

PRODUCTION AND VALUE
OF
MINERAL PRODUCTS IN MICHIGAN
FOR
1918 AND PRIOR YEARS

MICHIGAN GEOLOGICAL AND BIOLOGICAL SURVEY

Publication 29
Geological Series 24

MINERAL RESOURCES OF MICHIGAN

WITH

STATISTICAL TABLES OF PRODUCTION
AND VALUE OF MINERAL PRODUCTS

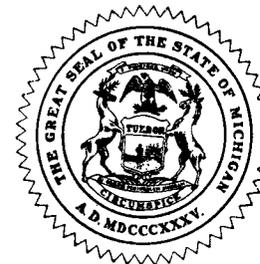
FOR

1918 AND PRIOR YEARS

PREPARED UNDER THE DIRECTION OF

R. C. ALLEN

DIRECTOR MICHIGAN GEOLOGICAL AND BIOLOGICAL SURVEY



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LETTER OF TRANSMITTAL

*To the Honorable, the Board of Geological and Biological Survey of
the State of Michigan:*

Gov. Albert E. Sleeper
Hon. Frank Cody
Hon. Fred L. Keeler

Gentlemen:—Under authority of act number seven, Public Acts of Michigan, Session of 1911, I have the honor to present herewith Publication 29, Geological Series 24, the eighth of a series of annual statements of the production and value of the mineral products of Michigan.

Very respectfully,
R. C. ALLEN,
Director.

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PART I. METALLIC MINERALS

THE MICHIGAN COPPER INDUSTRY IN 1918

L. P. BARRETT

MICHIGAN COPPER INDUSTRY IN 1918

GENERAL REVIEW

According to the preliminary report for 1918 on the mineral resources of the United States published by the United States Geological Survey, the smelter production of refined copper for the United States was 1,908,533,595 pounds, an increase of 22,412,874 pounds or 1.17 percent over the production of 1917. The figures for the mine production which always differ slightly from the smelter production, are not yet available. The average price received for all copper sold was 24.7 cents per pound.

The smelter output for Michigan was 231,096,158 and the mine production, 228,173,863 pounds. Sales of copper totaled 240,714,297 pounds at an average price of 24.38838 cents per pound or \$58,706,317.46. Silver production in 1918 amounted to 473,341.94 ounces which sold for \$1.06518 per ounce or \$504,480.11. The gross sum received from sale of all metal was \$59,210,797.57 or 24.59795 cents per pound copper sold.

The chief features of the copper industry in 1918 were the continuation of mounting costs and the fixing of the sale price of the metal by the United States Government at 23.5 cents per pound for the first half of the year and at 26 cents for the last six months.

We present a table compiled from the reports of the mining companies to the Board of State Tax Commissioners, showing the average costs per ton of twenty-one principal producing companies for the period of the last eight years. This table presents some interesting facts relative to costs in the Michigan copper district. The cost per pound in 1911 excluding exploration, development, construction, and interest charges, was 9.38040 cents and the cost per pound in 1918 excluding charges previously mentioned and also depreciation, depletion, and Federal taxes was 15.87972 cents, an increase of 6.49932 cents or 69.2 percent. Milling, smelting, and refining costs increased from 2.28828 cents per pound in 1911 to 4.34628 cents per pound in 1918, an increase of 89.9 percent. Mining costs per pound in 1911 were 6.06801 cents and in 1918, 9.88072 cents, an increase of 62.8 percent. Selling costs increased from 0.30017 cents to 0.44558 cents or 48.4 percent and general expenses including general offices, State taxes, insurance, and legal expenses advanced from 0.72394 cents in 1911 to 1.20714 cents in 1918, an increase of 66.7 percent. The relatively small increase in cost of mining as compared with the general advance of costs in all com-

modities is a tribute to the efficiency and management of the Michigan copper mines. This is especially noticeable when it is considered that wages have more than doubled, that the mines are continually getting deeper, and that the grade of ore is practically the same as in 1911.

Until 1917 depreciation and depletion seldom appeared as costs on the books of the mining companies. These charges are now made by practically all mining companies as a direct result of the Federal income and excess profit tax laws. These items are responsible for approximately 1.5 cents per pound increase in costs.

Thirteen companies paid dividends in 1918, totaling \$15,872,269. This is a decrease of \$12,168,757 from dividend payments in 1917.

DETAILS OF MINING COMPANIES

Adventure Consolidated Copper Company

Office: 32 Broadway, New York City.

Mine office: Mass, Ontonagon County, Michigan.

President: W. Parsons Todd.

Secretary and Treasurer: W. A. O. Paul.

Superintendent: M. R. Hore.

The Adventure Mine has been closed since October, 1917. The annual report for the year 1918 shows a deficit of \$11,295.33.

Ahmeek Mining Company

Office: 12 Ashburton Place, Boston, Massachusetts.

Managing office: Calumet, Michigan.

Mine office: Kearsarge, Keweenaw County, Michigan.

President: Rudolphe L. Agassiz.

Vice President and General Manager: James MacNaughton.

Secretary and Treasurer: Clarence R. Bissell.

Superintendent: S. Russell Smith.

Ahmeek mined 1,196,541 tons of rock which yielded 24,851,235 pounds of refined copper, an average of 20.8 pounds refined copper per ton. This is a decrease of 3,068,577 pounds from the production of 1917. The Company had 8,620,222 pounds of copper on hand January 1, 1918 and sold during the year 28,597,173 pounds, leaving a balance of 4,874,284 pounds of copper on hand January 1, 1919.

The total cost of production, exclusive of selling was \$3,552,829.88 or 14.30 cents per pound copper produced during 1918. The gross receipts from sale of metal was \$6,950,160.69 or an average

of 24.30 cents per pound. The total cost of production and delivery of the 28,597,173 pounds of copper delivered in 1918 was \$3,842,019.44 or 13.43 cents per pound. The gain on copper delivered was 10.87 cents per pound or \$3,108,141.25. The net income from all sources was \$3,174,625.32. During the year \$1,600,000 was declared and paid in dividends and \$1,640,000 set aside to meet estimated Federal taxes.

No. 1 shaft is bottomed 43 feet below the 22d level. No sinking was done at this shaft. Openings and stopes show average ground except on the 10th, 11th, 14th and 16th levels south beyond the distributed area; at these points the lode is below average and bunched.

No. 2 shaft is 165 feet below the 25th level. Openings are of average quality for this part of the mine. Work on the mass copper fissure was limited because of the shortage of labor and lack of compression capacity. Advances were made on the 11th and 16th levels west and stoping done on the 10th, 14th, 16th and 17th levels west and on the 18th level east. The mass copper fissure was encountered on the 20th and 21st levels north of No. 2 shaft with a good showing of copper at both points. One electric pump was installed on the 11th and one on the 21st level. These pumps are handling all of the water at this end of the mine which was formerly handled by eight air pumps.

No further work was done on Kearsarge Conglomerate because of the shortage of labor.

No. 3 shaft is bottomed 322 feet below the 20th level in hanging wall trap. All of the opening and stopes showed average ground.

On July 15 a fire broke out in No. 3 shaft which necessitated the closing down of the north end of the mine and the sealing of both No. 3 and No. 4 shafts. On July 20 an attempt was made to reopen this part of the mine but it was found that the fire was still burning and it was necessary to again seal the shafts. On July 30 the shafts were again opened. Inspection showed that timbers for 180 feet in the 80° portion of the shaft and the concrete sets for 200 feet above the 6th level had been destroyed. Repairs were made as rapidly as possible but it was not until January 17, 1919 that hoisting could be resumed.

No. 4 shaft is 185 feet below the 20th level with two feet of average lode exposed on the hanging wall side. In continuing the drift north on the 15th level the turn of the lode to the east (mentioned in the 1917 report) was found to be local; the lode has again turned west and it has been found necessary to resume drifting on the 14th level. All of the openings and stopes are of average quality for this section of the mine.

Three storage battery locomotives for trammings have been installed at No. 2 shaft, two at No. 3 shaft and five at No. 4 shaft, all of which are giving satisfactory results.

