel-copper ore to the Mond smelter at Coniston.

Nickel was recovered as a by-product in the smelters of the following companies:—

The Coniagas Reduction Company, Thorold, Ont.

The Deloro Smelting and Refining Co., Deloro, Ont.

The Metals Chemical Co., Ltd., Welland, Ont.

¹ Report on Nickel and Copper Deposits of Sudbury, Ont. By A. E. Barlow, Geol. Surv. Canada, No. 873, 1901.

The Sudbury Nickel Region. By A. P. Coleman, Ph.D., Bureau of Mines, Vol. XIV, Part III, 1904.

The Nickel Industry with special reference to the Sudbury Region, Ontario. Report by A. P. Coleman, Ph.D., Mines Branch, Ottawa, No. 170, 1913.

Report of the Royal Ontario Nickel Commission with Appendix, Toronto, 1917.

² See chapter on "Cobalt."

Prices.—The price of refined nickel in New York according to quotations published by the Engineering and Mining Journal remained at from 45 to 50 cents per pound until March. From March 7th. until 8th. August the price was 50 to 55 cents, and for the balance of the year it remained at 50 cents per pound for ordinary forms.

Electrolytic nickel was five cents higher per pound.

The price of nickel in Europe in 1917 as given by the "London Mining Journal", was quoted throughout the year at £225 per long ton, or 48.9 cents per pound for exports. The home quotations were at £225 until first week of June. From June 9th. to the end of the year the price was £190 to 220, or 41.3 to 47.8 cents per pound.

In 1916 the price remained at £225 throughout the year.

Exports and Imports.—The exports of nickel in 1917 amounted to 81,272,400 pounds valued at \$8,708,650, as against 80,441,700 pounds valued at \$8,662,179 in 1916.

The imports of nickel in 1917 were valued at \$519,064 and included nickel in ingots, bars, sheets, etc., 853,845 pounds valued at \$369,346, and manufactures of nickel valued at \$149,718. In 1916 the imports were valued at \$414,410 and included nickel in ingots, bars, sheets 892,436 pounds valued at \$325,326 and manufactures of nickel valued at \$89,084.

There is also a considerable import of nickel-plated ware.

Exports of Nickel since 1903.

| Calendar year. | Pounds. | Value. | Cents per pound. | Calendar year. | Pounds. | Value. | Cents per pound. |
|----------------|------------|--------------|------------------|----------------|------------|--------------|------------------|
| 1903 | 12,699,227 | \$ 1,116,009 | 8.78 | 1911 | 32,619,971 | \$ 3,676,396 | 11.27 |
| 1904 | 11,233,869 | 1,091,349 | 9.71 | 1912 | 44,221,860 | 4,661,758 | 10.54 |
| 1905 | 17,318,059 | 1,569,693 | 9.06 | 1913 | 49,469,017 | 5,195,560 | 10.50 |
| 1906 | 20,653,845 | 2,042,965 | 9.89 | 1914 | 46,528,327 | 5,149,427 | 11.07 |
| 1907 | 19,376,335 | 2,280,374 | 11.76 | 1915 | 66,410,442 | 7,394,446 | 11.13 |
| 1908 | 19,419,893 | 1,866,624 | 9.61 | 1916 | 80,441,700 | 8,662,179 | 10.77 |
| 1909 | 25,616,398 | 2,676,483 | 10.45 | 1917 | 81,272,400 | 8,708,650 | 10.72 |
| 1910 | 36,014,782 | 4,030,040 | 11.19 | | | | |

Imports of Nickel, Nickel-Silver, and German Silver, 1916 and 1917.

| | 1916. | | 1917. | |
|---|---------|-----------|---------|------------|
| | Pounds. | Value. | Pounds. | Value. |
| Nickel, nickel-silver, and German silver in ingots or blocks | 179,367 | \$ 66,515 | 303,853 | \$ 123,976 |
| Nickel, nickel-silver, and German silver in bars and rods, and also in strips, sheets or plates | 713,072 | 258,811 | 549,992 | 245,370 |
| Manufactures of German, Nevada, and nickel-silver, not plated | | 89,084 | | 149,718 |
| | | 414,410 | | 519,064 |

In view of the large export of nickel from Canada to the United States, and its refinement in that country, a record of the imports into, and exports of nickel from the United States, may be of special interest and is shown below as compiled from the "Foreign Commerce of the United States."

The values of the United States exports ranged from 38.5 to 48.8 cents per pound, with an average of 40.7 cents in 1917, as against 37 to 46 cents per pound with an average of 38.7 cents per pound in 1916, and 34 to 43 cents per pound with an average of 38 cents per pound in 1914.

United States: Imports and Exports of Nickel.*

| | 1916. | | | 1917. | | |
|------------------------------------|------------|-------------|------------------|------------|-------------|------------------|
| | Quantity. | Value. | Cents per pound. | Quantity. | Value. | Cents per pound. |
| <i>Imports into United States—</i> | | | | | | |
| Ore and matteGross tons. | 59,741 | \$9,889,122 | 13-62 | 61,053 | \$9,612,400 | 12-73 |
| Nickel content.Pounds. | 72,611,492 | | | 75,510,793 | | |
| <i>Exports from United States—</i> | | | | | | |
| To FrancePounds. | 2,823,132 | 1,101,813 | 39-02 | 1,232,142 | 562,105 | 45-62 |
| " Italy" | 2,715,521 | 1,110,035 | 40-88 | 5,470,042 | 2,392,711 | 43-74 |
| " Netherlands" | 523,463 | 227,910 | 43-54 | | | |
| " Russia in Europe" | 7,767,875 | 3,010,599 | 38-76 | 168,000 | 64,700 | 38-51 |
| " United Kingdom" | 16,674,487 | 6,191,029 | 37-13 | 14,409,272 | 5,679,603 | 38-72 |
| " Japan" | 245,920 | 109,268 | 44-43 | 275,018 | 134,172 | 48-79 |
| " Russia in Asia" | 1,148,366 | 467,328 | 40-70 | | | |
| " Other countries" | 1,505,247 | 734,511 | 48-80 | 441,938 | 207,221 | 46-89 |
| | 33,404,011 | 12,952,493 | 38-78 | 21,996,412 | 8,940,512 | 40-65 |

*From the "Foreign Commerce of the United States," Dec. 1917.

Imports of Nickel Ore and Matte into the United States during the following fiscal years ending June 30.*

| From | 1914. | | 1915. | | 1916. | | 1917. | |
|--------------------------|--------|------------|--------|------------|--------|------------|--------|------------|
| | Tons. | Pounds. | Tons. | Pounds. | Tons. | Pounds. | Tons. | Pounds. |
| Belgium | 1,243 | 2,037,008 | 242 | 317,971 | | | | |
| France | | | | | 297 | 514,828 | | |
| Norway | 3 | 5,040 | 366 | 530,704 | | | | |
| Canada (a) | 35,174 | 41,507,255 | 20,592 | 36,607,235 | 52,742 | 64,622,286 | 56,603 | 70,738,737 |
| Oceania—French | | | | | 2,618 | 2,391,922 | 409 | 887,805 |
| —Australia | | | 601 | 539,109 | 1,329 | 1,268,084 | 3,120 | 2,912,298 |
| Peru | | | | | 1 | 118 | | |
| Totals | 36,420 | 43,549,303 | 30,801 | 37,995,019 | 56,927 | 68,797,238 | 60,132 | 74,038,840 |

* From Reports on the commerce and navigation of the United States, Department of Commerce, Washington, D.C.

(a) Values were: in 1914, \$5,621,480; in 1915, \$4,788,145; in 1916, \$8,596,921, and in 1917, \$9,219,634.

Exports of Nickel, Nickel-Oxide, and Matte from the United States during the following fiscal years, ending June.*

(In pounds).

| To | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| Austria-Hungary | | | 134,400 | 672,043 | 67,200 | | |
| Belgium | | 551,740 | 1,719,285 | 1,230,274 | 210,612 | | |
| Denmark | | | | | 43,830 | 2,174 | 23,051 |
| France | 3,765,510 | 5,579,335 | 4,197,110 | 4,419,663 | 3,210,980 | 1,871,595 | 2,336,684 |
| Germany | 1,902,393 | 2,527,273 | 2,346,325 | 11,084,366 | 1,036,242 | | 1,168,056 |
| Italy | 604,938 | 1,321,733 | 1,075,303 | 1,276,905 | 2,365,177 | 1,880,661 | 5,471,426 |
| Netherlands | 8,205,836 | 7,584,653 | 9,164,012 | 2,376,216 | 22,033 | 139,300 | 506,588 |
| Norway | | | | | 31,163 | 34,460 | 33,614 |
| Portugal | | | | | | | 66,520 |
| Russia in Europe | | | 7,250 | 186,626 | 4,082,280 | 5,371,089 | 4,917,075 |
| Spain | | | | | 700 | 112,450 | 158 |
| Sweden | | | | | 367,696 | 313,958 | 23,554 |
| U. Kingdom— | | | | | | | |
| England | 1,342,714 | 3,019,333 | 2,334,845 | 2,171,511 | 8,535,418 | 7,973,478 | 10,024,301 |
| Scotland | 3,114,166 | 5,970,045 | 6,878,264 | 5,433,081 | 7,817,384 | 6,113,198 | 5,820,442 |
| N. America— | | | | | | | |
| Canada | 8,926 | 3,373 | 16,379 | 42,529 | 52,949 | 11,646 | 27,169 |
| Cuba | | | | | | 10 | 34,410 |
| Mexico | 40 | | | | 1,773 | | 249 |
| West Indies (British) | | | | | 300 | | |
| West Indies (Dutch) | | | | | | 10 | |
| S. America— | | | | | | | |
| Brazil | | | 1,796 | | | 473 | 7,623 |
| Chili | | | | | | 100 | 101 |
| Colombia | | | 32 | | | | 70 |
| Asia— | | | | | | | |
| British India | | | | | | 411 | |
| China | | | | | | | 6,720 |
| Hong Kong | | | | | | | 13,899 |
| Japan | 1,957 | 4,005 | 5,447 | 2,023 | 308,444 | 597,257 | 237,944 |
| Russia in Asia | | | | | 1,423,030 | 1,226,990 | |
| Oceania— | | | | | | | |
| British Australia and Tasmania | 1,330 | | 829 | | 22,400 | 679 | 217,280 |
| Philippine Islands | | | | | | 56 | 1,510 |
| | 18,947,810 | 26,561,990 | 27,881,277 | 28,895,242 | 29,599,612 | 25,649,995 | 31,005,606 |

* From Reports on the commerce and navigation of the United States, Department of Commerce, Washington, D.C.

Bounty on Refined Nickel and Nickel-Oxide.—Under the terms of "The Metal Refining Act, 1907," of the Province of Ontario (7 Edward VII, Chap. XIV), a bounty was authorized to be paid on nickel, cobalt, copper, and arsenic under certain conditions and restrictions during a period of five years following the passing of the Act (April, 1907). In March, 1912, the Act was amended to cover a further period of five years. The Act expired in April, 1917, and was not re-enacted.

The sections affecting nickel were as follows:—

The Treasurer of the Province may under the authority of such regulations as may from time to time be made in that behalf by the Lieutenant Governor in Council pay in each year to the refiners of the metals, or metal compounds hereinafter specified, when refined in the Province from ores raised and mined in the Province, a bounty on each pound of such metal or compound so refined, as follows:—

Class 1. On refined metallic nickel, or on refined oxide of nickel, 6 cents per pound on the free metallic nickel or on the nickel contained in the nickel-oxide, but nickel on which a bounty has already been paid in one form of product shall not be entitled to any further bounty in any other form, and the amount to be paid as bounty on the nickel products therein mentioned is not to exceed in all \$60,000 in any one year.

PLATINUM AND PALLADIUM.

In past years, the chief source of platinum production of Canada was the placer gravels of British Columbia, principally in the Similkameen district.

During 1917 the reported recovery was 57 crude ounces valued at \$3,823, as against 15 crude ounces, valued at \$600 in 1916 and 23 crude ounces, valued at \$1,063 in 1915. It is possible that the production of platinum is considerably greater than actually reported. A perusal of the imports from Canada to the United States as given by the United States Department of Commerce, and the exports from Canada into the United States as given by the Canadian Department of Customs, shows that much larger quantities are leaving Canada. The Canadian export records have in the past included "Old and scrap" platinum as well as platinum in ores.

The exports from Canada into the United States were in 1917 platinum in concentrates, etc., 136 ounces, valued at \$11,309, and "old and scrap" 195 ounces valued at \$18,290, or a total of 331 ounces valued at \$29,599; as against 532 ounces valued at \$41,945 in 1916; and 236 ounces, valued at \$11,052 in 1915.

Annual Production of Platinum.

| Year. | Value. | Year. | Value. | Year. | Crude Ounces. | Value. |
|-------|----------|-------|----------|-----------|---------------|-----------|
| 1887 | \$ 5,600 | 1895 | \$ 3,800 | 1904 | | \$ 10,872 |
| 1888 | 6,000 | 1896 | 750 | 1905 | | 500 |
| 1889 | 3,500 | 1897 | 1,600 | 1906 | | * |
| 1890 | 4,500 | 1898 | 1,500 | 1907-1912 | | ** |
| 1891 | 10,000 | 1899 | 325 | 1913 | 18 | 489 |
| 1892 | 3,500 | 1900 | | 1914 | | |
| 1893 | 1,800 | 1901 | 457 | 1915 | 23 | 1,063 |
| 1894 | 950 | 1902 | 46,502 | 1916 | 15 | 600 |
| | | 1903 | 33,345 | 1917 | 57 | 3,823 |

* See under Palladium.

** See explanation in text.

Annual Production of Palladium.

| | Ounces. | Value. |
|-----------------------------------|---------|-----------|
| 1902 Palladium | 4,411 | \$ 86,014 |
| 1903 " | 3,177 | 61,952 |
| 1904 " | 952 | 18,564 |
| 1905 Metals of the platinum group | 1,562 | 28,116 |
| 1906 " | 314 | 5,652 |
| 1907-1917 | (a) | |

(a) See explanation in text.

Exports of Platinum.

| Year. | Ounces. | Value. | Year. | Ounces. | Value. |
|-------|---------|----------|-------|---------|----------|
| 1907 | 242 | \$ 4,864 | 1913 | 158 | \$ 7,929 |
| 1908 | 43 | 937 | 1914 | 43 | 2,161 |
| 1909 | 466 | 2,118 | 1915 | 236 | 11,052 |
| 1910 | 2,254 | 62,776 | 1916 | 532 | 41,945 |
| 1911 | 39 | 1,961 | 1917 | 331 | 29,599 |
| 1912 | 92 | 3,821 | | | |

Imports of Platinum.*

| Calendar Year. | Crucibl. s. | Wire and bars, strips, sheets, or plates. | Retorts, pans, condensers, etc. | Total Imports. |
|----------------|-------------|---|------------------------------------|----------------|
| | Value. | Value. | Value. | Value. |
| 1907..... | \$ 2,974 | \$ 89,719 | \$ 3,415 | \$ 96,108 |
| 1908..... | 1,709 | 37,223 | 5,321 | 44,253 |
| 1909..... | 3,617 | 61,441 | 9,432 | 74,590 |
| 1910..... | 2,133 | 100,185 | 10,741 | 113,062 |
| 1911..... | 4,549 | 170,944 | ..... | 175,493 |
| 1912..... | 7,874 | 224,216 | 73 | 232,163 |
| 1913..... | 4,557 | 141,117 | ..... | 145,674 |
| 1914..... | 9,795 | 69,736 | 142 | 79,673 |
| 1915..... | 5,147 | 65,040 | 13,900 | 84,087 |
| 1916..... | 5,430 | 68,633 | 14,480 | 88,543 |
| 1917..... | 6,834 | 107,409 | 36 | 114,279 |

* Platinum wire and platinum in bars, strips, sheets or plates; platinum retorts, pans, condensers, tubing and pipe, imported by manufacturers of sulphuric acid for use in their works; crucibles. Duty free.

The Royal Ontario Nickel Commission which investigated the nickel industry in Canada, made some most interesting observations on the platinum production derived from the Sudbury ores, and the prominence taken by platinum at the present time will justify an extensive quotation of their remarks, and findings. The following extracts are taken from the Commission's Report:—

“Although the presence of gold and silver and of metals of the platinum group in practically all nickelliferous pyrrhotites throughout the world has long been known, their importance in connection with the Ontario nickel industry is even now practically unrecognized, except by those who recover and sell them.

“The nickel-copper ores of Sudbury are capable of producing much more palladium than the whole of the present world's supply, together with a very large proportion of platinum, iridium, and other metals of the platinum group. The quantity of palladium present is much in excess of the platinum. It may be mentioned that the assay of ores and mattes, and of other metallurgical products, for palladium is exceedingly difficult, and that the results published are often unreliable. They are commonly too low, so that the official or private figures given by the companies or otherwise obtained, are not likely to be too high. The recovery of palladium is also much more difficult than that of platinum or other metals of the platinum group, so that both the assay values reported and the recoveries which have been made, are undoubtedly lower than they should be. Anything which can be done to encourage the better recovery of these metals, or enforce the use of refining processes which recover them, would be justifiable, and particularly so now that platinum and palladium are increasingly required, and stand at so high a price. It may be mentioned that, apart from the Mond Nickel Company's method, the processes most likely to recover these metals are the electrolytic methods of refining.”

“In this connection, it may be stated that the blister copper obtained from practically all the sulphide copper ores throughout the world contains not only gold and silver, but also the metals of the platinum group, and that the electrolytic copper and bullion refiners are recovering increasing quantities year by year, partly through a tardy recognition of their presence, but mainly through extra care in endeavouring to recover them”.

“Although it is not possible to state correctly the actual quantity of the platinum metals present in the ores mined, the quantity recovered per ton of ore can be accurately determined from assay of the matte, provided the number of tons of ore smelted per ton of matte produced is known”.

"The Canadian Copper Company reports that the average content of precious metals per ton of matte for the three years ending 1915 was roughly as follows:—

| | |
|----------------|----------------|
| Gold..... | 0.05 oz. troy. |
| Silver..... | 1.75 " |
| Platinum..... | 0.10 " |
| Palladium..... | 0.15 " |

"The figures given by the company for an isolated month in 1915, were higher, as were also figures obtained by the Commission on samples received from the company in 1916, but the above may be taken for the purposes of calculation".

"The Mond Nickel Company has not furnished figures as to the precious metal contents of its matte, but from assays made on behalf of the Commission on samples obtained from that company, it would appear that the matte produced by the Mond Nickel Company is considerably richer in metals of the platinum group than that from the Canadian Copper Company."

"Taking the basis of \$50 which the United States Geological Survey regards as a fair average for platinum or palladium, and ignoring other metals of the platinum group, although they represent a considerable additional amount and are worth more per ounce, the weight and value of the platinum and palladium in the 63,567 tons of matte produced at Copper Cliff in the year ending December 31, 1916, would be 15,892 oz., worth \$794,600, a figure which may be regarded as conservative."

"Large though the figure is, it represents only the platinum metals actually present in the matte, such additional amounts as may have been present in the original ores and lost in smelting them to matte, being ignored. Hence, such recoveries as are made by the refining companies represent only the percentage recoveries on that present in the matte, and would be still lower on that in the original ores."

The following table shows the recovery of the precious metals by the International Nickel Company over a period of years together with the quantities of matte refined.

The Company points out that during part of the period covered by these figures, it was treating material from other sources, so that the whole of the recoveries could not be attributed to the Sudbury matte.

Recovery at the International Nickel Company's Works—New Jersey.

| Year. | Matte Treated. | Gold. | Silver. | Platinum. | Palladium. |
|-----------|----------------|-----------|------------|-----------|------------|
| | (a) | | | | |
| | Tons. | Ounces. | Ounces. | Ounces. | Ounces. |
| 1907..... | 17.840 | 993.572 | 63,400.70 | 226.800 | 607.300 |
| 1908..... | 18.839 | 5,338.181 | 139,329.29 | 172.316 | 328.287 |
| 1909..... | 18.407 | 2,113.669 | 63,138.66 | 546.627 | 1,270.598 |
| 1910..... | 24.309 | 2,649.799 | 60,256.83 | 258.325 | 522.804 |
| 1911..... | 26.840 | 2,203.052 | 70,954.38 | 665.652 | 753.363 |
| 1912..... | 27.653 | 2,476.533 | 62,169.66 | 496.850 | 680.130 |
| 1913..... | 38.733 | 2,336.405 | 77,924.03 | 292.863 | 298.780 |
| 1914..... | 40.267 | | | | 1,437.0 |
| 1915..... | 31.428 | | | | |
| 1916..... | 56.405 | 3,953,000 | 114,975.00 | | 1,093.0 |
| 1917..... | | | | | |

(a) As published by the Royal Ontario Commission, p. 485, 1917.

"In 1916, 257 ounces of other platinum metals, mainly rhodium and iridium, were also recovered."

"The low values placed by the different companies upon the platinum metals content and upon that of the precious metals generally, including the gold and silver,

is shown by the fact that the Mond Nickel Company estimate that their ore resources will yield not over 70 cents precious metal value per ton of ore, and the British America Nickel Corporation \$1. An assay made by Ledoux and Company on a parcel of between 5,000 and 6,000 tons of ore shipped from the Alexo mine in 1915 showed 0.3 oz. of platinum and palladium per ton of ore. The Norwegian ore appears to yield about 50 cents per ton of ore. The Tasmanian ore has not been smelted alone, so that the recoveries cannot be given, but one large parcel is stated to have contained 0.06 oz. of platinum per ton. Palladium was not tested for."

"Bearing in mind the normal and particularly the present and future demands for all metals of the platinum group, investigations should be continued, both as to the amounts present and the possibility of increasing the recoveries. It need scarcely be pointed out that the electrolytic process of refining nickel matte acquires added value from the fact that it recovers these metals automatically at practically no additional cost."

"Palladium has long been used in dentistry, and is now largely replacing platinum, both in that work and in jewellery. It has risen in price since the war began until now it possesses as high a value as platinum, which it is likely to replace still further both in the above and other industries."

Average Yearly Prices of Platinum.*

(In Dollars per ounce troy).

| | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|---|-------|-------|-------|-------|-------|-------|--------|
| New York refined platinum | 43.12 | 45.55 | 44.88 | 45.14 | 47.13 | 83.40 | 102.82 |
| St. Petersburg, Russia, 83% | 35.21 | 37.08 | 36.54 | | | | |
| Ekaterinburg crude metal platinum | 35.09 | 37.05 | 36.25 | | | | |

* From quotation in "Engineering and Mining Journal," p. 47, January 8, 1916.

(a) Estimate of World's Production of Crude Platinum.

| Country. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|------------------------------|---------|---------|---------|---------|---------|--------|--------|
| Borneo and Sumatra | | 200 | 200 | * | * | * | * |
| Canada | 30 | 30 | 50 | 30 | 100 | 60 | 80 |
| Colombia | 12,000 | 12,000 | 15,000 | 17,500 | 18,000 | 25,000 | 32,000 |
| New South Wales | 470 | 778 | 1,275 | 1,248 | 303 | 222 | * |
| Russia | 300,000 | 300,000 | 250,000 | 241,200 | 124,000 | 63,900 | 50,000 |
| United States | 628 | 721 | 483 | 570 | 742 | 750 | 605 |
| | 313,128 | 313,729 | 267,008 | 250,548 | 143,145 | 89,932 | 82,685 |

* No basis for estimate.

(a) From the Mineral Resources of the United States, July, 1918.

¹ Report of the Royal Ontario Nickel Commission, 1917, pp. 485, 486.

SILVER.

The total production of silver in 1917 amounted to 22,221,274 ounces valued at \$18,091,895 and included: (a) refined silver, or silver contained in silver and gold bullion, 18,214,066 ounces, or 82.0 per cent; (b) silver contained in blister copper and copper matte 606,164 ounces of 2.7 per cent; and (c) silver estimated as recoverable from ores exported 3,401,044 ounces, or 15.3 per cent.

The total production in 1916 was 25,459,741 fine ounces, valued at \$16,717,121, and included: (a) refined silver, or silver contained in silver or gold bullion, 20,465,384 ounces, or 80.3 per cent; (b) silver contained in blister copper and copper matte, 779,916 ounces, or 3.1 per cent; and (c) silver estimated as recoverable from ores exported 4,214,441 ounces, or 16.6 per cent.

For the last few years, the production had shown a falling off both in quantity and value; while in 1916, the production decreased 4.4 per cent and the value increased 26.3 per cent, and in 1917 the production again decreased 12.7 per cent while the value increased 8.2 per cent.

From 1887 to 1893, the production ranged in value between \$300,000 and \$400,000, and was derived chiefly from Ontario and Quebec. The next three years saw a rapid increase in production, due to the development of the silver-lead deposits of British Columbia, and in 1896 a production of over \$2,000,000 is recorded. From that year until 1905, the production varied between \$2,000,000 and \$3,500,000 rising rapidly during the next six years to \$17,580,455 in 1910, as a result of the discovery of the rich ores of the Cobalt district. Since then, there has been a falling off in quantity, but owing to the higher price of the metal, the total value was higher in 1912, 1913, 1916, and 1917.

Annual Production of Silver, 1887 to 1917.

| Year. | Ounces. | Value. | Cents per ounce. | Year. | Ounces. | Value. | Cents per ounce. |
|-----------|-----------|------------|------------------|---------------|------------|-------------|------------------|
| 1887..... | 355,083 | \$ 347,271 | 98.00 | 1903..... | 3,193,581 | \$1,709,642 | 53.45 |
| 1888..... | 437,232 | 410,998 | 94.00 | 1904..... | 3,577,526 | 2,047,095 | 57.22 |
| 1889..... | 383,318 | 358,785 | 93.60 | 1905..... | 6,000,023 | 3,621,133 | 60.35 |
| 1890..... | 400,687 | 419,118 | 104.60 | 1906..... | 8,473,379 | 5,659,455 | 66.79 |
| 1891..... | 414,523 | 409,549 | 98.00 | 1907..... | 12,779,799 | 8,348,659 | 65.33 |
| 1892..... | 310,651 | 272,130 | 86.00 | 1908..... | 22,106,233 | 11,686,239 | 52.86 |
| 1893..... | | 330,128 | 77.00 | 1909..... | 27,529,473 | 14,178,504 | 51.50 |
| 1894..... | 847,697 | 534,049 | 63.00 | 1910..... | 32,869,264 | 17,580,455 | 53.49 |
| 1895..... | 1,578,275 | 1,030,299 | 65.28 | 1911..... | 32,559,044 | 17,355,272 | 53.30 |
| 1896..... | 3,205,343 | 2,149,503 | 67.06 | 1912..... | 31,955,560 | 19,440,165 | 60.83 |
| 1897..... | 5,558,456 | 3,323,395 | 59.79 | 1913..... | 31,845,863 | 19,040,924 | 59.79 |
| 1898..... | 4,452,333 | 2,593,929 | 58.26 | 1914..... | 28,449,821 | 15,593,630 | 54.81 |
| 1899..... | 3,411,644 | 2,032,658 | 59.58 | 1915..... | 26,625,960 | 13,228,842 | 49.68 |
| 1900..... | 4,468,225 | 2,740,362 | 61.33 | 1916..... | 25,459,741 | 16,717,121 | 65.66 |
| 1901..... | 5,539,192 | 3,265,354 | 58.95 | 1917 (a)..... | 22,221,274 | 18,091,895 | 81.417 |
| 1902..... | 4,291,317 | 2,238,351 | 52.16 | | | | |

(a) Included a very small production from New Brunswick and Alberta.