The high rate of wages, abnormal cost of supplies, together with shortage of men and decreased output due to the fire in No. 3 shaft account for increased cost of production over 1917.

The existing system of figuring wages on the old base rates to which was added a premium of 10 percent and a bonus of 50 cents per day was discontinued on May 1 and new base rates were established. These rates were arrived at by adding 15 percent and 50 cents per day to the old base rates. On October 1 there was a second increase in wages of from ten to thirty percent; the larger rate of increase applying to the lower rate of wages.

Algomah Mining Company

Office: 60 Congress Street, Boston, Massachusetts.
 Mine office: Lake Mine, Ontonagon County, Michigan.
 President and General Manager: R. M. Edwards.
 Secretary: Albert L. Wyman.
 Treasurer: Henry Tolman.
 Superintendent: Thomas Bennett.
 The Algomah Mine was idle during 1918.

Allouez Mining Company

Office: 12 Ashburton Place, Boston, Massachusetts.
 Mine office: Allouez, Keweenaw County, Michigan.
 President: Rudolphe L. Agassiz.
 Vice-President and General Manager: James MacNaughton.
 Secretary and Treasurer: George G. Endicott.
 Superintendent: F. W. Ridley.

Total production of the Allouez Mine in 1918 was 514,888 tons of rock yielding 7,071,218 pounds of refined copper, an average of 13.73 pounds per ton. This is a decrease of 1,821,697 pounds from the production of 1917 and a decrease of 1.96 pounds of refined copper per ton. The total cost of production, excluding selling, was \$1,394,950.21 or 19.73 cents per pound. This represents an increase of 6.26 cents per pound over 1917. The company had 1,553,627 pounds of copper on hand December 31, 1917 and sold 7,266,393 pounds during 1918, leaving a balance of 1,358,442 pounds on hand December 31, 1918.

The total cost of copper sold in 1918 was 19.09 cents per pound or \$1,386,882.09 and the gross sum received for copper sold, \$1,779,-

253.32 or 24.49 cents per pound, leaving a gain on copper sold of 5.40 cents per pound or \$392,371.23. The balance of miscellaneous charges and receipts amounted to \$30,886.74, leaving a net income of \$361,484.49.

During 1918 Allouez paid \$600,000 in dividends.

No. 1 shaft was sunk to a point 72 feet below the 22d level and the skip road completed to that level. The ground passed through continued bad and on this account the progress of the shaft has been somewhat retarded. Drifting on territory tributary to this shaft disclosed average ground except on the 20th level north, which in being holed through to No. 2 shaft opened ground below the average in copper contents. Storage batteries for trammings have been installed on the 19th and 20th levels.

No. 2 shaft was not sunk during 1918. The new openings tributary to this shaft are of average quality. Stoping operations on the 14th, 15th, 16th and 17th levels north yielded a grade of rock somewhat lower than the average. The stopes on the 17th level south yielded rock above the average. A new electric locomotive of the trolley type was installed on the 18th level.

In order to secure better water for boiler feed connection was made with the Ahmeek village water system with satisfactory results. One new boiler was installed.

The fourth unit of Mill No. 2 of the Lake Milling, Smelting and Refining Company at Hubbell went into commission October 22 and since that date all Allouez rock is stamped at this plant.

There were two wage increases, on May 1 and October 1. For details see Ahmeek.

Baltic Mining Company

(See Copper Range)

Calumet and Hecla Mining Company

Office: 12 Ashburton Place, Boston, Massachusetts.
 Mine office: Calumet, Michigan.
 President: Rudolphe L. Agassiz.
 Vice-President and General Manager: James MacNaughton.
 Secretary and Treasurer: John F. Perkins.
 Superintendent: John Knox.

The copper product for the year was 67,968,357 pounds divided among the various operations as follows:

	Tons	Pounds Copper	Pounds per Ton
Conglomerate lode.....	1,547,603	43,329,816	28.00
Amalgaloid lode.....	1,328,789	15,393,153	11.58
Conglomerate sands.....	715,007	9,245,388	12.93

The total production costs, excluding selling, were \$14,310,-670.54 or 21.05 cents per pound. Mining and milling costs including State taxes for the different operations were as follows: Mine 15.01 cents; reclamation plant 7.20 cents; average for all operations 13.95 cents. Smelting, refining, eastern office and corporation taxes 1.76 cents; depreciation and depletion 5.34 cents.

There were 17,967,381 pounds of copper on hand January 1, 1918. 78,367,245 pounds were sold during 1918, leaving a balance on hand January 1, 1919 of 7,568,490 pounds.

The gross sum received for copper delivered in 1918 was \$19,027,-052.27 and the average price per pound was 24.28 cents. The total cost, including selling, of copper delivered in 1918 was \$15,507,297.21 or 19.79 cents per pound. The gain on copper delivered was \$3,519,-755.06 or 4.49 cents per pound.

The balance of miscellaneous charges and receipts was \$1,429,-441.01 and the net income for 1918, \$4,949,196.07. During the year the Calumet and Hecla Mining Company paid \$5,500,000 in dividends and had a balance of current assets on December 31, 1918 of \$12,565,925.76.

Conglomerate Lode

The operating shafts on this lode have attained the following depths:

Calumet No. 5 and 6, 155 feet to boundaries of 60th level.

Calumet No. 4, 7,995 feet, boundary 81st level.

Calumet No. 2, 6,186 feet; permanently bottomed 63d level.

Slope shaft, 1,588 feet below 57th level or 185 feet under 66th level.

Hecla No. 6, 7,874.6 feet; 32.7 feet under 80th level.

Hecla No. 7, 7,977.7 feet; 40 feet under 81st level.

South Hecla No. 8, 6,102 feet; second permanently discontinued at 63d level.

South Hecla No. 9 and No. 10, 8,132.7 feet; 142 feet under 82d level.

Red Jacket Shaft, 4,900 feet; 100 feet under 81st level.

Tamarack No. 3, 5,253 feet; 29.5 feet from 18th level.

Tamarack No. 3, (incline) 616 feet below 18th level; 8 feet below 24th level.

Tamarack No. 5, 5,308.5 feet; 147 feet below the 40th level.

About 81 drills were worked during the year, moving shaft pillars and cleaning up arches and the backs of old stopes. A total of 477,541 tons was secured from these operations.

In the Calumet Branch the 40th level drift north of No. 6 shaft was extended 600 feet opening up a fair grade of rock.

In the Hecla Branch drifts in the lode have been advanced 2,261 feet disclosing rock of average copper content.

In the South Hecla Branch the drifts were in average rock. No. 11 shaft pillars have been all removed and the shaft is abandoned.

Drifts in the Red Jacket shaft branch disclosed 409 feet of fair rock and 905 feet of poor rock, and in the Tamarack Branch 1,411 feet of fair grade rock and 265 feet of poor rock.

Because of the excessive cost of maintaining No. 6 and No. 7 Hecla, No. 9 and No. 10 South Hecla, it was decided to discontinue sinking at these points. In order to reach the ground lower down in this end of the mine, a haulage level (at the elevation of the 80th level) connecting this territory with Red Jacket shaft is being driven in an amygdaloid lode 180 feet under the conglomerate. This haulage level when completed will have a total length of 7,800 feet, 2,826 feet of which have been driven. From this hauling level, sub-shafts will be sunk through which the lower part of the conglomerate can be mined. All of the product obtained from these lower workings will be trammed by power to the Red Jacket shaft.

Osceola Lode

The operating shafts on the Osceola lode have attained the following depths:

No. 13.....	3232 feet
No. 14.....	2958 feet
No. 15.....	3002 feet
No. 16.....	3274 feet
No. 17.....	2279 feet
No. 18.....	1460 feet

The openings on this lode show about the same grade of rock as last year. The products obtained from the foot-wall stopes were about 22.5 percent of the total product from this branch. Fourteen storage battery locomotives were installed during 1918.

No work was done on the Kearsarge lode, Manitou—Frontenac, or St. Louis Branches during 1918.