Ontario produced in 1905, 40.9 per cent of the output of Canada, in 1911 its percentage was 93.8; in 1914 it had fallen to 88.4 per cent; in 1915 it decreased again to 85.4 per cent; in 1916 to 84.9 per cent, while in 1917 it increased to 86.7 per cent of the total.

The production of British Columbia, which has varied between two and five million ounces for the last twenty years, was in 1914, 11.1 per cent of the total production of Canada; in 1915 it increased to 13.4 per cent; in 1916 it was 13.3 per cent and in 1917 it decreased to 11.9 per cent of the total.

The balance of the production — 1.2 per cent is derived from Quebec, Manitoba and the Yukon, with also a very small production from New Brunswick and Alberta.

Production of Silver by Provinces, 1887-1917.

| Year. | Ontario. | | Quebec. | | British Columbia. | | Yukon Territory. | |
|-------|------------|------------|---------|------------|-------------------|-----------|------------------|------------|
| | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. |
| 1887 | 190,495 | \$ 186,304 | 146,898 | \$ 143,666 | 17,690 | \$17,301 | | |
| 1888 | 208,064 | 195,580 | 149,388 | 140,425 | 79,780 | 74,993 | | |
| 1889 | 181,609 | 169,986 | 148,517 | 139,012 | 53,192 | 49,787 | | |
| 1890 | 158,715 | 166,016 | 171,545 | 179,436 | 70,427 | 73,666 | | |
| 1891 | 225,633 | 222,926 | 185,584 | 183,357 | 3,306 | 3,266 | | |
| 1892 | 41,581 | 36,425 | 191,910 | 168,113 | 77,160 | 67,592 | | |
| 1893 | | 8,689 | | 126,439 | | 195,000 | | |
| 1894 | | | 101,318 | 63,830 | 746,379 | 470,219 | | |
| 1895 | | | 81,753 | 53,369 | 1,496,522 | 976,930 | | |
| 1896 | | | 70,000 | 46,942 | 3,135,343 | 2,102,561 | | |
| 1897 | 5,000 | 2,990 | 80,475 | 48,116 | 5,472,971 | 3,272,289 | | |
| 1898 | 85,000 | 49,521 | 74,932 | 43,655 | 4,292,401 | 2,500,753 | | |
| 1899 | 202,000 | 120,352 | 40,231 | 23,970 | 2,939,413 | 1,751,302 | 230,000 | \$ 137,034 |
| 1900 | 161,650 | 99,140 | 58,400 | 35,817 | 3,958,175 | 2,427,548 | 290,000 | 177,857 |
| 1901 | 151,400 | 89,250 | 41,459 | 24,440 | 5,151,333 | 3,036,711 | 195,000 | 114,953 |
| 1902 | 145,000 | 75,632 | 42,590 | 22,168 | 3,917,917 | 2,043,586 | 185,900 | 96,955 |
| 1903 | 17,777 | 9,502 | 29,600 | 15,287 | 2,966,204 | 1,601,471 | 156,000 | 83,362 |
| 1904 | 206,875 | 118,376 | 15,000 | 8,583 | 3,222,481 | 1,843,935 | 133,170 | 76,201 |
| 1905 | 2,451,356 | 1,479,442 | 19,620 | 11,841 | 3,439,417 | 2,075,757 | 89,630 | 54,093 |
| 1906 | 5,401,766 | 3,607,894 | 17,686 | 11,813 | 2,990,262 | 1,997,226 | 63,665 | 42,522 |
| 1907 | 9,982,363 | 6,521,178 | 16,000 | 10,452 | 2,745,448 | 1,793,519 | 35,988 | 23,510 |
| 1908 | 19,398,545 | 10,254,847 | 13,299 | 7,030 | 2,631,389 | 1,391,058 | 63,000 | 33,304 |
| 1909 | 24,822,099 | 12,784,126 | 13,233 | 6,815 | 2,649,141 | 1,364,387 | 45,000 | 23,176 |
| 1910 | 30,366,366 | 16,241,755 | 7,593 | 4,061 | 2,407,887 | 1,287,883 | 87,418 | 46,756 |
| 1911 | 30,540,754 | 16,279,443 | 18,435 | 9,827 | 1,887,147 | 1,005,924 | 112,708 | 60,078 |
| 1912 | 29,214,025 | 17,772,352 | 9,465 | 5,758 | 2,651,002 | 1,612,737 | 31,068 | 49,318 |
| 1913 | 28,411,261 | 16,987,377 | 34,573 | 20,672 | 3,312,343 | 1,980,483 | 87,626 | 52,392 |
| 1914 | 25,139,214 | 13,779,055 | 57,737 | 31,646 | 3,159,897 | 1,731,971 | 92,973 | 50,959 |
| 1915 | 22,748,609 | 11,302,419 | 63,450 | 31,524 | 3,565,852 | 1,771,658 | 248,049 | 123,241 |
| 1916 | 21,608,158 | 14,188,133 | 98,610 | 64,748 | 3,392,872 | 2,227,794 | 360,101 | 236,446 |
| 1917 | 19,301,835 | 15,714,975 | 136,914 | 110,885 | 2,655,994 | 2,162,430 | 119,605 | 97,379 |

Prices.—The average price of silver in New York for the year 1917, was 81.417 cents per ounce, as against 65.661 cents in 1916.

The price of silver remained fairly stationary around 75 cents until June. During May and June purchases were made by India and China at higher prices than the New York market and shipments were made from the Pacific coast. A large sale was made in July to the Russian Government and the prospect of good crops for India stimulated the price for silver so much so that the highest quotation of \$1.08½ was reached in September.

Then the Indian Government took control of all imports of silver, and China was induced by the British Government to stop buying silver, which facts account for the decline in the silver quotations during the last quarter of 1917.

“The notable events of the year in the silver market have been: (a) the highest price in 40 years; (b) the enormous coinage of rupees in India (207,737,326); (c) the unusual large purchases by India from China and the Philippines; (d) the large purchase by Russia; and (e) the diversion of the usual flow of silver through New York to an equal exportation through San Francisco.”¹

In London the average price for the year was 40,851 pence per standard ounce (925 parts fine), as against 31,315 pence in 1916. The minimum price was 36¼ pence early in January, while the maximum was 54 pence late in September and the year closed with the price at 43 pence per standard ounce.

¹ The Engineering and Mining Journal, January 12, 1918, p. 51.

Yearly Average Prices of Silver in New York and London.

| Year. | New York. Cents per fine ounce. | London. Pence per Standard ounce. (a) | Year. | New York. Cents per fine ounce. | London. Pence per Standard ounce. (a) |
|-----------|---------------------------------------|--|-----------|---------------------------------------|--|
| 1908..... | 52.864 | 24.402 | 1913..... | 59.791 | 27.576 |
| 1909..... | 51.503 | 23.726 | 1914..... | 54.811 | 25.313 |
| 1910..... | 53.486 | 24.670 | 1915..... | 49.684 | 23.675 |
| 1911..... | 53.804 | 24.592 | 1916..... | 65.661 | 31.315 |
| 1912..... | 60.835 | 28.042 | 1917..... | 81.417 | 40.851 |

(a) 925 parts fine.

Average Monthly Prices of Silver.

| Months. | New York.—Cents per fine ounce. | | | | | | | London. Pence per Standard ounce. (a) |
|---------------------------|---------------------------------|--------|--------|--------|--------|--------|---------|--|
| | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. | |
| January..... | 53.795 | 56.260 | 62.938 | 57.572 | 48.855 | 56.775 | 75.630 | 36.682 |
| February..... | 52.222 | 59.043 | 61.642 | 57.506 | 48.477 | 56.755 | 77.585 | 37.742 |
| March..... | 52.745 | 58.375 | 57.870 | 58.067 | 50.241 | 57.935 | 73.861 | 36.410 |
| April..... | 53.325 | 59.207 | 59.490 | 58.519 | 50.250 | 64.415 | 73.875 | 36.963 |
| May..... | 53.308 | 60.880 | 60.361 | 58.175 | 49.915 | 74.269 | 74.745 | 37.940 |
| June..... | 53.043 | 61.290 | 58.990 | 56.471 | 49.034 | 65.024 | 76.971 | 39.065 |
| July..... | 52.630 | 60.654 | 58.721 | 54.678 | 47.519 | 62.940 | 79.010 | 40.110 |
| August..... | 52.171 | 61.606 | 59.293 | 54.344 | 47.163 | 66.083 | 85.407 | 43.418 |
| September..... | 52.440 | 63.078 | 60.640 | 53.290 | 48.680 | 68.515 | 100.740 | 50.920 |
| October..... | 53.340 | 63.471 | 60.793 | 50.654 | 49.335 | 67.855 | 87.332 | 44.324 |
| November..... | 55.719 | 62.792 | 58.995 | 49.082 | 51.714 | 71.604 | 85.891 | 43.584 |
| December..... | 54.905 | 63.365 | 57.760 | 49.375 | 54.971 | 75.765 | 85.960 | 43.052 |
| Average for the year..... | 53.304 | 60.835 | 59.791 | 54.811 | 49.684 | 65.661 | 81.417 | 40.851 |

(a) 925 parts fine. From "Engineering and Mining Journal," Jan. 12, 1918.

Important quantities of silver are being produced in Canada, both as fine metal and as silver bullion, ranging in fineness from 850 to 998.2. Fine silver is produced at Trail, B.C., by the Consolidated Mining and Smelting Company of Canada, Limited, being derived chiefly from the silver-lead ores of the Province, and finds a market in Canada, the United States and China.

In Ontario, ores from the Cobalt district are treated by the Coniagas Reduction Co., Thorold, Ontario; the Deloro Smelting and Refining Co., Deloro, Ontario; the Metals Chemical Co., Welland, Ontario; and the Standard Smelting and Refining Co., Chippewa, Ontario.

Silver bullion varying from 850 to 998.2 is produced at these works, other products being white arsenic, metallic nickel and cobalt, sulphate of nickel and cobalt, nickel and cobalt oxides, and mixed oxides. The silver bullion as a rule finds a market in the United States and in England.

Bullion shipped by these Ontario smelters in 1907 contained 4,449,722 fine ounces of silver; in 1908, 11,168,689 ounces; in 1911, 17,753,167 ounces; in 1913, 11,356,707 ounces; in 1915, 9,835,989 ounces; in 1916, 9,665,516 ounces; and in 1917, 6,450,075 fine ounces.

The bullion shipped from the mines and mills in the Cobalt district in 1917 is reported as 9,921,465 fine ounces, as against 8,551,070 ounces in 1916, 9,204,393 ounces in 1915, and 10,335,527 ounces in 1914.

Shipments to United States smelters in 1917 amounted to 7,347 tons with a silver content of 2,986,100 ounces, as against 7,180 tons containing 3,409,258 ounces in 1916, and 7,310 tons containing 3,769,308 ounces in 1915.

Exports and Imports.—The exports of silver as bullion or contained in ores, concentrates, etc., during 1917 were 21,718,784 fine ounces valued at \$17,621,398, as against 25,279,359 ounces valued at \$15,637,885 in 1916, and 27,672,481 ounces valued at \$13,812,038 in 1915.

The imports of silver bullion into Canada in 1917 were valued at \$959,153, as against \$875,157 in 1916 and \$337,254 in 1915. Silver is also imported as "manufactures of silver" and mention is made in the chapter on "Gold."

Exports of Silver in Ore, etc.

| Calendar Year. | Value. | Calendar Year. | Value. | Calendar Year. | Value. | Calendar Year. | Value. |
|----------------|-----------|----------------|------------|----------------|--------------|----------------|---------------|
| 1886..... | \$ 25,957 | 1894..... | \$ 359,731 | 1902.... | \$ 1,820,058 | 1910... | \$ 15,649,537 |
| 1887..... | 206,284 | 1895..... | 994,354 | 1903.... | 1,989,474 | 1911..... | 15,807,366 |
| 1888..... | 219,008 | 1896..... | 2,271,959 | 1904.... | 1,904,394 | 1912..... | 19,494,416 |
| 1889..... | 212,163 | 1897.... | 3,576,391 | 1905.... | 2,777,218 | 1913..... | 21,441,220 |
| 1890..... | 204,142 | 1898..... | 2,902,277 | 1906.... | 5,686,444 | 1914..... | 15,584,813 |
| 1891..... | 225,312 | 1899..... | 1,623,905 | 1907.... | 9,941,849 | 1915..... | 13,812,038 |
| 1892..... | 56,688 | 1900..... | 2,341,872 | 1908.... | 12,403,482 | 1916..... | 15,637,835 |
| 1893..... | 213,695 | 1901..... | 2,026,727 | 1909.... | 15,719,909 | 1917..... | 17,621,398 |

Imports of Silver Bullion.*

| Calendar Year. | Value. | Calendar Year. | Value. |
|----------------|------------|----------------|------------|
| 1910..... | \$ 975,045 | 1914..... | \$ 629,279 |
| 1911..... | 847,645 | 1915..... | 337,254 |
| 1912..... | 1,100,344 | 1916..... | 875,157 |
| 1913..... | 840,245 | 1917..... | 959,153 |

* Silver imports are given more fully in the chapter on "Gold".

Quebec.

The small quantity of silver credited to Quebec province for a number of years represents a small silver content of the pyritic ores mined at Eustis and Weedon, in the Eastern Townships, and the lead-zinc ores of Notre-Dames-des-Anges, Portneuf county. The production in 1917 was 136,194 fine ounces, valued at \$110,885, as against 98,610 ounces, valued at \$64,748 in 1915 and 63,450 ounces valued at \$31,524 in 1916.

Ontario.

The production of silver in Ontario increased from 17,777 fine ounces in 1903 to 2,451,356 fine ounces in 1905, and reached a maximum of 30,540,754 fine ounces in 1911. The maximum value, \$17,772,352, was reached in 1912.

The production in 1917 was 19,301,835 fine ounces valued at \$15,714,975, as against 21,608,158 fine ounces valued at \$14,188,133 in 1916, a decrease of 10.8 per

SILVER.

The total production of silver in 1917 amounted to 22,221,274 ounces valued at \$18,091,895 and included: (a) refined silver, or silver contained in silver and gold bullion, 18,214,066 ounces, or 82.0 per cent; (b) silver contained in blister copper and copper matte 606,164 ounces of 2.7 per cent; and (c) silver estimated as recoverable from ores exported 3,401,044 ounces, or 15.3 per cent.

The total production in 1916 was 25,459,741 fine ounces, valued at \$16,717,121, and included: (a) refined silver, or silver contained in silver or gold bullion, 20,465,384 ounces, or 80.3 per cent; (b) silver contained in blister copper and copper matte, 779,916 ounces, or 3.1 per cent; and (c) silver estimated as recoverable from ores exported 4,214,441 ounces, or 16.6 per cent.

For the last few years, the production had shown a falling off both in quantity and value; while in 1916, the production decreased 4.4 per cent and the value increased 26.3 per cent, and in 1917 the production again decreased 12.7 per cent while the value increased 8.2 per cent.

From 1887 to 1893, the production ranged in value between \$300,000 and \$400,000, and was derived chiefly from Ontario and Quebec. The next three years saw a rapid increase in production, due to the development of the silver-lead deposits of British Columbia, and in 1896 a production of over \$2,000,000 is recorded. From that year until 1905, the production varied between \$2,000,000 and \$3,500,000 rising rapidly during the next six years to \$17,580,455 in 1910, as a result of the discovery of the rich ores of the Cobalt district. Since then, there has been a falling off in quantity, but owing to the higher price of the metal, the total value was higher in 1912, 1913, 1916, and 1917.

Annual Production of Silver, 1887 to 1917.

| Year. | Ounces. | Value. | Cents per ounce. | Year. | Ounces. | Value. | Cents per ounce. |
|-------|-----------|------------|------------------|----------|------------|-------------|------------------|
| 1887 | 355,083 | \$ 347,271 | 98.00 | 1903 | 3,193,581 | \$1,709,642 | 53.45 |
| 1888 | 437,232 | 410,998 | 94.00 | 1904 | 3,577,526 | 2,047,095 | 57.22 |
| 1889 | 383,313 | 358,785 | 93.60 | 1905 | 6,000,023 | 3,621,133 | 60.35 |
| 1890 | 400,687 | 419,118 | 104.60 | 1906 | 8,473,379 | 5,659,455 | 66.79 |
| 1891 | 414,523 | 409,549 | 98.00 | 1907 | 12,779,799 | 8,348,659 | 65.33 |
| 1892 | 310,651 | 272,130 | 86.00 | 1908 | 22,106,233 | 11,686,239 | 52.86 |
| 1893 | | 330,128 | 77.00 | 1909 | 27,529,473 | 14,178,504 | 51.50 |
| 1894 | 847,697 | 534,049 | 63.00 | 1910 | 32,869,264 | 17,580,455 | 53.49 |
| 1895 | 1,578,275 | 1,030,299 | 65.28 | 1911 | 32,559,044 | 17,355,272 | 53.30 |
| 1896 | 3,205,343 | 2,149,503 | 67.06 | 1912 | 31,955,560 | 19,440,165 | 60.83 |
| 1897 | 5,558,456 | 3,323,395 | 59.79 | 1913 | 31,845,863 | 19,040,924 | 59.79 |
| 1898 | 4,452,333 | 2,593,929 | 58.26 | 1914 | 28,449,821 | 15,593,630 | 54.81 |
| 1899 | 3,411,644 | 2,032,658 | 59.58 | 1915 | 26,625,960 | 13,228,842 | 49.68 |
| 1900 | 4,468,225 | 2,740,362 | 61.33 | 1916 | 25,459,741 | 16,717,121 | 65.66 |
| 1901 | 5,539,192 | 3,265,354 | 58.95 | 1917 (a) | 22,221,274 | 18,091,895 | 81.417 |
| 1902 | 4,291,317 | 2,283,351 | 52.16 | | | | |

(a) Included a very small production from New Brunswick and Alberta.

Ontario produced in 1905, 40.9 per cent of the output of Canada, in 1911 its percentage was 93.8; in 1914 it had fallen to 88.4 per cent; in 1915 it decreased again to 85.4 per cent; in 1916 to 84.9 per cent, while in 1917 it increased to 86.7 per cent of the total.

The production of British Columbia, which has varied between two and five million ounces for the last twenty years, was in 1914, 11.1 per cent of the total production of Canada; in 1915 it increased to 13.4 per cent; in 1916 it was 13.3 per cent and in 1917 it decreased to 11.9 per cent of the total.

The balance of the production — 1.2 per cent is derived from Quebec, Manitoba and the Yukon, with also a very small production from New Brunswick and Alberta.

Production of Silver by Provinces, 1887-1917.

| Year. | Ontario. | | Quebec. | | British Columbia. | | Yukon Territory. | |
|-------|------------|------------|---------|------------|-------------------|-----------|------------------|------------|
| | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. | Ounces. | Value. |
| 1887 | 190,495 | \$ 186,304 | 146,898 | \$ 143,666 | 17,690 | \$17,301 | | |
| 1888 | 208,064 | 195,580 | 149,388 | 140,425 | 79,780 | 74,993 | | |
| 1889 | 181,609 | 169,986 | 148,517 | 139,012 | 53,192 | 49,787 | | |
| 1890 | 158,715 | 166,016 | 171,545 | 179,436 | 70,427 | 73,666 | | |
| 1891 | 225,633 | 222,926 | 185,584 | 183,357 | 3,306 | 3,266 | | |
| 1892 | 41,581 | 36,425 | 191,910 | 168,113 | 77,160 | 67,592 | | |
| 1893 | | 8,689 | | 126,439 | | 195,000 | | |
| 1894 | | | 101,318 | 63,830 | 746,379 | 470,219 | | |
| 1895 | | | 81,753 | 53,369 | 1,496,522 | 976,930 | | |
| 1896 | | | 70,000 | 46,942 | 3,135,343 | 2,102,561 | | |
| 1897 | 5,000 | 2,990 | 80,475 | 48,116 | 5,472,971 | 3,272,289 | | |
| 1898 | 85,000 | 49,521 | 74,932 | 43,655 | 4,292,401 | 2,500,753 | | |
| 1899 | 202,000 | 120,352 | 40,231 | 23,970 | 2,939,413 | 1,751,302 | 230,000 | \$ 137,034 |
| 1900 | 161,650 | 99,140 | 58,400 | 35,817 | 3,958,175 | 2,427,548 | 200,000 | 177,857 |
| 1901 | 151,400 | 89,250 | 41,459 | 24,440 | 5,151,333 | 3,036,711 | 195,000 | 114,953 |
| 1902 | 145,000 | 75,632 | 42,500 | 22,168 | 3,917,917 | 2,043,586 | 185,900 | 96,985 |
| 1903 | 17,777 | 9,502 | 28,600 | 15,287 | 2,966,204 | 1,601,471 | 156,000 | 83,362 |
| 1904 | 206,875 | 118,376 | 15,000 | 8,533 | 3,222,481 | 1,843,935 | 133,170 | 76,201 |
| 1905 | 2,451,356 | 1,479,442 | 19,620 | 11,841 | 3,439,417 | 2,075,757 | 89,630 | 54,093 |
| 1906 | 5,401,766 | 3,607,894 | 17,686 | 11,813 | 2,990,262 | 1,997,226 | 63,665 | 42,522 |
| 1907 | 9,982,363 | 6,521,178 | 16,000 | 10,452 | 2,745,448 | 1,793,519 | 35,988 | 23,510 |
| 1908 | 19,398,545 | 10,254,847 | 13,299 | 7,030 | 2,631,339 | 1,391,058 | 63,000 | 33,304 |
| 1909 | 24,322,099 | 12,784,126 | 13,233 | 6,815 | 2,649,141 | 1,364,387 | 45,000 | 23,176 |
| 1910 | 30,366,366 | 16,241,755 | 7,593 | 4,061 | 2,407,887 | 1,287,883 | 37,418 | 46,756 |
| 1911 | 30,540,754 | 16,279,443 | 18,435 | 9,827 | 1,887,147 | 1,005,924 | 112,708 | 60,078 |
| 1912 | 29,214,025 | 17,772,352 | 9,465 | 5,758 | 2,651,002 | 1,612,737 | 81,068 | 49,318 |
| 1913 | 28,411,261 | 16,987,377 | 34,573 | 20,672 | 3,312,343 | 1,980,483 | 87,626 | 52,392 |
| 1914 | 25,139,214 | 13,779,055 | 57,737 | 31,646 | 3,159,897 | 1,731,971 | 92,973 | 50,959 |
| 1915 | 22,748,609 | 11,302,419 | 63,450 | 31,524 | 3,505,852 | 1,771,658 | 248,049 | 123,241 |
| 1916 | 21,608,158 | 14,188,133 | 98,610 | 64,748 | 3,392,872 | 2,227,794 | 360,101 | 236,446 |
| 1917 | 19,301,835 | 15,714,975 | 136,914 | 110,885 | 2,655,994 | 2,162,430 | 119,605 | 97,379 |

Prices.—The average price of silver in New York for the year 1917, was 81.417 cents per ounce, as against 65.661 cents in 1916.

The price of silver remained fairly stationary around 75 cents until June. During May and June purchases were made by India and China at higher prices than the New York market and shipments were made from the Pacific coast. A large sale was made in July to the Russian Government and the prospect of good crops for India stimulated the price for silver so much so that the highest quotation of \$1.08½ was reached in September.

Then the Indian Government took control of all imports of silver, and China was induced by the British Government to stop buying silver, which facts account for the decline in the silver quotations during the last quarter of 1917.

“The notable events of the year in the silver market have been: (a) the highest price in 40 years; (b) the enormous coinage of rupees in India (207,737,326); (c) the unusual large purchases by India from China and the Philippines; (d) the large purchase by Russia; and (e) the diversion of the usual flow of silver through New York to an equal exportation through San Francisco.”

In London the average price for the year was 40,851 pence per standard ounce (925 parts fine), as against 31,315 pence in 1916. The minimum price was 36½ pence early in January, while the maximum was 54 pence late in September and the year closed with the price at 43 pence per standard ounce.

Yearly Average Prices of Silver in New York and London.

| Year. | New York. Cents per fine ounce. | London. Pence per Standard ounce. (a) | Year. | New York. Cents per fine ounce. | London. Pence per Standard ounce. (a) |
|-----------|---------------------------------------|--|-----------|---------------------------------------|--|
| 1908..... | 52-864 | 24-402 | 1913..... | 59-791 | 27-576 |
| 1909..... | 51-503 | 23-726 | 1914..... | 54-811 | 25-313 |
| 1910..... | 53-486 | 24-670 | 1915..... | 49-684 | 23-675 |
| 1911..... | 53-304 | 24-592 | 1916..... | 65-661 | 31-315 |
| 1912..... | 60-835 | 28-042 | 1917..... | 81-417 | 40-851 |

(a) 925 parts fine.