Stamp Mill

At the Stamp Mill the new steam turbine went into commission and the new office building was completed. The size units of the Hecla mill stamping conglomerate rock were remodeled and the slimes made are being treated by flotation replacing the round-table system. The remodeling of No. 1 regrinding plant is completed. It now operates twenty-four large Hardinge mills. During the year the following results were obtained from the regrinding plant:

	From Mines	From Old Sands
Tons treated.....	530,657	715,007
Assay headings.....	.599	.868
Assay tailings.....	.414	.568
Pounds refined copper.....	2,243,022	4,776,392
Pounds refined copper (per ton treated)	4.23	6.68
Cost per pound excluding smelting and selling.....	6.75	4.33

Leaching Plant

The results during 1918 at the leaching plant were as follows:

Assay headings.....	.535
Assay tailing.....	.126
Pounds refined copper.....	8,035,156
Pounds refined copper (per ton treated)	8.
Cost per pound copper (excluding smelting and selling).....	7.71

During 1918 there were two wage increases taking effect May 1 and October 1. These increases are similar to those made elsewhere in Calumet and Hecla group and are fully described under "Ahmeek."

Centennial Copper Mining Company (Subsidiary of Calumet Hecla Mining Company)

Office: 12 Ashburton Place, Boston, Mass.

Mine office: Calumet, Houghton Co., Michigan.

President: Rudolph Agassiz.

Vice-President and General Manager: James MacNaughton.

Secretary and Treasurer: C. H. Bissell.

Superintendent: F. W. Ridley.

During 1918 Centennial produced 159,040 tons of rock which yielded 2,492,857 pounds of refined copper or 15.67 pounds per ton. This is an increase of 490,000 pounds over 1917. Production costs exclusive of selling were \$464,888.49 or 18.65 cents per pound. The company had on hand January 1, 1918, 318,215 pounds of copper and sold during 1918, 2,048,762 pounds leaving a balance on hand December 31, 1918 of 562,310 pounds.

The gross sum received for copper delivered was \$553,373.69. The total production costs on copper sold were \$429,639.88 leaving a net gain on copper delivered of \$123,733.81. Miscellaneous receipts were \$5,061.05 and the total net income \$128,794.86.

During 1918 Centennial Copper Mining Company paid \$100,000 in dividends and closed the year with a balance of current assets of \$430,716.82.

No. 1 shaft was used only for handling men and supplies. No. 2 shaft is bottomed below the 40th level. All hoisting is through this shaft. The rock mined during 1918 was of better quality than

that mined during the previous year, but the new openings extending to the north on the 37th, 38th and 39th levels disclosed grounds slightly below the average in quality.

Since the completion of the 4th unit at No. 2 mill of the Lake Milling Smelting and Refining Company at Hubbell, all Centennial rock has been stamped at this plant.

In common with other subsidiaries of the Calumet and Hecla Mining Company there were two wage increases effective May 1 and October 1.

Champion Copper Company

Office: 82 Devonshire Street, Boston, Mass.

Main office: Painsdale, Michigan.

President: Wm. A. Paine.

Secretary and Treasurer: F. W. Paine.

General Manager: Wm. H. Schacht.

The production of the Champion Copper Company was 594,235 tons yielding 21,748,514 pounds of refined copper or 36.59 pounds refined copper per ton. This yield per ton is the highest of any of the Michigan Copper Mining Companies. The gross sum received from sale of copper was \$5,408,068.21 and the total costs were \$2,616,267.83 leaving a net gain of \$2,791,800.38. During 1918 the Champion Copper Company paid \$1,280,000.00 in dividends. The financial statement of the company indicates a balance of assets for December 31, 1918 of \$2,079,762.35.

During the year No. 2 shaft was sunk 95 feet, the total depth is now 2,463 feet and the bottom level, 22d. There was no sinking as Nos. 1, 3 and 4 shafts. The depths of these shafts and the bottom levels are as follows:

No. 1.....	2,514 ft.,	23d level
No. 3.....	2,339 ft.,	21st level
No. 4.....	2,388 ft.,	22d level

The total tons of rock hoisted was 618,572 of which 24,337 tons or 3.9 were discarded. The mine showed a decrease of production of 5,801,829 pounds from 1917. This falling off in production was due to the shortage of labor which was a common difficulty in all the Michigan Copper Mines in 1918. The ground opened up in development work was of average quality.

Cherokee Copper Company

Office: Houghton, Michigan.

Mine office: Winona, Houghton Co., Mich.

President: W. A. Hodgson.

Secretary and Treasurer: Wm. D. Calverly.

The Cherokee Mine was closed during 1918.

Cliff Mining Company
(Subsidiary of Calumet & Hecla Mining Co.)

Office: 12 Ashburton Place, Boston, Mass.

Operating Office: Calumet, Michigan.

President: Rudolph L. Agassiz.

Vice-President: James McNaughton.

Secretary and Treasurer: C. H. Bissell.

This property has been idle since 1915; the last work consisting of diamond drilling to explore territory lying eastward toward the Eastern Sandstone. The Cliff is the first mine ever opened on native copper and the production in 1845 was 19,903 pounds which was the output of the Lake Superior Region. The last active mining was in 1878. Since that time there have been occasional operations by tributers.

Contact Copper Company

Office: 70 State Street, Boston, Mass.

Mine office: Houghton, Michigan.

President: Harry F. Fay.

Secretary and Treasurer: C. J. Morrisey.

Superintendent: G. S. Goodale.

This property was idle during 1918.

Copper Range Company

Office: 682 Devonshire Street, Boston, Mass.

Mine office: Painsdale, Michigan.

President: Wm. A. Paine.

Vice-President: F. W. Denton.

Secretary and Treasurer: F. W. Paine.

General Manager: W. H. Schacht.

The total production of the Copper Range Company was 37,498,197 pounds of copper. The net operating income was \$2,895,615.28 and the dividends paid during the year were \$6.00 per share or \$2,666,394.00. The company closed the year with a balance of assets of \$6,007,528.92. The following comparative statement includes the Baltic, Tri-Mountain Mines and one-half Champion.

Tons of rock stamped.....	792,151
Pounds of refined copper produced.....	26,623,940
Pounds of refined copper per ton stamped.....	33.61
Total cost per pound.....	14.46c
Average price received per pound.....	24.76c
Profit per pound.....	10.30c

The same features which caused high cost of production in 1917 were present in still more aggravated form in 1918. The number

of men employed was reduced some fifteen percent compared with the number of men working in 1917 and the wages were further increased twice during the year. This shortage was partly confined to the underground force. The yield of copper per ton of rock was maintained in spite of the shortage of labor as the underground method was not changed but many stopes and other places from which production is made, remained idle.

At the Baltic Mine the shortage was not serious but at the Champion and Trimountain it was responsible for a large drop in output.

PRODUCTION

Champion.....	21,748,514 lbs.
Baltic.....	10,406,097 lbs.
Trimountain.....	5,343,586 lbs.
Total.....	37,498,197 lbs.
Decrease from previous year	
Champion.....	5,801,829 lbs.
Baltic.....	808,764 lbs.
Trimountain.....	934,511 lbs.
Total.....	7,545,104 lbs.
The total cost per pound for the different mines was as follows:—	
Baltic.....	15.07c
Trimountain.....	18.42c
Champion.....	11.92c
Average for Copper Range.....	14.46c

Depletion and depreciation charged against 1918 production amounted to \$903,832.41 or 3.4 cents per pound of copper produced. The Federal, income and excess profit taxes paid in 1918 on account of 1917 profits of the Copper Range Company aggregated \$711,905.45. This was provided for out of the surplus carried over from the 1917 income. The total taxes of all sorts paid in 1918 amount to \$1,489,500.62.

At the Baltic Mine No. 3 shaft was sunk 178 feet and has now reached a total depth of 3,498 feet on the 36th level. No sinking was carried on in No. 2 and 4 shafts. The former is 2,839 feet deep and the bottom level is 29th and the latter is 2,982 feet deep and the bottom level the 31st. During the year 4,222,085 tons were hoisted; 128,484 tons or 30 percent was discarded and 293,601 tons were stamped. The yield of copper per ton stamped being 34.44 pounds. Most of the rock came from the main lode with No. 2 shaft the largest producer. Most of the rock from the West lode came from No. 5 territory.