Average Monthly Prices of Silver.

| Months. | New York.—Cents per fine ounce. | | | | | | | London. Pence per Standard ounce. (a) |
|---------------------------|---------------------------------|--------|--------|--------|--------|--------|---------|--|
| | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. | 1917. |
| January..... | 53-795 | 56-260 | 62-938 | 57-572 | 48-855 | 56-775 | 75-630 | 36-682 |
| February..... | 52-222 | 59-043 | 61-642 | 57-506 | 48-477 | 56-755 | 77-585 | 37-742 |
| March..... | 52-745 | 58-375 | 57-870 | 58-067 | 50-241 | 57-935 | 73-861 | 36-410 |
| April..... | 53-325 | 59-207 | 59-490 | 58-519 | 50-250 | 64-415 | 73-875 | 36-963 |
| May..... | 53-308 | 60-830 | 60-361 | 58-175 | 49-915 | 74-269 | 74-745 | 37-940 |
| June..... | 53-043 | 61-290 | 58-990 | 56-471 | 49-034 | 65-024 | 76-971 | 39-065 |
| July..... | 52-630 | 60-654 | 58-721 | 54-678 | 47-519 | 62-940 | 79-010 | 40-110 |
| August..... | 52-171 | 61-606 | 59-293 | 54-344 | 47-163 | 66-083 | 85-407 | 43-418 |
| September..... | 52-440 | 63-078 | 60-646 | 53-290 | 48-680 | 68-515 | 100-740 | 50-920 |
| October..... | 53-340 | 63-471 | 60-793 | 50-654 | 49-385 | 67-855 | 87-332 | 44-324 |
| November..... | 55-719 | 62-792 | 58-995 | 49-082 | 51-714 | 71-604 | 85-891 | 43-584 |
| December..... | 54-905 | 63-365 | 57-760 | 49-375 | 54-971 | 75-765 | 85-960 | 43-052 |
| Average for the year..... | 53-304 | 60-835 | 59-791 | 54-811 | 49-684 | 65-661 | 81-417 | 40-851 |

(a) 925 parts fine. From "Engineering and Mining Journal," Jan. 12, 1918.

Important quantities of silver are being produced in Canada, both as fine metal and as silver bullion, ranging in fineness from 850 to 998.2. Fine silver is produced at Trail, B.C., by the Consolidated Mining and Smelting Company of Canada, Limited, being derived chiefly from the silver-lead ores of the Province, and finds a market in Canada, the United States and China.

In Ontario, ores from the Cobalt district are treated by the Coniagas Reduction Co., Thorold, Ontario; the Deloro Smelting and Refining Co., Deloro, Ontario; the Metals Chemical Co., Welland, Ontario; and the Standard Smelting and Refining Co., Chippewa, Ontario.

Silver bullion varying from 850 to 998.2 is produced at these works, other products being white arsenic, metallic nickel and cobalt, sulphate of nickel and cobalt, nickel and cobalt oxides, and mixed oxides. The silver bullion as a rule finds a market in the United States and in England.

Bullion shipped by these Ontario smelters in 1907 contained 4,449,722 fine ounces of silver; in 1908, 11,168,689 ounces; in 1911, 17,753,167 ounces; in 1913, 11,356,707 ounces; in 1915, 9,885,989 ounces; in 1916, 9,665,516 ounces, and in 1917, 6,450,075 fine ounces.

The bullion shipped from the mines and mills in the Cobalt district in 1917 is reported as 9,921,465 fine ounces, as against 8,551,070 ounces in 1916; 9,204,893 ounces in 1915, and 10,335,527 ounces in 1914.

Shipments to United States smelters in 1917 amounted to 7,347 tons with a silver content of 2,986,100 ounces, as against 7,180 tons containing 3,409,258 ounces in 1916, and 7,310 tons containing 3,769,308 ounces in 1915.

Exports and Imports.—The exports of silver as bullion or contained in ores, concentrates, etc., during 1917 were 21,718,784 fine ounces valued at \$17,621,398, as against 25,279,359 ounces valued at \$15,637,835 in 1916, and 27,672,481 ounces valued at \$13,812,038 in 1915.

The imports of silver bullion into Canada in 1917 were valued at \$959,153, as against \$875,157 in 1916 and \$337,254 in 1915. Silver is also imported as “manufactures of silver” and mention is made in the chapter on “Gold.”

Exports of Silver in Ore, etc.

| Calendar Year. | Value. | Calendar Year. | Value. | Calendar Year. | Value. | Calendar Year. | Value. |
|----------------|-----------|----------------|------------|----------------|--------------|----------------|---------------|
| 1886..... | \$ 25,957 | 1894..... | \$ 359,731 | 1902.... | \$ 1,820,058 | 1910.... | \$ 15,649,537 |
| 1887..... | 206,284 | 1895..... | 994,354 | 1903.... | 1,989,474 | 1911..... | 15,807,366 |
| 1888..... | 219,008 | 1896..... | 2,271,959 | 1904.... | 1,904,394 | 1912..... | 19,494,416 |
| 1889..... | 212,163 | 1897.... | 3,576,391 | 1905..... | 2,777,218 | 1913..... | 21,441,220 |
| 1890..... | 204,142 | 1898..... | 2,902,277 | 1906.... | 5,686,444 | 1914..... | 15,534,813 |
| 1891..... | 225,312 | 1899..... | 1,623,905 | 1907..... | 9,941,849 | 1915..... | 13,812,038 |
| 1892..... | 56,688 | 1900..... | 2,341,872 | 1908..... | 12,403,482 | 1916..... | 15,637,835 |
| 1893..... | 213,695 | 1901.... | 2,026,727 | 1909..... | 15,719,909 | 1917..... | 17,621,398 |

Imports of Silver Bullion.*

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|----------------|------------|----------------|------------|
| 1910..... | \$ 975,045 | 1914..... | \$ 623,279 |
| 1911..... | 847,645 | 1915..... | 337,254 |
| 1912..... | 1,100,344 | 1916..... | 875,157 |
| 1913..... | 840,245 | 1917..... | 959,153 |

* Silver imports are given more fully in the chapter on “Gold”.

Quebec.

The small quantity of silver credited to Quebec province for a number of years represents a small silver content of the pyritic ores mined at Eustis and Weedon, in the Eastern Townships, and the lead-zinc ores of Notre-Dames-des-Anges, Portneuf county. The production in 1917 was 136,194 fine ounces, valued at \$110,885, as against 98,610 ounces, valued at \$64,748 in 1915 and 63,450 ounces valued at \$31,524 in 1916.

Ontario.

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The production in 1917 was 19,301,835 fine ounces valued at \$15,714,975, as against 21,608,158 fine ounces valued at \$14,188,133 in 1916, a decrease of 10.8 per

cent in quantity, but an increase of 10.7 per cent in value. In 1916 there had been also a decrease of 5.0 per cent in quantity and an increase of 15.5 per cent in value. The production included in addition to the production of the Cobalt and adjacent silver camps, 74,357 ounces contained in gold bullion and also a small recovery from copper ores.

The silver ores of the Cobalt district, which in the early days of the camp were all exported for treatment, are being reduced to an increasing extent each year within the camp by a combination of amalgamation cyanide process, with recovery of silver bullion. During 1917, 9,726,215 ounces, or 51.1 per cent of the output, was thus recovered as bullion in the district, while 6,450,075 ounces, or 33.9 per cent of the total was recovered by the silver smelters of the Province, so that over 16 millions, or 85 per cent of the Ontario production was recovered in the form of bullion within the Province, leaving a balance of 15.0 per cent treated in the United States. In 1916 about 39.5 per cent was recovered as bullion in the district and 44.7 per cent by the silver smelters, giving a total of 84.2 per cent as recovered in the form of bullion within the Province.

The following table shows the percentage production by the camp, by the southern Ontario smelters and from ores exported to the United States:—

| | 1914. | 1915. | 1916. | 1917. |
|------------------------|-------|-------|-------|-------|
| | % | % | % | % |
| Cobalt district..... | 41.0 | 41.0 | 39.5 | 51.1 |
| Ontario smelters..... | 36.0 | 43.0 | 44.7 | 33.9 |
| Total for Ontario..... | 77.0 | 84.0 | 84.2 | 85.0 |
| U.S. smelters..... | 23.0 | 16.0 | 15.8 | 15.0 |
| Total..... | 100.0 | 100.0 | 100.0 | 100.0 |

Manitoba.

The silver production in Manitoba in 1917 amounted to 7,201 fine ounces valued at \$5,863 and was derived from the gold and copper ores of the new Pas district.

British Columbia.

The silver production of British Columbia based on smelter recoveries amounted in 1917 to 2,655,994 fine ounces valued at \$2,162,430, as against 3,392,872 ounces valued at \$2,227,794 in 1916, a decrease of over 21 per cent in quantity and of 3 per cent in value.

The chief sources of the silver production in this Province are the silver-lead ores of the East and West Kootenays, supplemented by the silver contained in the gold-copper ores of Rossland, the Boundary, and Coast districts.

Production of Silver in British Columbia by Districts, 1912-17.*

(Silver contents of ores shipped, in fine ounces.)

| | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|--------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Cariboo— | | | | | | |
| Omineca division..... | | 46,298 | 135,265 | 79,155 | 112,635 | 82,311 |
| Cassiar— | | | | | | |
| Atlin..... | | | | | 3,054 | |
| Skeena, etc..... | 5,868 | 4,714 | 131,509 | 175,179 | 256,802 | 343,805 |
| Kootenay, East— | | | | | | |
| Fort Steele division..... | 376,918 | 362,311 | 492,080 | 481,258 | 509,693 | 180,168 |
| Other divisions..... | 7,405 | 4,756 | | 1,188 | 29,178 | 79,685 |
| Kootenay, West— | | | | | | |
| Ainsworth division..... | 301,755 | 477,015 | 329,586 | 239,565 | 321,202 | 224,461 |
| Slocan division..... | 1,657,105 | 1,841,226 | 1,775,975 | 1,812,550 | 1,480,571 | 1,547,576 |
| Nelson division..... | 164,182 | 129,011 | 150,268 | 9,405 | 32,547 | 46,229 |
| Trail Creek division..... | 87,530 | 109,535 | 136,185 | 169,584 | 132,080 | 47,112 |
| Revelstoke, Trout Lake, and Lardeau. | 43,536 | 23,397 | 11,293 | 16,740 | 22,419 | 37,733 |
| Yale— | | | | | | |
| Boundary..... | 389,341 | 394,048 | 347,981 | 273,795 | 280,578 | 220,213 |
| Similkameen Nicola..... | | 335 | 15 | 347 | 830 | 3,470 |
| Yale, Ashcroft, and Kamloops..... | | 126 | 57 | 1,702 | 4,215 | 3,525 |
| Lillooet..... | | 295 | 390 | 5 | | 276 |
| Coast and other districts..... | 98,468 | 103,034 | 91,574 | 66,033 | 116,119 | 112,652 |
| Total..... | 3,132,108 | 3,465,856 | 3,602,180 | 3,366,506 | 3,301,923 | 2,929,216 |

*From the Minister of Mines Reports, British Columbia.

Yukon.

The silver production of the Yukon territory in 1917 amounted to 119,605 fine ounces valued at \$97,379, as against 360,101 ounces valued at \$236,466 in 1916, and 248,049 ounces valued at \$132,241 in 1915.

The comparatively large increase in the production for the past three years is due to the shipments of high grade silver-lead ores from the Silver King property in the Mayo area, north of the Stewart river, and to the activity in the copper mines in the Whitchorse district and the gold mines of the Conrad district.

In 1917, lode mining produced 66.8 per cent of the total output leaving 33.2 per cent as the production from the alluvial workings, as against 87 per cent from lode mining and 13 per cent from alluvial workings in 1916.

On an average about one ounce of silver is contained in each five ounces of crude bullion from the alluvial workings.

TIN.

Tin ores have not yet been found in sufficient quantities in Canada to be of economic importance.

The occurrence of tin ore has been reported from several localities, the most important, perhaps, being the discovery of cassiterite, near New Ross, Lunenburg county, Nova Scotia. Reports upon it may be found in the Summary Reports of the Geological Survey Branch of the Department of Mines for 1907, 1908, 1910, 1911, and 1912.

Tin has also been found in black sands in the Atlin district of British Columbia.

The imports of tin in 1917 were valued at \$5,656,665 and included tins in blocks, pigs and bars, 3,685,200 pounds valued at \$1,786,212; tin foil, bichloride of tin and strip waste valued at \$267,249; and tinware and crystals valued at \$3,603,204.

The imports of 1916 were valued at \$2,999,675, and included: tin in blocks, pigs and bars, 3,457,500 pounds, valued at \$1,372,200; tin foil, bichloride of tin and strip waste, \$1,544,420; and tinware and crystals, valued at \$1,311,432.

There is also a large annual import of tin plates and sheets, the quantity in 1917 being 133,351,700 pounds, valued at \$9,985,631, as against 115,084,900 pounds, valued at \$5,221,163, in 1916.

Annual Imports of Tin.

| Calendar Year. | Tin in blocks, pigs and bars. | | Tin foil. | |
|----------------|-------------------------------|-------------|-----------|-----------|
| | Pounds. | Value. | Pounds. | Value. |
| 1910..... | 3,231,100 | \$1,058,778 | 866,751 | \$114,602 |
| 1911..... | 4,047,500 | 1,623,670 | 1,531,877 | 176,602 |
| 1912..... | 4,894,700 | 2,134,221 | 1,316,882 | 183,707 |
| 1913..... | 5,085,700 | 2,252,324 | 1,074,131 | 188,779 |
| 1914..... | 3,382,700 | 1,191,466 | 1,244,628 | 173,088 |
| 1915..... | 2,912,600 | 1,009,597 | 1,002,413 | 151,599 |
| 1916..... | 3,457,500 | 1,372,200 | 1,507,318 | 314,970 |
| 1917..... | 3,685,200 | 1,786,212 | 933,217 | 266,725 |

| Calendar Year. | (a) Tinware, etc. | Tin crystal. | Bichloride of tin. | | Strip waste. | |
|----------------|-------------------------|-----------------|-----------------------|---------|--------------|--------|
| | Value. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1910..... | \$ 389,040 | \$ 3,903 | 31,219 | \$3,846 | | |
| 1911..... | 461,029 | 4,370 | 25,797 | 3,876 | | |
| 1912..... | 540,599 | 6,308 | 36,045 | 5,595 | | |
| 1913..... | 667,158 | 8,077 | 19,114 | 2,422 | | |
| 1914..... | 650,987 | 7,759 | 200 | 29 | | |
| 1915..... | 463,610 | 9,852 | | | 5,335 | \$138 |
| 1916..... | 1,301,008 | 10,474 | 81 | 48 | 37,021 | 975 |
| 1917..... | 3,588,891 | 14,313 | 12 | 6 | 16,620 | 518 |

(a) Tinware, plain, japanned or lithographed, and all manufactures of tin, n.e.s.