Hoisting from No. 5 shaft was discontinued in May and rock from No. 5 territory is hoisted through No. 4 shaft. There has been no change in the ground opening to No. 3 and 4 shafts. No. 2 shaft continues in rock of average quality.

At the Trimountain Mine No. 2 shaft was sunk 159 feet to a total depth of 3,125 feet. Its bottom level is the 30th. No. 3

shaft is still bottomed at 2,563 feet on the 24th level. No. 4 shaft was sunk 154 feet and has now reached 3,007 with its bottom level the 29th.

The tons of rock hoisted during 1918 from the Trimountain Mine were 252,545 of which 51,112 tons or 20 percent were discarded and 201,433 tons sent to the stamping mill. The yield of copper per ton of rock stamped was 26.52 pounds. The openings made during the year were in ground of average quality.

Franklin Mining Company

Office: 60 Congress Street, Boston, Mass.

Mine Office: Demmon, Michigan.

President: R. M. Edwards.

Secretary: Albert L. Wyman.

Treasurer: Henry Tolman.

Superintendent: Enoch Henderson.

Franklin produced 2,827,313 pounds of refined copper in 1918. The treasurer's statement shows a total income of \$697,671.84. This includes 377,708 pounds of copper on hand December 31, 1918, inventoried at 20 cents per pound.

Mining expenses were \$710,750.55, smelting \$62,224.57, Total, \$806,795. The deficit for the year was \$109,123.16.

The production record for 1918 is as follows:

Tons rock hoisted.....	296,182
Discard.....	22,218
Tons rock stamped.....	273,964
Pounds copper produced.....	2,827,313
Pounds copper per ton.....	10.32

Twenty-five percent of the rock produced came from the Pewabic lode and 75 percent from the Allouez conglomerate.

During the year, No. 2 Conglomerate shaft was sunk 253 feet and the total of new openings aggregated 2,149 feet. In general the openings during the year were encouraging, particularly the openings on the Allouez conglomerate on the 18th and 19th levels. The openings on the Pewabic level were also in ground that promises to yield more copper than heretofore encountered in this lode.

A crosscut was driven west from No. 1 shaft on the 37th level and cut the "west lode" at a distance of 227 feet. The lode was then opened by drifts for a distance of 172 feet. In portions of the drift the showing was encouraging but in general the lode was "spotty," narrow and unprofitable.

Because of the excessive cost of labor and supplies, construction was kept as low as possible. An electric coal rig to convey coal from the stock pile to No. 1 boiler house was built in the company's

shops and put in service and an experimental regrinding plant consisting of one Hårdinge mill, 75 H. P. motor and six Wilfley tables were set up but were not put into operation on account of a delay in the shipment of some of the electrical equipment.

In general the operations of the company were most adversely affected by conditions due to the War, the most serious factor being the shortage of miners which prevented the mining of sufficient tonnage for economical operation. At no time was the mine operating at better than 66 percent capacity.

Hancock Consolidated Mining Company

Office: Hancock, Michigan.

President: John D. Cudahy.

Secretary and Treasurer: John H. Hicock.

Superintendent: Clyde E. Weed.

Hancock produced 227,049 tons of rock which yielded 3,041,514 pounds of refined copper an average of 13.4 pounds per ton.

The treasurer's statement for the year shows receipts from the sale of 3,774,166 pounds of copper, \$917,092.48. Disbursements totaled \$869,540.98 leaving a profit on the year's operation of \$47,551.50. The balance sheet of the company shows a deficit on December 31, 1918, of \$203,066.18.

The Hancock operated through No. 2 shaft of the Hancock and also through No. 7 shaft of the Quincy mine.

Sixty-two and five-tenths percent of the rock hoisted from No. 2 shaft came from No. 4 vein west, which was worked from the 44th to 53rd level. This vein showed about its average mineralization. New openings on this vein aggregated 2,117 feet. No. 1 west vein showed a good mineralization and furnished 13.7 of the product from No. 2 shaft. New openings on this vein totaled 508 feet.

The Pewabic vein continued to maintain a good showing but the hanging wall gives trouble. Seven pounds of No. 2 shaft production came from this vein.

On the 53d level a crosscut was driven 611 feet east and cut two mineralized veins first located by diamond drilling in 1917. The first was narrow and only 75 feet of drifting was done but the second, called No. 3 east, showed some good mineralization and 571 feet of drift were driven while 10.2 percent of rock hoisted came from this vein.

Another east crosscut on the 49th level 428 feet long intersected two amygdaloids, called No. 1 and No. 2 east. No. 1 east produced 5.7 percent of rock tonnage. No. 2 east is very similar to No. 1 but as this was reached toward the end of the year, only

a small production, 0.9 percent was obtained. The total new openings tributary to No. 2 shaft were 3,713 feet of drifting, 1,180 feet of crosscutting and 78 feet raising.

No. 7 shaft Quincy underleased to Hancock was operated until May 31, when it was closed on account of labor shortage. A total production of 34,920 tons from this shaft came from two veins, No. 1 west and the Pewabic. The latter furnishing 78.7 percent.

In common with all the mines, Hancock was troubled by high costs and a shortage of labor. Two wage increases were granted—an increase of 9.3 percent May 1 and 15 percent October 1.

The copper content of rock from No. 2 shaft showed an improvement of 0.8 pound per ton. No construction of importance was carried on.

Indiana Mining Company

Office: 60 Congress Street, Boston, Massachusetts.

Mine office: Lake Mine, Michigan.

President: R. M. Edwards.

Secretary: A. L. Wyman.

Treasurer: Henry Tolman.

Superintendent: Thomas Bennett.

This property was idle during most of 1918. A small amount of exploratory work was done at No. 2 shaft.

Isle Royale Copper Company

Office: 12 Ashburton Place, Boston, Mass.

Managing Office: Calumet, Michigan.

Mine Office: Houghton, Michigan.

President: Rudolph L. Agassiz.

Vice-President and General Manager: James MacNaughton.

Secretary and Treasurer: Clarence L. Bissell.

Superintendent: James Richards.

The Isle Royale Mine produced 974,508 tons of rock which yielded 15,442,508 pounds of refined copper, an average of 15.9 pounds per ton. Isle Royale entered the year with 3,244,274, and 18,686,782 pounds were sold during 1918, leaving a balance on hand December 31, 1918 of 3,922,064 pounds.

The cost of production exclusive of selling, was 16.51 cents or \$2,549,957.31. Selling costs were .49 cents per pound. The total cost of production on copper delivered was 16.80 cents per pound, and the gain on copper delivered during 1918, \$1,130,312.15. Silver sales amounted to \$80,743.43 and the balance of miscellaneous in-

come and charges brought the total net income to \$1,219,404.41.

The Isle Royale Copper Company paid \$375,000 in dividends during 1918. The company closed the year with a balance of assets of \$1,134,332.21.

No sinking was done at No. 1 shaft. The water pocket mentioned in annual report for 1917, was located and drained. Total openings consisted of 1,171 feet of drifting, 208 feet of drift stoping and 51 feet of crosscutting. Drifts indicate 45 percent of ground opened can be stoped.

The bottom of No. 2 lode is in trap between the two lodes 62 feet below the 33d level or 3,650 feet from surface. Openings for year were 47 feet of shaft, making 1,906 feet of drifting, 159 feet of drift stoping and 143 feet of crosscutting. Drifts indicate 55 percent of this ground may be available for stoping.

No. 4 shaft is bottomed in lode of average quality 70 feet below the 19th level or 2,512.5 feet from surface. Openings for the year were 2,576 feet of drift stoping, 227 feet of drifting and 30 feet of crosscutting. About ninety of the openings disclosed copper ground and will be tried for stoping. The old Huron Mine has been completely drained of water. Storage battery locomotives for draining were installed on the 11th, 12th, 13th and 14th levels.

Sinking was resumed at No. 5 shaft in December. The year closed with the bottom of the shaft in foot wall trap, eighty-four feet below the 16th level or 2,118 feet from the surface. The openings for the year included 12 feet of shaft making, 555 feet of drifting, 1,095 feet of drift stoping and 173 feet of crosscutting. About 80 percent of the ground appears to be suitable for stoping. Storage battery locomotives were installed on the 10th, 11th, 12th and 13th levels.

No. 6 shaft is bottomed in the lode 38 feet below the 19th level, or 2,304.5 feet from surface. The openings consisted of 15 feet of shaft sinking, 389 feet of drifting, 413 feet of drift stoping and 30 feet of crosscutting. About 60 percent of new ground appears to be of commercial value. Storage battery locomotives were installed on the 10th, 12th, 13th and 14th levels.

No. 7 shaft is bottomed in foot trap 66 feet below the 9th level or 1,201.5 feet from surface. The year's openings consisted of 10 feet of shaft sinking, 1,618 feet of drifting, and 1,665 feet of drift stoping. About one-half of this appears to be stoping ground.

Two new boilers (making a total of five) were installed at No. 6 boiler house. A 6-inch air line was laid connecting No. 2 and No. 4 compressor plants and a 7-inch air line connecting No. 4 and No. 6 compressor plants, the object being to maintain a more uniform air pressure throughout the mine.

In common with the other subsidiaries of the Calumet and Hecla Mining Company, there were two wage increases on May 1 and on October 1.

Keweenaw Copper Company

Office: Calumet State Bank Building, Calumet, Mich.

President: Thomas F. Cole.

Secretary and Treasurer: F. W. Taylor.

No mining or exploration was carried on during the year on the property of this company. Equipment and rails of the Mandan Lac La Belle branch of the Keweenaw Central Railroad Company, were disposed of and the proceeds invested in Liberty Bonds—\$200,000.00 of the first issue and \$25,200 of the fourth issue.

Lake Copper Company

Office: 85 Devonshire St., Boston, Mass.

Mine Office: Lake Mine, Ontonagon County, Michigan

President: William A. Paine.

Secretary and Treasurer: Robert H. Gross.

Superintendent: C. J. McKie (resigned).

Lake Copper Company produced 717,403 pounds of copper during 1918. The total receipts for the year were \$178,318.15 and expenditures, \$246,006.59, leaving a net loss on the year's operation of \$110,688.08. The books of the company show a surplus of \$220,-836.96 on April 30, 1919.

Mining operations were suspended January 31, 1919, owing to the low price of copper and high cost of labor and supplies.

The result of operations at the Lake shaft on the Lake lode, were disappointing. According to the report of General Manager McKie, the new stopes in this ground showed a steadily decreasing copper content and five or six tons had to be discarded for every ton shipped.

The exploration on the Evergreen which runs in the northern part of the property, was much more satisfactory. During the year the openings on this vein were 121 feet of drifting and 22 feet of raising on 6th level end Butler, 390 feet of crosscutting to the Evergreen lode, 513 feet of drifting on the End Evergreen and 158 feet on the west Evergreen.

Mr. McKie's statement regarding the result of operation on the Evergreen lode is as follows: "This drifting on the Evergreen lode has been very encouraging, especially on the east side. We have

started one stope over 200 feet long on this lode. Following are the results of four tests on this Evergreen rock:

December 5, 1918, 246 tons yielding 7,020 pounds copper, or 28.54 pounds per ton.

January 18, 1919, 574 tons yielding 12,990 pounds copper, or 22.63 pounds per ton.

October 19, 1918, 451 tons yielding 15,705 pounds copper, or 34.82 pounds per ton.

January 2, 1919, 492 tons yielding 8,860 pounds, copper, or 18.01 pounds per ton.

"The rock for these tests was not picked underground, but was roughly picked on the surface as it was being loaded and hauled to cars. I consider this Evergreen showing the best we have had on this series so far. There is another lode about 250 feet in the foot of the Evergreen lode. This lode out-crops at the Trissides shaft and has a good surface showing. I think it would be wise to cross-cut to this lode whenever the Knowlton shaft is reopened."

La Salle Copper Company

Office: 12 Ashburton Place, Boston, Mass.

Mine office: Calumet, Michigan.

President: Rudolphe L. Agassiz.

Vice-President and General Manager: James MacNaughton.

Secretary and Treasurer: George G. Endicott.

Superintendent: Ole Hallingby.

The La Salle Copper Company mined 176,423 tons yielding 1,832,665 pounds of refined copper ore, 10.388 pounds per ton. This production exclusive of selling cost was 21.81 cents per pound. La Salle delivered 1,858,328 pounds of copper and closed the year with 347,134 pounds on hand. The total cost per pound on copper delivered was 21.96 cents and the average price mined, 24.35 cents. The gain on copper delivered was \$44,605.81 or 2.39 cents per pound. The balance of miscellaneous charges and receipts, including silver sales, was \$32,450.70 and the net income for the year, \$68,256.61. The financial statement shows a balance of assets on December 31, 1918 of \$401,457.78.

No. 1 shaft supplied 62 percent of the rock hoisted. The quantity of merchantable ground tributary to this shaft is limited and operations are being pushed with the idea of mining out the available ore and abandoning the shaft. On the whole the stopes were lean. The ground between the 9th and 15th levels is exhausted excepting two small areas near the shaft, one above the 14th and one above

the 15th level. Limited areas of probable stoping value remain to be tested on the 9th, 16th, and 17th levels.

No. 2 shaft is 2,511 feet deep, the bottom being 133 feet below the 23d level, an advance of 269 feet for the year. Drifting on alternate levels from 17th to 23d developed fair ground north of the shaft. As the north boundary is approached the ground is leaner. On the south side of the shaft the 21st and 23d levels were in fair ground. The 19th level north was stoped in poor ground 900 feet from the shaft. Stoping from the 15th and 17th levels north, furnished 65 percent of the rock output of this shaft.

No work was done on the Osceola lode exploration. The mine showed an unusual cost of production due to the abnormal cost of supplies, shortage of men and high wages. There were two wage increases—one on May 1 and the second on October 1.

Mass Consolidated Mining Company

Office: 79 Milk Street, Boston, Mass.

Mine office: Mass City, Ontonagon County, Michigan.

President: John W. Linnell.

Secretary and Treasurer: Wilfred A. Bancroft.

Superintendent: Elton W. Walker.

The Mass Mine produced 196,456 tons of copper rock yielding 3,403,827 pounds of refined copper or 17.33 pounds per ton. This is a decrease of 480,789 pounds from the record of 1917, but an increase of 1.04 pounds copper per ton stamped.

The cost per pound was 23.82 cents. During the year 2,849,759 pounds of copper were sold for 24.34 cents per pound or \$693,547.87 and the stock on hand December 31, 1918, 554,068 pounds is inventoried at 16 cents per pound or \$88,650.88. Interest and rents bring the total income for year to \$796,638.33. Expenditures for the year totaled \$810,967.81, leaving a loss on the operations of the year of \$14,329.48. The company closed the year with a balance of assets of \$295,773.01.

The development work was somewhat restricted due to high costs and scarcity of labor, but a total of 2,280 feet of new openings was made. These consisted of 575 feet of drifting in territory adjacent to B shaft and 1,368 feet of drifting and 337 feet of cross-cutting in C shaft territory.

Mass copper produced during the year amounted to 29.4 percent of the gross mass and mineral as compared with 29.7 percent in 1917. Production by lodes was as follows: Butler and branches, 127,491 tons; Evergreen, 59,866 tons; and Ogima 9,099 tons.

Construction amounted to \$11,269.24. The Ingersol Rand compressor mentioned in a previous report, was completed and a permanent concrete foundation built under the compressor and hoist building at the main plant.

The scarcity of labor and increased cost of supplies resulted in increased cost of production. During 1918 the average number of men employed underground was 269 as compared with 320 in 1917. The conditions underground are satisfactory, the copper content of the rock showed an improvement of one pound over 1917.