TUNGSTEN.

The only important production of tungsten ore in Canada reported previous to 1918 is that of 1912, being 14 tons of concentrates produced by the Scheelite Mines, Ltd., of Moose River, N.S.

In 1917 a small test shipment of a few hundred pounds was made from Halifax county, N.S., and another from Dublin Gulch, Mayo district, Y.T., amounting in all to 580 pounds running 69.41 per cent WO_3 and netting \$234.

Early in 1918 the Acadia Tungsten Mines, Ltd., operating at Burnt Hill, N.B., shipped 15 tons of concentrates to New York.

Scheelite was discovered in Halifax county, N.S., in 1908, and reported on by E. R. Fairbault in the Summary Report of the Geological Survey for 1908 and 1909. A concentrating mill was erected in 1912 by the Scheelite Mines, Ltd., operating the Moose River property in Nova Scotia.

The occurrence of wolframite was also noted by Dr. T. L. Walker in 1909 in association with molybdenite near the confluence of Burnt Hill brook and the Mira-michi river, N.B. This property is now operated by the Acadia Tungsten Mines Company, which erected a concentrating mill during 1916.

The tungsten ore deposits were reported on by Dr. Walker in 1909¹, and the deposits in New Brunswick and Nova Scotia by Charles Camsell and Dr. D. D. Cairns in the Summary Report of the Geological Survey for 1916. The Burnt Hill mines of New Brunswick were also inspected in 1917 by J. C. Gwillim, acting for the Munition Resources Commission, Ottawa; who reported some tonnage of wolframite ore, but stated that the operators could not afford to produce concentrates at the official British price of 55 shillings per unit.

In British Columbia the Cariboo Chisholm Creek Mining Co. Ltd., Van Winkle, B.C., has been operating the old deposit on Hardscrabble Creek in the Cariboo district.

The occurrence of scheelite sands in the alluvial deposits of Dublin Gulch, Mayo district, Yukon, received a special mention by Dr. Cairns in the Summary Report of the Geological Survey for 1916.

Uses²:—"The metal tungsten is of primary importance because of certain valuable qualities it imparts to steel when alloyed with it. Its principal use at the present time is in the manufacture of high-speed tool steels so essential for the rapid production of all forms of projectiles, ordnance, and similar munitions.

"Tungsten has so far, distanced its rival molybdenum in this particular field because supplies of its crude ores were more readily obtainable; but the known tungsten resources of the world are limited, and molybdenum production has increased several hundred per cent during the past two years, so that the relative importance of the two metals may eventually be reversed.

"Tungsten enters into the manufacture of armour plate, armour-piercing projectiles, gun liners, and aeroplane engines. It is also used in filaments for electric light bulbs. Alloyed with aluminium it is employed in automobile construction, and with aluminium and copper in propeller blades. It is an important constituent of a new tool alloy called "stellite". With molybdenum it forms an alloy in dentistry as a substitute for platinum."

Prices.—In 1915 the British Government commandeered all supplies of tungsten concentrates within the empire at a fixed price of 55 shillings (\$13.50) per unit (22.4 pounds) of contained tungstic acid. The price of ferro-tungsten (75 to 85 per cent and 1 per cent carbon max.) was 5s. 6d. (\$1.34) and that of tungsten powder was 6s. 3d. (\$1.52). Both were based on ore at 60 shillings and ruled from March till the end of the year.

The price of tungsten ore on the New York market was around \$17.00 per unit (20 pounds) for the first quarter of 1917, but the purchases made by France and Italy strengthened the market so that the price gradually raised to a maximum of \$28 in August and remained fairly well around \$26 for the remainder of the year.

¹ Report on the Tungsten Ores of Canada. By Dr. T. L. Walker, Mines Branch No. 25, 1909. (Publication out of print.)

² Report of the Canadian Munition Commission, Ottawa, 1918, p. 21.

ZINC.

Adding to the actual recoveries of refined zinc at Trail the estimated recoveries from ores shipped to United States smelters, we have a zinc production of 29,663,764 pounds, which at the average price of zinc for the year, 8.901 cents per pound, would be worth \$2,640,817. Of the total production thus recorded 1,786,740 pounds are credited to the Notre-Dame-des-Anges ores in Quebec and the balance, with the exception of a few thousand pounds from Alberta, is credited to British Columbia and amounted to 27,861,441 pounds.

In 1916 the production based on smelter recoveries was 23,364,760 pounds which, at the average price for the year 12.804 cents, was valued at \$2,991,623.

The total zinc ore shipments from the mines in 1917, including the zinc-lead ores from the Sullivan mine, East Kootenay, B.C., and ores exported, were about 116,489 tons, valued by the operators at \$1,323,985, and containing 64,655,713 pounds of zinc.

In 1916 the ore shipments were 82,077 tons valued by the operators at \$1,086,249 and containing 48,498,078 pounds of zinc.

A portion of the ores shipped to Trail in 1916 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 the primary difficulties have been overcome.

The ores shipped contain also a varying silver content for which payment is made by the smelter and without which, on account of the import duty to the United States and the long rail haul, it would not in many cases pay to ship.

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 refinery at Trail has placed the metallurgy of this metal in Canada on a similar basis to that of lead and copper, and it will now be in order to record the production accordingly. The production of refined zinc at Trail, in 1917, was 9,985 tons, as against 2,974 tons in 1916.

Annual Shipments of Zinc Ores.

| Year. | Zinc ore shipped. | | Metallic zinc in ore shipped. |
|---------------|-------------------|-------------|-------------------------------------|
| | Tons. | Spot value. | Pounds. |
| 1898..... | 1,162 | \$ 11,000 | 788,000 |
| 1899..... | 865 | 18,165 | 814,000 |
| 1900..... | 261 | 4,810 | 212,000 |
| 1901*..... | | | |
| 1902..... | 158 | 1,659 | 142,200 |
| 1903..... | 1,000 | 10,500 | 900,000 |
| 1904..... | 597 | 3,700 | 477,568 |
| 1905*..... | 9,413 | 139,200 | * |
| 1906*..... | 1,154 | 23,800 | * |
| 1907*..... | 1,575 | 49,100 | * |
| 1908*..... | 452 | 3,215 | * |
| 1909 (a)..... | 18,371 | 242,699 | 16,468,204 |
| 1910..... | 5,063 | 120,003 | 4,361,712 |
| 1911..... | 2,590 | 101,072 | 2,346,849 |
| 1912..... | 6,415 | 215,149 | 5,354,700 |
| 1913..... | 7,889 | 186,827 | 7,069,800 |
| 1914..... | 10,893 | 262,563 | 9,101,460 |
| 1915..... | 14,895 | 554,938 | 12,231,439 |
| 1916..... | 82,077 | 1,086,249 | 48,498,078 |
| 1917..... | 116,489 | 1,510,262 | 64,655,713 |

* Figures not available.

(a) Includes 7,424 tons shipped late in 1908.

The zinc industry has been the subject of a special report in 1905 by a Commission appointed to investigate the zinc resources of British Columbia, and the conditions affecting their exploitation.¹

In 1916 a brief report was made by Dr. A. W. G. Wilson on the production of spelter in Canada, and conditions in connexion with the home treatment of British Columbia zinc ore.²

A report on the zinc-lead deposits of Notre-Dame-des-Anges was made by J. A. Bancroft and published in the Annual Report of the Bureau of Mines, Quebec, for 1915.³

The Provincial Bureau of Mines of Ontario, also published in 1916, a report on the lead and zinc deposits of Ontario and Eastern Canada.⁴

During 1913 the new United States customs tariff came into effect considerably reducing the duties payable on Canadian ore, the new items affecting Canadian shipments being:—

Zinc ores containing 25 per cent or more zinc: 10 per cent on zinc contained therein. Lead-bearing ore: $\frac{3}{4}$ cent per pound on lead contained therein.

Although not paid for by the United States smelters, the lead in ore is considered as dutiable and there is often a small lead content in the zinc ore or concentrates shipped, the lead duty applies. The result of the decreased duties has been a considerable increase in zinc shipments.

There is also a duty of 15 per cent on metallic zinc exported to the United States, and at present an import of $7\frac{1}{2}$ per cent on zinc and other materials imported into Canada from the United States.

Prices.—For the first quarter of 1917 the price of spelter remained around 10 cents but the effects of the over-production were eventually felt and the price gradually declined closing the year at $7\frac{3}{8}$ cents per pound.

Average Price of Spelter in Cents per Pound at New York.*

| Month. | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|-----------------|-------|-------|-------|-------|-------|--------|--------|--------|
| January | 6-101 | 5-452 | 6-442 | 6-931 | 5-262 | 6-386 | 16-915 | 9-619 |
| February | 5-569 | 5-518 | 6-499 | 6-239 | 5-377 | 8-436 | 18-420 | 10-045 |
| March | 5-637 | 5-563 | 6-626 | 6-078 | 5-250 | 8-541 | 16-846 | 10-300 |
| April | 5-439 | 5-399 | 6-633 | 5-641 | 5-113 | 10-012 | 16-695 | 9-459 |
| May | 5-191 | 5-348 | 6-079 | 5-406 | 5-074 | 14-781 | 14-276 | 9-362 |
| June | 5-128 | 5-520 | 6-377 | 5-124 | 5-000 | 21-208 | 11-752 | 9-371 |
| July | 5-152 | 5-695 | 7-116 | 5-278 | 4-920 | 19-026 | 8-925 | 8-643 |
| August | 5-279 | 5-953 | 7-028 | 5-658 | 5-568 | 12-781 | 8-730 | 8-360 |
| September | 5-514 | 5-869 | 7-454 | 5-694 | 5-380 | 13-440 | 8-990 | 8-136 |
| October | 5-628 | 6-102 | 7-426 | 5-340 | 4-909 | 12-800 | 9-829 | 7-983 |
| November | 5-976 | 6-380 | 7-371 | 5-229 | 5-112 | 15-962 | 11-592 | 7-847 |
| December | 5-624 | 6-301 | 7-162 | 5-154 | 5-592 | 15-391 | 10-669 | 7-685 |
| Year | 5-520 | 5-758 | 6-943 | 5-648 | 5-213 | 13-230 | 12-804 | 8-901 |

*From the Engineering and Mining Journal, N.Y., Jan. 12, 1918.

¹ Mines Branch No. 12. Report of the Commission on the Investigation of the Zinc Resources of British Columbia, 1905. (Out of print.)

² Mines Branch No. 428. Report on the Production of Spelter in Canada, 1916, by Dr. A. W. G. Wilson.

³ Geology of part of the Township of Montauban and Chavigny, and of the Seigneurie de Grondines, by J. A. Bancroft, Annual Report of the Province of Quebec for 1915.

⁴ Lead and Zinc Deposits of Ontario and Eastern Canada, by W. L. Uglow, Annual Report of the Ontario Bureau of Mines for 1915. Vol. XXV, Part II.

Average Prices of Spelter, Ordinary Brands, in London.*

(In pounds per ton.)

| Month. | 1910. | | | 1911. | | | 1912. | | | 1913. | | | 1914. | | | 1915. | | | 1916. | | | 1917. | | |
|-----------|-------|----|----|-------|----|----|-------|----|----|-------|----|----|-------|----|----|-------|----|----|-------|----|----|-------|----|----|
| January | 23 | 4 | 3 | 23 | 16 | 7 | 26 | 9 | 11 | 25 | 19 | 1 | 21 | 6 | 6 | 30 | 16 | 1 | 33 | 12 | 5 | 48 | 8 | 3 |
| February | 23 | 3 | 1 | 23 | 3 | 10 | 26 | 6 | 5 | 25 | 4 | 3 | 21 | 7 | 6 | 39 | 16 | 4 | 93 | 10 | 11 | 54 | 4 | 6 |
| March | 23 | 3 | 7 | 22 | 19 | 2 | 25 | 19 | 11 | 24 | 11 | 4 | 21 | 7 | 7 | 44 | 2 | 7 | 90 | 1 | 9 | 54 | 10 | 4 |
| April | 22 | 9 | 11 | 23 | 13 | 8 | 25 | 8 | 11 | 25 | 2 | 4 | 21 | 10 | 2 | 49 | 17 | 9 | 94 | 1 | 8 | 52 | 18 | 11 |
| May | 22 | 1 | 1 | 24 | 6 | 1 | 25 | 11 | 2 | 24 | 10 | 4 | 21 | 5 | 9 | 67 | 19 | 0 | 89 | 11 | 4 | 52 | 0 | 0 |
| June | 22 | 3 | 2 | 24 | 9 | 7 | 25 | 11 | 11 | 21 | 19 | 10 | 21 | 6 | 0 | 100 | 12 | 3 | 63 | 16 | 4 | 52 | 0 | 0 |
| July | 22 | 5 | 6 | 24 | 13 | 10 | 25 | 13 | 1 | 20 | 11 | 2 | 21 | 6 | 7 | 97 | 5 | 0 | 48 | 7 | 6 | 52 | 0 | 0 |
| August | 22 | 14 | 0 | 26 | 11 | 2 | 26 | 1 | 2 | 20 | 14 | 0 | 29 | 0 | 9 | 67 | 15 | 9 | 47 | 19 | 7 | 52 | 0 | 0 |
| September | 23 | 2 | 7 | 27 | 12 | 7 | 26 | 17 | 0 | 21 | 3 | 10 | 25 | 14 | 0 | 67 | 17 | 9 | 48 | 15 | 8 | 52 | 0 | 0 |
| October | 23 | 16 | 6 | 27 | 4 | 10 | 27 | 5 | 10 | 20 | 13 | 9 | 23 | 13 | 6 | 66 | 10 | 11 | 52 | 4 | 4 | 52 | 0 | 0 |
| November | 24 | 1 | 9 | 26 | 13 | 2 | 26 | 14 | 3 | 20 | 14 | 4 | 24 | 14 | 10 | 85 | 6 | 4 | 55 | 0 | 5 | 52 | 0 | 0 |
| December | 23 | 17 | 7 | 26 | 13 | 7 | 26 | 0 | 4 | 21 | 6 | 8 | 27 | 6 | 10 | 82 | 4 | 1 | 54 | 5 | 9 | 52 | 0 | 0 |
| Year | 23 | 0 | 0 | 25 | 3 | 2 | 26 | 3 | 3 | 22 | 14 | 3 | 23 | 6 | 8 | 66 | 13 | 8 | 63 | 8 | 11 | 52 | 3 | 6 |

* From the annual publication of the "Metal Information Bureau", London, E.C.