According to President T. W. Linnell, "The mine has been brought to a point where there remains no question that under normal conditions we can operate to the capacity of our mill and show a good profit therefrom."

Mayflower-Old Colony Copper Company

Office: 70 State Street, Boston, Mass.

Mine office: Houghton, Michigan.

President: H. F. Fay.

Secretary and Treasurer: C. T. Morrissey.

Superintendent: George S. Goodale.

During the period January 1, 1918 to March 1, 1919, this company has devoted all efforts toward the sinking of No. 1 shaft. During this period the shafts were sunk from 139 feet to 994 feet. This included all timbering and special construction and the installation of pump stations at 177 and 511 feet. Only a very moderate quantity of water has been encountered and except for short distances the rock was of uniform hard nature. The character of the ground has necessitated timbering close to the bottom of the shaft, a condition which operates against rapid sinking.

The annual report shows that expenditures for the period were \$95,199.21 and there was a balance on hand December 31, 1918 of \$23,766.49.

Michigan Copper Mining Company

Office: 15 William Street, New York City.

Mine office: Rockland, Ontonagon County, Michigan.

President: L. P. Yandell.

Secretary: F. G. Hinmann.

Treasurer: R. E. Graver.

Superintendent: Samuel Brady (Died Sept. 1919.)

The Michigan Mine produced 40,865 tons yielding 1,177,176 pounds of refined copper, an average of 28.56 pounds per ton stamped.

The receipts of the company during the year were \$445,782.09. Sales of copper totaled \$290,923.17. There was received from assessments \$153,884 and interest added the balance of \$974.92. Total expenditures were \$290,242.21 to which should be added construction amounting to \$18,729.68 and \$10,000 for purchase of real estate. The balance of receipts over expenditures was \$126,810.20. The deficit of the company has been reduced to \$52,067.97.

According to the report of Mr. L. P. Yandell, President of the company, "the character of the ground opened by drifts in the Butler lode has been highly satisfactory throughout the past year. The number of drills at work on January 1, 1918 were six; increased to eighteen at the present date (December 31, 1918). Steady shipments of rock have continued throughout the year increasing month by month with December the record for the year. However, production of copper rock and drifting have both been hampered somewhat by a continuous shortage of labor. The average recovery of 28.56 pounds of refined copper per ton of rock stamped and sold at an average of 24.7 cents is responsible for the mine's ability to pay expenses with the limited production possible in its first year of mining from "E" shaft.

"A study of the underground conditions of the mine at the beginning of 1919 shows a very substantial body of copper rock exposed for stoping by comparison to the amount exposed at the beginning of 1918 and it is believed that production can be doubled in the coming year.

"The same high quality of rock is in sight at this writing that was available for stoping last year. With increased production the cost of our refined copper will be reduced.

"Necessary machinery is on hand and is being installed as fast as required for increased production, and, when the mine has operated continuously producing a tonnage of rock that justifies starting our own mill, custom stamping will stop and operation of our mill commence, effecting an additional economy."

Mohawk Mining Company

Office: 15 Williams St., New York, N. Y.
 Mine Office: Mohawk, Keweenaw Co., Mich.
 President: L. P. Yandell.
 Secretary: F. G. Hinmann.
 Treasurer: F. E. Graver.
 Agent: Theo. Dangler.
 Superintendent: W. F. Hartmann.

The Mohawk produced 454,293 tons yielding 10,781,041 pounds of refined copper, an average of 23.73 pounds per ton stamped. This is an increased yield of 2.62 pounds per ton.

The total cost of production was 14.641 cents per pound, or \$1,578,452.10 less copper on hand at cost equals \$1,444,117.32. Sales of 9,775,014 pounds of copper at 24.73 cents amounted to \$2,417,580.50 leaving a gain on copper sold of \$973,463.18. Miscellaneous income amounted to \$60,226.73. The company had a balance of assets of \$2,208,397.80 on December 31, 1918.

During 1918 No. 4 shaft was sunk 100 feet and its total depth is 2,489 feet. No. 6 shaft was sunk 157 feet to a total depth of 1,451 feet. No. 1 shaft, depth 2,693 feet and No. 5, depth 1,787, were not sunk during the year. The total sinking was 257 feet, drifting 5,639 feet, crosscutting 277 feet, raises 3,080 feet or a total of all openings of 9,253 feet.

Tons rock hoisted amounted to 465,603 of which 11,310 tons or 2.4 percent were discarded and 454,293 tons stamped. Of this product No. 1 shaft produced 6 percent; No. 4 shaft 33 percent; No. 5 shaft 20 percent and No. 6 shaft 41 percent.

The new opening in No. 1 shaft showed no improvement over those of the past three years and it will be necessary to resort to underground selection prior to hoisting. The new opening in Nos. 4, 5 and 6 shafts showed amygdaloid of the same excellent mineralization as in previous years, No. 4 and 5 territory being slightly better than No. 6.

President Yandell sums up the result of operation and general condition at the property as follows: "The smaller rock tonnage handled in 1918 as compared to recent years is due entirely to labor shortage and the increased copper content in the rock handled in 1918 is due to improved mineralization in the workings of the mine. The character of the new ground opened up has been most satisfactory. Our engineers estimate that there remain in the property yet unmined 260,738,612 pounds of copper and it will be noted that to December 31, 1918, 170,235,843 pounds have been taken from the mine.

"The mechanical haulage established in 1918 is now operating effectively and is reducing costs. The improvements being installed at the mill will still further reduce operating costs."

Naumkeag Copper Company

Office: 61 Broadway, New York, N. Y.
 Mine office: Houghton, Michigan.
 President: J. Parke Channing.

Secretary and Treasurer: E. H. Westlake.

Superintendent: J. H. Reader.

This property is a prospect and has never reached the production stage. During 1918 work on the 400 foot level consisted in driving two crosscuts No. 2 west 450 feet, and No. 2 east 450 feet to the foot wall of the Pewabic beds. This work developed no commercial ground.

The inclined shaft was sunk to a depth of 1,027 feet from the adit level. On the 1,000 foot level 300 feet of drifting and 200 feet of crosscutting was done. The showing on the 1,000 foot level was markedly inferior to that on the adit or even the 400 foot level and it was concluded to abandon work in this part of the mine. The rails, pumps and cars were removed and the shaft allowed to fill up to the adit level.

Present work on the property will be to relay the tracks in the adit level and explore the south end of the property.

In December 1918, Mr. Sidney S. Lang resigned as superintendent and was succeeded by Mr. J. Harry Reader.

New Arcadian Copper Company

Office: Houghton, Michigan.

President: Robert H. Shields.

Secretary and Treasurer: W. F. Miller.

General Manager: Robert H. Shields.

During 1918 the New Arcadian produced 10,195 tons yielding 164,794 pounds of copper or a little more than 16 pounds per ton. Owing to the shortage of labor and supplies the mine was closed down in September, 1918.

Total openings in the mine consist of 5,762 feet of drifting, 4,028 feet of crosscutting and the shaft has been sunk 1,860 feet.

Work during the year included a 520 foot crosscut on the 1,700 foot level to No. 8 conglomerate which was found to be 26 feet wide and carrying some fine copper but nothing of commercial grade. West of the shaft development work has disclosed a fault which displaces the New Arcadian vein 100 feet. On the 1,700 foot level the lode is 47 feet east of the shaft and on the 1,850 foot level the vein was located by a crosscut 62 feet west of the shaft. Drifting on the lode on these levels disclosed good copper ground. According to Mr. H. W. Fesing "Copper has been in evidence on all levels occurring in 'bunches' or 'pockets' some of which are very rich in mineral contents. The New Arcadian vein in all respects is very similar to the vein that is proving commercially valuable at the Isle Royale."

New Baltic Copper Company

Office: Houghton, Michigan.

President: Robert H. Shields.

Secretary and Treasurer: John Edwards.

A small amount of exploration was carried on at this property during 1918. Operations were suspended in September 1918.

North Lake Mining Company

Office: 60 Congress Street, Boston, Massachusetts.

Mine Office: Lake Mine, Ontonagon County, Michigan.

President: R. M. Edwards.

Secretary: A. L. Wyman.

Treasurer: Henry Tolman.

Superintendent: Thomas Bennett.

The North Lake is a prospect. Development work has disclosed a number of copper bearing amygdaloids of some promise but sufficient work has not as yet been done to determine if any of the amygdaloids carry enough copper to warrant mining.

Ojibway Mining Company

Office: 120 Broadway, New York.

Mine Office: Calumet, Michigan.

President: Thos. F. Cole.

Secretary and Treasurer: Frederick R. Kennedy.

General Manager: W. J. Uren.

This property has been idle since 1913.

Osceola Consolidated Mining Company

Office: 12 Ashburton Place, Boston, Massachusetts.

Mine office: Calumet, Michigan.

President: Eugene V. R. Thayer.

Secretary and Treasurer: Clarence H. Bissell.

General Manager: James MacNaughton.

Superintendent: F. H. Haller.

Osceola produced 1,194,967 tons yielding 15,919,647 pounds of refined copper or 13.3 pounds per ton. This is a decrease of 165,311 pounds from the production of 1917. The company had 3,701,040 pounds of copper on hand January 1, 1918 and delivered 16,380,996 pounds during the year, leaving a balance of 3,239,691 pounds on hand December 31, 1918.

The total cost of production exclusive of selling was \$2,812,920.66 or 17.67 cents per pound. The total receipts from sale of copper were \$3,997,884.36, an average of 24.41 cents per pound. The cost per pound of copper delivered in 1918 was 17.37 cents and gain on copper delivered was 7.04 cents. The net income of the Osceola Consolidated Mining Company was \$1,203,953.42; dividends paid during the year 1918 amounting to \$961,500.

Osceola Branch

The product for 1918 from the Osceola Company Mine was 230,517 tons yielding 3,252,233 pounds of refined copper or an average of 14.11 pounds per ton. The cost per ton was \$2.10. The product of copper for the Osceola Branch was nearly 30 percent more than last year and costs were lower in spite of greatly increased wages and labor shortage. The reduction of over two cents a pound on the cost of copper was due to a better grade of rock encountered in the mine, and to the concentration of effort toward labor saving devices and strict economy in the use of new material.

Mine operations were carried on through No. 6 shaft only. The most active and best part of the mine was above the 46th level near the extreme south and west boundaries between 2,000 and 3,500 feet south of No. 6 shaft. In the tunnel beyond the older workings a great deal of development right up to the LaSalle boundary has been done during the past five years, giving this branch a new lease of life. During 1918 a new level was opened above the 38th for a distance of 500 feet in very good ground. It can be driven one thousand feet before reaching the boundary with a probability of showing copper most of the way. The 39th level drift has been carried to within 100 feet of the boundary in rich ground. The 41st and 43d level drifts have reached a boundary in fair ground and stoping has been in progress along the boundary on every level from the 39th to the 45th throughout the year.

The 46th level drift was extended south during the latter part of the year in very lean ground. Stopes on the 47th and 48th levels have yielded a good tonnage, but of only fair grade rock. The total of new openings for the year amounted to 1,219 feet. No new construction was carried on at this branch aside from necessary improvements in miners change house and repairs.

North Kearsarge Branch

North Kearsarge produced 745,722 tons yielding 9,395,968 pounds of copper or an average of 12.6 pounds per ton. Mining

costs were \$1.69 per ton. This branch increased its product nearly ten percent over 1917 producing more copper than in any year since 1911. The grade of rock was only slightly better than last year, being practically the same as the average for the past eight years.

All three shafts were in commission throughout the year with no serious interruptions. No. 1 shaft produced the largest tonnage but during the last quarter the largest production came from No. 4 shaft. This was made possible with fewer men by the highly successful operation of storage battery locomotives on the 15th and 16th levels.

No. 1 shaft was timbered and equipped for three levels below the 35th. Preparations were made for the installation of electric haulage on the 34th and 35th levels of this shaft and the 31st and 32d levels of No. 3 shaft. The total new openings for this branch amounted to 501 ft.

South Kearsarge Branch

The product for the year amounted to 218,728 tons yielding 3,271,446 pounds of refined copper, an average of 14.96 pounds per ton; the cost per ton for the year was \$1.74. The shortage of labor accounted for the decrease of one-third in South Kearsarge product during 1918. The shortage of men resulted in closing down of No. 2 shaft the end of September and even No. 1 shaft did not have enough men to make a fair showing. The grade of rock stamped was slightly better than 1917.

Footwall mining yielded only a small tonnage this year and only 80,000 tons were secured from shaft pillars. The ground under the bottom level has been mined as far as possible and a hole was made from the Wolverine Mine to take the water when pumping in South Kearsarge is stopped.

In the early fall the old workings south of No. 2 shaft caved from the 14th level to the surface, but without damage to the shaft or loss of ground for mining. A gradual increased flow of water soon developed however, doubling the pumping expense but otherwise doing no harm.

General

In common with other subsidiaries of the Calumet and Hecla Mining Company there were two wage increases during the year, the first on May 1 and the second on October 1.

Quincy Mining Company

Office: 32 Broadway, New York, New York.

Mine office: Hancock, Michigan.

President: William R. Todd.

Secretary and Treasurer: W. A. O. Paul.

General Manager: Charles L. Lawton.

The product of the mine for 1918 was 1,174,147 tons yielding 19,948,965 pounds of refined copper an average of 16.99 pounds per ton. The total receipts from sale of refined copper were \$4,802,405.99 and from silver \$54,680.06 or a total of \$4,857,085.05; the total cost of production was \$3,733,133.25. The gain from sale of metal amounted to \$1,123,951.90. Miscellaneous receipts were \$81,475.02 and construction and accident accounts amounted to \$342,382.52 leaving a net income for the year of \$863,044.40. Dividends for 1918 amounted to \$935,000.00 and the company closed the year with a balance of assets of \$2,803,123.65. Mining operations were carried on along normal lines. The opening and development work total 24,580 feet and the amount of shaft sinking was 428 feet. In the progress of general mining operations openings on the several branches of the Pewabic lode were made at a great many different points and developed ground that varied but little in the average copper content from that of recent years and yielded about the same percentage of mass and barrel copper.

No. 7 shaft operated for the account of the Hancock Consolidated Mining Company until June 1 when operations of the shaft were suspended. No. 2 shaft produced the largest tonnage of stamp rock which, though of better tenor than that from No. 8 shaft, was lower than that from No. 6, the middle shaft. In No. 2 shaft, however, enough mass copper was found in the ground north of the shaft to make it produce the greatest amount of refined copper. No. 6 shaft produced a good grade of stamp rock throughout the year, although No. 8 shaft produced less refined copper than either of the other two shafts. The prospects for No. 8 shaft for 1919 are much better than they were a year ago for 1918 and in general the physical condition of the mine and the showing for copper at the beginning of the year 1919, compare well with that of one year ago.

A gradual flattening of the lode with depth has increased the difficulty of handling the rock from the flat foot walls of the stopes into the chutes and to the levels below and made it important to design a mechanical power scraper to do this work. The result of many experiments to this end was the perfecting of a power scraper adapted to the underground conditions at the Quincy. Several of these scrapers are now being successfully operated. The company has also experimented with an underground power shovel with encouraging results.

The Quincy Mining Company carried on a considerable construction program during 1918. During the year a new hoisting engine house for No. 2 shaft was practically completed. This engine house is of the latest design of reinforced concrete. The walls have red brick facings, the windows are all prism glass in steel frames; the roof is of concrete with tar felt sheathing and green tar. Other construction included expensive additions to both the stamp mills which are designed to house five 8 foot Marcy ball mills and two hundred forty additional tables.

Seneca Copper Corporation

Office: 11 Broadway, New York, New York.

Mine office: Calumet, Michigan.

President: Frederick Lewisohn.

Secretary: E. J. MacNamara.

Treasurer: E. C. Westervelt.

General Manager: W. J. Uren.