Imports.—The imports of zinc in 1917 amounted to 37,132,445 pounds valued at \$3,562,228 with also manufactures of zinc valued at \$79,044. The imports of brass, which alloy contains about 30 per cent zinc, were valued at \$1,277,249 and manufactures of brass valued at \$4,051,410.

The imports in 1916 were 29,999,838 pounds of zinc valued at \$3,642,476 with also manufactures of zinc valued at \$48,101. The imports of brass were valued at \$923,523 and the manufactures of brass at \$3,752,851.

The detailed imports for the last four years are given in the following table, with also the estimated zinc content of the zinc and brass products.

Summary of Imports of Zinc and Zinc Products, 1914-1917.

| Zinc and Zinc Products. | 1914. | | | 1915. | | |
|---|--------------------|-------------------|-------------------------------|--------------------|-------------------|-------------------------------|
| | Product in Pounds. | Value of Product. | Zinc Content in Pounds. | Product in Pounds. | Value of Product. | Zinc Content in Pounds. |
| Zinc, in blocks, pigs and sheets | 3,160,900 | \$ 189,785 | 3,160,900 | 1,653,700 | \$ 226,104 | 1,653,700 |
| " as spelter | 10,845,400 | 551,031 | 10,845,400 | 14,265,700 | 1,784,471 | 14,265,700 |
| " seamless tubing | | | | 100 | 27 | 100 |
| " white (80% Zn.) | 9,445,397 | 389,796 | 7,556,318 | 11,368,569 | 656,132 | 9,094,855 |
| " dust (90% Zn.) | 362,109 | 34,295 | 325,898 | 503,143 | 70,822 | 452,829 |
| " sulphate and chloride of (44% Zn.) | 352,715 | 9,390 | 155,195 | 379,545 | 16,090 | 167,000 |
| Total | 24,166,521 | 1,174,297 | 22,043,711 (11,021.8 tons) | 28,170,757 | 2,753,647 | 25,634,184 (12,817.1 tons) |
| " as manufacture of | | 36,355 | | | 21,711 | |
| Brass, in blocks, pigs and ingots (30% Zn.) | 1,010,600 | 126,357 | 303,180 | 1,677,800 | 226,499 | 503,340 |
| " old and scrap (30% Zn.) | 1,407,900 | 150,346 | 422,370 | 311,900 | 41,971 | 93,570 |
| " tubing (30% Zn.) | 1,590,573 | 314,675 | 477,172 | 1,381,482 | 349,958 | 414,445 |
| " plain wire | 370,407 | 59,984 | 111,122 | 439,766 | 95,952 | 131,930 |
| " bars and rods (free (30% Zn.) | 1,747,700 | 255,656 | 524,310 | | | |
| Total | 6,127,180 | 937,018 | 1,838,154 (919.1 tons) | 3,810,948 | 714,410 | 1,143,285 (571.6 tons) |
| Brass, bars and rods | | 94,827 | | | 215,782 | |
| " strips, sheets or plates | | 110,733 | | | 234,590 | |
| " wire cloth n.o.p. | | 120,614 | | | 147,464 | |
| " cups for manuf. of shells | | 124,622 | | | 435,161 | |
| " caps for electric batteries | | 5,684 | | | 5,367 | |
| " hand-pumps | | 11,956 | | | 10,930 | |
| " nails, tacks, etc. | | 6,736 | | | 7,562 | |
| " other manufactures n.o.p. | | 1,445,898 | | | 1,406,676 | |
| Total | | 1,921,070 | | | 2,468,532 | |

Summary of Imports of Zinc and Zinc Products, 1914-1917.—*Concluded.*

| Zinc and Zinc Products. | 1916. | | | 1917. | | |
|---|--------------------|-------------------|-----------------------------|--------------------|-------------------|-------------------------------|
| | Product in Pounds. | Value of Product. | Zinc Content in Pounds. | Product in Pounds. | Value of Product. | Zinc Content in Pounds. |
| Zinc, in blocks, pigs and sheets..... | 1,624,600 | \$ 267,750 | 1,624,600 | 2,975,700 | \$ 450,161 | 2,975,700 |
| " as spelter..... | 13,214,800 | 1,873,605 | 13,214,800 | 17,139,600 | 1,686,568 | 17,139,600 |
| " seamless tubing..... | | | | | | |
| " white (80% Zn.)..... | 14,171,673 | 1,314,629 | 11,327,338 | 16,039,236 | 1,301,405 | 12,831,389 |
| " dust (90% Zn.)..... | 691,704 | 162,186 | 622,534 | 547,158 | 91,699 | 492,442 |
| " sulphate and chloride of (44% Zn.)..... | 297,061 | 24,306 | 130,707 | 430,751 | -32,395 | 189,530 |
| Total..... | 29,999,838 | 3,642,476 | 26,919,979 (13,460 tons) | 37,132,445 | 3,562,223 | 33,628,661 (16,814.3 tons) |
| " as manufacture of..... | | 48,101 | | | 79,044 | |
| Brass, in blocks, pigs and irgots (30% Zn.)... | 736,000 | 163,540 | 220,800 | 1,191,300 | 307,740 | 357,390 |
| " old and scrap (30% Zn.)..... | 848,800 | 183,611 | 254,640 | 1,192,700 | 279,032 | 357,810 |
| " tubing (30% Zn.)... | 993,119 | 411,539 | 297,936 | 1,059,010 | 431,277 | 315,903 |
| " plain wire " | 396,757 | 164,833 | 119,027 | 525,947 | 259,200 | 157,784 |
| " bars and rods (free) (30% Zn.)..... | | | | | | |
| Total..... | 2,974,676 | 923,523 | 892,403 (446.2 tons) | 3,962,957 | 1,277,249 | 1,188,887 (594.4 tons) |
| Brass, bars and rods... strips, sheets or plates..... | | 362,318 | | | 493,859 | |
| " wire cloth n.o.p. " | | 242,101 | | | 354,908 | |
| " cups for manuf. of shells..... | | 266,202 | | | 454,163 | |
| " caps for electric batteries..... | | 1,069,678 | | | 442,599 | |
| " hand-pumps..... | | 6,985 | | | 13,265 | |
| " nails, tacks, etc..... | | 22,795 | | | 41,325 | |
| " other manufactures n.o.p..... | | 13,796 | | | 11,023 | |
| Total..... | | 1,778,976 | | | 2,246,268 | |
| Total..... | | 3,752,851 | | | 4,051,410 | |

Imports of Zinc in Blocks, Pigs, etc.

| Calendar Year. | In blocks, pigs and sheets. | | As spelter. | | As manufactures of zinc. | Seamless tubing. | |
|----------------|-----------------------------|------------|-------------|------------|--------------------------|------------------|--------|
| | Cwt. | Value. | Cwt. | Value. | Value. | Pounds. | Value. |
| 1907..... | 30,130 | \$ 198,570 | 58,430 | \$ 343,810 | \$ 21,812 | .670 | \$ 53 |
| 1908..... | 24,273 | 180,689 | 54,780 | 254,225 | 14,577 | | |
| 1909..... | 35,283 | 199,016 | 120,615 | 592,148 | 16,073 | | |
| 1910..... | 31,660 | 191,051 | 109,084 | 561,170 | 21,829 | | |
| 1911..... | 33,678 | 206,859 | 116,996 | 654,097 | 30,862 | | |
| 1912..... | 100,095 | 617,836 | 117,845 | 686,585 | 46,336 | | |
| 1913..... | 47,226 | 291,368 | 126,051 | 661,207 | 54,898 | | |
| 1914..... | 31,609 | 189,785 | 108,454 | 551,031 | 36,355 | | |
| 1915..... | 16,537 | 226,104 | 142,657 | 1,784,471 | 21,711 | 100 | 27 |
| 1916..... | 16,246 | 267,750 | 132,148 | 1,873,605 | 48,101 | | |
| 1917..... | 29,757 | 450,161 | 171,396 | 1,686,568 | 79,044 | | |

Imports of Zinc White, Zinc Dust, and Zinc Sulphate and Chloride.

| Calendar Year. | Zinc white. | | Zinc dust. | | Zinc, sulphate and chloride of. | |
|----------------|-------------|------------|------------|----------|---------------------------------|----------|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1910 | 8,496,399 | \$ 312,779 | 97,461 | \$ 4,859 | 237,466 | \$ 6,470 |
| 1911 | 8,537,498 | 314,194 | 86,242 | 5,718 | 414,500 | 15,930 |
| 1912 | 10,505,944 | 425,714 | 308,239 | 18,914 | 941,780 | 29,104 |
| 1913 | 12,682,126 | 525,643 | 412,294 | 26,403 | 634,634 | 17,424 |
| 1914 | 9,415,397 | 389,796 | 302,109 | 34,295 | 352,715 | 9,390 |
| 1915 | 11,868,569 | 656,132 | 503,143 | 70,823 | 379,545 | 16,090 |
| 1916 | 14,171,673 | 1,314,629 | 691,704 | 162,186 | 297,061 | 24,306 |
| 1917 | 16,039,236 | 1,300,621 | 547,158 | 91,699 | 430,751 | 32,395 |

Consumption.—The table of imports shows that in 1917, 16,814 tons of zinc were imported as zinc and zinc products with also 594 tons of zinc in brass and approximately 1,100 tons as zinc contents of manufactures of zinc and brass, or a total of 18,498 tons, which, added to the 9,985 tons of zinc refined in Canada, the output of the Trail refinery, would give a total consumption of 28,483 tons, as against 18,000 tons in 1916 and 14,000 in 1915.

It is probable, however, in the case of zinc, as has already been shown for steel, copper, and lead, that there have been other imports besides those recorded under the usual classification, and that the actual consumption during the last few years was greater than the above estimate. Information from other sources would bring the consumption to about 41,000 tons for 1917.

There are now in Canada three companies constructing, or operating electrolytic plants, viz.: The Electro Zinc Company, formerly at Welland, Ontario, and now at Shawinigan Falls, Que., which uses the Watt's process; the French Complex Ore Reduction Company at Nelson, B.C., using the French process; and the Consolidated Mining and Smelting Co., of Canada, Ltd., at Trail, B.C., which company has erected a large plant and is increasing its capacity so as to treat, it is reported, about 70 tons per day.

In 1917 the operations, with the exception of the Trail plant, were still in the experimental stages of development.

The plant of the Electro Zinc Co. was designed to recover refined zinc ores from Notre-Dame-des-Anges, Quebec.

The French Complex Ore Reduction Co. established a plant at Nelson, after the Provincial Government had guaranteed its bonds to the amount of \$40,000 and was reported to be in a position to start operations early in 1917, but was unable to do so, owing to financial difficulties. Early in 1918, the Provincial Government guaranteed bonds to the extent of another \$25,000 to permit the company to resume operations.

The Trail plant of the Consolidated Mining and Smelting Co. started regular commercial operations early in 1916, and in July it was reported to be producing 20 tons per day. Later in the year, the company undertook to increase its capacity to 45 tons. Early in 1917 it was reported to be producing 45 tons per day and its capacity is now rated at 70 tons.

Bounties.—An Act to provide for the payment of bounties on zinc produced from zinc ores mined in Canada was passed by the House of Commons of Canada, May 3 1916. This Act was cited as "The Zinc Bounties Act, 1916".

A new Act was passed by the House of Commons of Canada, May 24, 1918, and reads as follows:—

"An Act to provide for the payment of bounties on zinc produced from zinc ores mined in Canada."

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada enacts as follows:—

1. This Act may be cited as The Zinc Bounties Act, 1918.

2. Whenever it appears to the satisfaction of the Minister of Trade and Commerce who is charged with the administration of this Act, that the standard price of zinc or spelter in cakes, blocks or pigs, in London, England, or St. Louis, United States, as the Minister of Trade and Commerce may determine, is less than nine cents per pound, the Governor in Council may authorize the payment out of the Consolidated Revenue Fund of a bounty on zinc or spelter, containing not more than two per centum of impurities, produced in Canada, at the time the price is as hereinbefore stated, from zinc ores mined in Canada. Such bounty shall be equal to the difference between such standard price per pound and nine cents per pound, but shall in no case exceed two cents per pound, and in no event shall any bounty be paid when the price received for such zinc or spelter by the producer is nine cents or more per pound.

3. No bounty shall be payable under this Act on zinc or spelter produced after the thirty-first day of July, one thousand nine hundred and twenty.

4. The total amount payable under the provisions of this Act shall not exceed the sum of \$400,000.

5. The Governor in Council may make regulations for carrying out the provisions of this Act.

Production of Zinc in British Columbia by Districts, 1912-1917.*

(Contents of ore shipped in pounds.)

| | 1912. | 1913. | 1914. | 1915. | 1916. | 1917. |
|---------------------------|-----------|-----------|-----------|------------|------------|------------|
| Kootenay, East— | | | | | | |
| Port Steele division..... | | | | 180,000 | 14,840,000 | 20,715,090 |
| Windermere—Golden..... | 142,643 | | | 311,719 | 210,000 | 18,000 |
| Kootenay, West— | | | | | | |
| Ainsworth..... | | 150,680 | 280,000 | 678,940 | 625,971 | 918,601 |
| Nelson..... | | | 332,003 | 3,127,209 | 3,470,036 | 982,309 |
| Slocan..... | 5,215,637 | 6,608,088 | 7,254,464 | 8,684,572 | 17,854,357 | 18,789,573 |
| Revelstoke, etc..... | | | | | | 33,279 |
| Boundary-Yale— | | | | | | |
| Kamloops, etc..... | | | | | | 27,564 |
| Cariboo— | | | | | | |
| Omineca..... | | | | | 168,616 | 364,097 |
| | 5,358,280 | 6,758,768 | 7,866,467 | 12,932,440 | 37,168,980 | 41,848,513 |

* From the Minister of Mines Reports, British Columbia.

World's Production of Spelter, in Short Tons.*

| Country. | 1908. | 1909. | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. |
|------------------------|---------|---------|---------|---------|-----------|------------|------------|---------|-------|
| Australia..... | 1,198 | | 560 | 1,904 | 2,531 | 4,105 | 5,616 (c) | 7,500 | |
| Austria and Italy..... | 14,063 | 13,931 | 14,666 | 18,602 | 21,609 | 23,928 | | | |
| Belgium..... | 181,851 | 184,194 | 190,233 | 215,050 | 220,678 | 217,928 | | | |
| France and Spain..... | 61,612 | 61,859 | 65,191 | 79,791 | 79,543 | 78,289 (a) | 12,944 (a) | 8,497 | |
| Germany..... | 239,062 | 242,594 | 251,046 | 276,008 | 298,794 | 312,075 | | | |
| Great Britain..... | 60,029 | 65,422 | 69,531 | 73,803 | 63,086 | 65,197 | | | |
| Holland..... | 19,017 | 21,548 | 23,121 | 25,059 | 26,380 | 26,811 | 18,098 | 12,243 | |
| Japan..... | | | | | | | 6,554 | 23,421 | |
| Poland..... | 9,740 | 8,758 | 9,514 | 10,952 | 9,659 | 8,589 (a) | 7,000 | | |
| United States..... | 210,424 | 255,760 | 269,184 | 286,526 | 338,806 | 346,676 | 353,049 | 489,519 | |
| Norway..... | | | | 7,363 | 8,959 | 10,237 (b) | 10,028 (b) | 17,349 | |
| Total..... | 796,896 | 854,066 | 893,046 | 986,058 | 1,070,045 | 1,093,635 | | | |

* Mineral Resources of the United States. (a) Spain only. (b) For Sweden. (c) Estimated.

World's Consumption of Spelter, in Short Tons.*

| Country. | 1908. | 1909. | 1910. | 1911. | 1912. | 1913. | 1914. | 1915. | 1916. |
|--------------------|---------|---------|---------|-----------|-----------|-----------|-------|-------|-------|
| Austria-Hungary.. | 35,935 | 36,155 | 37,258 | 47,950 | 51,588 | 44,533 | | | |
| Belgium..... | 74,956 | 71,209 | 84,326 | 81,240 | 85,098 | 84,216 | | | |
| France..... | 85,869 | 73,744 | 62,059 | 90,389 | 90,389 | 89,286 | | | |
| Germany..... | 198,634 | 207,343 | 203,374 | 241,734 | 248,899 | 255,734 | | | |
| Great Britain..... | 152,669 | 171,408 | 195,989 | 193,674 | 204,146 | 214,509 | | | |
| Holland..... | 4,189 | 4,409 | 4,409 | 4,409 | 4,409 | 4,409 | | | |
| Italy..... | 9,259 | 9,039 | 8,929 | 11,133 | 11,795 | 12,015 | | | |
| Russia..... | 19,621 | 20,282 | 27,417 | 31,856 | 30,754 | 36,707 | | | |
| Spain..... | 5,512 | 4,960 | 4,630 | 5,291 | 5,181 | 6,503 | | | |
| United States..... | 214,167 | 270,730 | 245,884 | 280,059 | 340,372 | 295,370 | | | |
| Other countries... | 11,023 | 9,921 | 13,669 | 19,621 | 21,715 | 23,038 | | | |
| Total..... | 811,834 | 879,200 | 887,974 | 1,007,356 | 1,094,346 | 1,066,319 | | | |

* Mineral Resources of the United States.

Electrolytic Zinc Plants in Canada.

| Company. | Location of plant. | Remarks. |
|--|------------------------|--|
| Consolidated Mining and Smelting Co. of Canada, Ltd..... | Trail, B. C. | Capacity of plant, 45 tons of refined zinc per day being increased to 70 tons per day. |
| Electro Zinc Company, Ltd..... | Shawinigan Falls, Que. | Experimental in 1916. Small plant for recovery of zinc from zinc oxide. |
| French Complex Ore Reduction Company..... | Nelson, B. C..... | Experimental. Small demonstration plant at Nelson, B. C. |

Electrolytic Zinc Plants in the United States.*

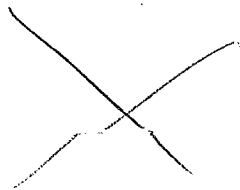
| Company. | Location of plant. | Daily spelter capacity. | Remarks. |
|-------------------------------------|----------------------|-------------------------|---|
| American Smelting and Refining Co.. | Omaha, Nebr..... | Experimental.... | Operated in 1915. |
| " " " | Garfield, Utah..... | 10 tons..... | Planned. |
| Anaconda Copper Mg. Co..... | Anaconda, Mont..... | 25 tons..... | Under construction: 10 tons operated in 1915. |
| " " " | Great Falls, Mont. | 100 tons..... | Under construction. |
| Bully Hill Copper Co..... | Bully Hill, Cal..... | Experimental.. | Operated in 1915. |
| Daly-Judge Mining Co..... | Park City, Utah..... | 15 tons..... | Under construction, |
| Electrolytic Zinc Co..... | Baltimore, Md..... | 10 tons..... | " " 2½ tons now in operation. |
| Mammoth Copper Mg. Co..... | Kemett, Cal..... | Experimental.... | Operated in 1915. |
| Northwestern Metals Co..... | Helena, Mont..... | Ore capacity 100 tons. | Malm process: not operated in 1915. |
| Reed Zinc Co.. | Palo Alto, Cal..... | Experimental.... | Operated in 1914-15. |
| River Smelting and Refining Co..... | Keokuk, Iowa..... | " "..... | Operated in 1915. |
| Western Metals Co..... | Georgetown, Colo. | Ore capacity 100 tons. | Malm process: under construction. |

* As published by the United States Geological Survey, April 4, 1916.

Active Zinc Smelters in the United States, and Capacity in 1916, by Companies and States.¹

| Company. | Location. | Acid Plants. | Retorts at close of 1915. | Retorts June 30, 1916. | Additional retorts contemplated or under construction. |
|------------------------------------|-------------------------------|--------------|---------------------------|------------------------|--|
| Fort Smith Spelter Co. | Fort Smith, Ark. | | | 2,560 | |
| Arkansas Zinc Co. | Van Buren, " | | | 2,400 | |
| United States Zinc Co. | Pueblo, Colo. | | 2,208 | 1,944 | |
| American Zinc Co. of Illinois | Hillsboro, Ill. | A | 4,000 | 4,864 | |
| Collinsville Zinc Sm. Co. | Collinsville, " | | 1,792 | 2,304 | |
| Granby Mg. & Sm. Co. | E. St. Louis, " | A | 3,220 | 3,220 | 2,400 |
| Hegeler Zinc Co. | Danville, " | A | 3,600 | 5,400 | |
| Illinois Zinc Co. | Peru, " | A | 4,640 | 4,640 | 800 |
| Matthiesson & Hegeler Zinc Co. | La Salle, " | A | 6,168 | 6,168 | |
| Missouri Zinc Co. | Beckemeyer, " | | 352 | 352 | |
| Mineral Pt. Zinc Co. | Depeue, " | A | 9,068 | 9,068 | |
| National Zinc Co. | Springfield, " | A | 3,200 | 4,480 | |
| Robt. Lanyon Z. & Acid Co. | Hillsboro, " | A | 1,840 | 3,200 | |
| Sandoval Zinc Co. | Sandoval, " | | 672 | 672 | |
| American Spelter Co. | Pittsburg, Kan. | | 896 | 992 | |
| American Zinc, Lead & Smelting Co. | Caney, " | | 6,080 | 6,080 | |
| " | Dearing, " | | 4,480 | 4,480 | |
| Chanute Spelter Co. | Chanute, " | | 1,280 | 1,280 | |
| Cherokee Smelting Co. | Bruce, " | | 896 | 896 | |
| Edgar Zinc Co. | Cherryvale, " | | 4,800 | 4,800 | |
| Granby Mg. & Sm. Co. | Neodesha, " | | 3,760 | 3,760 | |
| Iola Zinc Co. | Concreto, " | | 660 | 1,320 | |
| Joplin Ore & Spelter Corporation. | Pittsburg, " | | 1,444 | 1,792 | |
| Lanyon Smelting Co. | " | | 448 | 448 | |
| Owen Zinc Co. | Caney, " | | 1,280 | 1,280 | 640 |
| Pittsburg Zinc Co. | Pittsburg, " | | 910 | 910 | |
| Prime Western Spelter Company. | Gas, " | A | 4,868 | 4,868 | |
| U. S. Smelting Co. | Altoona, " | | 3,960 | 4,600 | |
| " | Iola, " | | 3,440 | 3,440 | |
| " | La Harpe, " | | 1,924 | 1,924 | |
| Weir Smelting Co. | Weir, " | | | | 448 |
| Edgar Zinc Co. | St. Louis, Miss. | | 2,000 | 2,000 | |
| Miss. Zinc Sm. Co. | Rich Hill, " | | | 448 | |
| Nevada Smelting Co. | Nevada, " | | 672 | 672 | |
| Bartlesville Zinc Co. | Bartlesville, Oida. | | 5,184 | 6,336 | |
| " | Blackwell, " | | | 1,600 | 4,800 |
| " | Collinsville, " | | 10,752 | 13,440 | |
| (Lanyon-Starr Plant) | Bartlesville, " | | 3,456 | 3,456 | |
| Eagle-Picher Lead Co. | Henryetta, " | | | | 4,000 |
| Henryetta Spelter Co. | " | | | 3,000 | |
| J. B. Kirk Gas & Sm. Co. | Checotah, " | | | 2,660 | 2,660 |
| Kusa Spelter Co. | Kusa, " | | 3,720 | 3,720 | |
| La Harpe Spelter Co. | " | | | 4,000 | |
| National Zinc Co. | Bartlesville, " | | 4,970 | 4,970 | |
| Oklahoma Spelter Co. | Kusa, " | | | 1,600 | |
| Quinton Spelter Co. | Quinton, " | | | | 1,840 |
| Tulsa Fuel & Mg. Co. | Collinsville, " | | 6,232 | 6,232 | |
| U. S. Zinc Co. | Sand Springs, " | | 5,680 | 8,000 | |
| American Steel & Wire Company. | Donora, Penn. | A | 3,648 | 9,120 | |
| American Zinc & Chemical Co. | Langeloth, " | A | 3,648 | 6,384 | 912 |
| N. J. Zinc Co. (of Pennsylvania). | Palmerton, " | | 6,720 | 6,960 | |
| Clarksburg Zinc Co. | Clarksburg, W. Va. | | 3,648 | 3,648 | |
| Grasselli Chemical Co. | " | A | 5,760 | 5,760 | |
| " | Meadowbrook, " | A | 8,592 | 8,592 | |
| United Zinc Smelting Corporation. | Moundsville, " | A | | | 6,912 |
| Total, for all States. | | | 156,568 | 196,640 | 24,812 |
| | Plants with special retorts:— | | | | |
| | Michael Hayman & Co., | | | | |
| | Buffalo, N. Y. | | 12 | 12 | |
| | Trenton Sm. & Refining | | | | |
| | Co., Trenton, N. J. | | 96 | 60 | |
| | Wm. Cramp & Sons Ship & | | | | |
| | Engine Bldg. Co., Phila- | | | | |
| | delphia, Pa. | | 32 | 32 | |

¹United States Geological Survey, Press Bulletin No. 285, August, 1916.



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