Operations at the Seneca consisted in the sinking of a new 3-compartment shaft which will reach the underlay of the Kearsarge lode from the Mohawk Mine.

South Lake Mining Company

Office: 60 Congress Street, Boston, Massachusetts.

Mine office: Lake Mine, Ontonagon County, Michigan.

President: R. N. Edwards.

Secretary and Treasurer: Arthur C. Paine.

Superintendent: T. H. Bennett.

South Lake mined 76,947 tons yielding 365,936 pounds of copper. Owing to the high cost of supplies and materials and labor shortage, the mine closed June 30.

The yield per ton was 47.55 pounds. This property is only a prospect but showing on the Evergreen series, particularly the Butler lode, is very encouraging and warrants further development.

Superior Copper Company

Office: 12 Ashburton Place, Boston, Massachusetts.

Mine office: Calumet, Michigan.

President: Rudolphe L. Agassiz.

Secretary and Treasurer: George G. Endicott.

General Manager: James MacNaughton.

Superintendent: Ocha Potter.

In 1918 Superior produced 120,464 tons yielding 1,676,446 pounds of refined copper or an average of 13.916 pounds per ton.

Superior had on hand January 1, 1918, 603,758 pounds and sold during the year 2,012,590 pounds, leaving a balance on hand December 31, 1918 of 267,614 pounds. The cost of production of the copper mined during the year was 25.06 cents per pound and the cost of the copper delivered was 23.29 cents. The copper delivered was sold for 24.22 cents leaving a gain on copper delivered of \$18,700.38 or .93 cents per pound, the net income for the year. The balance of miscellaneous receipts and charges brought the total net income of the year to \$51,780.31. The company closed the year with a balance of assets \$622,609.11.

No sinking was done at No. 1 shaft during the year and all development was confined to the West lode. The 23d level was extended 389 feet south to a total distance of 1,800 feet from the shaft. Very little copper was found.

The 25th level was drifted for a total of 884 feet disclosing about 100 feet of fair stoping ground. At the present time this drift is in very poor and narrow veins. The 31st level was extended 968 feet disclosing about 400 feet of stoping ground; 350 feet of which is almost continuous and of exceedingly good quality. No work aside from the necessary repairs was done at No. 2 shaft and there was no new construction during the year.

In common with other subsidiaries of the Calumet and Hecla Mining Company, there were two wage increases during the year; the first on May 1 and the second on October 1.

Trimountain Mining Company

(See Copper Range)

Victoria Copper Mining Company

Office: 60 Congress Street, Boston, Massachusetts.

President: Fred H. Williams.

Secretary: Sidney S. Millett.

Treasurer: James P. Graves.

Superintendent: George Hooper.

Victoria produced 106,730 tons yielding 1,533,536 pounds of copper, an average of 14.4 pounds per ton. This represents an increase of 2.6 pounds per ton over 1917 and is the highest yield per pound obtained by the Victoria Mining Company during the past eight years.

In common with all other Michigan copper companies, the Victoria had to contend with increasing cost and labor shortage which

accounts for the decrease of 30,000 tons over the production of 1917, however, the increased yield of copper resulted in a total product only slightly under the record of 1917.

White Pine Copper Company

Office: 12 Ashburton Place, Boston, Massachusetts.

Managing office: Calumet, Michigan.

Mine office: Ontonagon County, Michigan.

President: Rudolph L. Agassiz.

Secretary and Treasurer: George G. Endicott.

General Manager: James MacNaughton.

Superintendent: Thos. H. Wilcox.

The White Pine Mine produced 194,568 tons yielding 3,273,680 pounds of refined copper, an average of 16.83 pounds per ton. White Pine had 1,026,753 pounds on hand January 1, 1918 and delivered during the year 3,223,377 pounds leaving a balance on hand December 31, 1918 of 1,077,056 pounds. The product for the year was secured at a cost of 24.27 cents per pound and the total cost of copper delivered was 22.48 cents per pound which sold for 24.3 cents per pound leaving a gain on copper delivered of 1.82 cents per pound or 58,743.31 cents; the balance of miscellaneous receipts and charges brought the total net income to \$125,506.93. Dividends paid on preferred stock amounted to \$4,375 and the company closed the year with a balance of current assets December 31, 1918, of \$402,039.66.

No. 2 shaft was sunk 500.5 feet during the year. Its total depth is now 1,578.5 feet. Of this total depth 581 feet were vertical, 392 feet of curve and 605.5 feet of 45° underlay. At a point 1,300 feet from the surface 60 feet of badly faulted black and lead slate was encountered beyond which the strike and dip change to conform with that existing north of the main fault.

There was no sinking at No. 3 shaft which is 29.5 feet below the 6th level or 1,090 feet from surface. Openings on A. B. third and fourth levels disclosed good copper ground and stoping was started 800 feet east of the shaft on the 4th level (3d lobe) in rich ground. Third level openings west were in poor ground and east disclosed 300 feet showing fair values.

There was no sinking at No. 4 shaft during the year. This shaft is 12.2 feet below the 6th level or 978.4 feet from the surface. Developments were confined to the second 2½ and 3d levels.

At a point midway between the second and 2½ levels a drift stope east was driven 80 feet through fair ground. A crosscut on the 2½ level east was driven off 329 feet with a view of cutting

the 3d lode east of the fault as shown by diamond drill holes, but because of the very flat dip and broken condition of the ground the work was discontinued without discovering the lode; the 3d level (2d lode) was extended east 650 feet in fair ground.

Surface improvements were confined to building a new hoisting engine house and the installation of a new and larger hoist for No. 2 shaft and the erection of a concrete powder house.

A flotation plant has been installed and is a success. It has materially reduced tailing losses and has lengthened the life of the mine by making available lower grade rock and rock with copper in extremely fine state of sub-division. The tailing losses are still high compared to amygdaloid mines and the question of reducing them is a commercial one depending on the cost of finer grinding as balanced against copper obtained thereby.

There were two wage increases, on May 1 and October 1, respectively.

Winona Copper Company

Office: 60 Congress Street, Boston, Massachusetts.

Mine office: Winona, Houghton County, Michigan.

President: Thos. S. Wood.

Secretary and Treasurer: Arthur C. Paine.

Superintendent: G. A. Braun.

The Winona Mine was operated for the first four months of the year by Mr. R. R. Seeber, Lessee, during which period copper production was 756,826 pounds. On May 1 the Winona Copper Company assumed and continued operations for the balance of the year.

Copper production for the eight months of company operation was of 819,857 pounds, making a total of 1,576,683 pounds for the mine. The total expenditures amounted to \$284,020.04. The sale of copper netted \$166,228.38 and royalty and miscellaneous receipts brought the total to \$180,270.57. The net loss for the year was \$103,749.47.

Mr. Thomas S. Wood, President of the Winona, describes the general conditions at this mine as follows:

"The Winona Mine, including the King Philip property acquired in 1911, has been opened on the Winona-Isle Royale lode through six shafts, two of which have been abandoned. Although the workings cover a distance of one and one-half miles along the formation, at no point has developemnt work on a large scale been undertaken below the eleventh level.

"The lode is of good width, with a steep pitch favorable to economical mining. The rock is fine grained, hard and traversed by

numerous small seams filled with calcite. The masses of copper are comparatively few and small, while the metal in the stamp-rock is mostly in the form of disseminated particles and scales, difficult to recover by ordinary methods at the mill. All these characteristics warrant the belief that a considerable portion of the values once contained in the upper levels has leached downward and will be found lodged at greater depths.

"The Isle Royale Company, the one successful producer operating on the Winona-Isle Royale lode, developed good ground in No. 2 shaft only below the 25th level, although other shafts further south have been more fortunate. This mine showed high costs and deficits until production had been brought above 1,200 tons per day of rock yielding about as much copper as our own.

"Convinced that Winona can become a profitable producer only by following the methods through which Isle Royale has achieved success, your Directors have equipped the hoist at King Philip No. 1 shaft for deeper mining, believing, with many Michigan men, that our south ground gives promise of better copper at depth.

"Improved values must be found and extensive new openings made to furnish an output large enough to insure economical operation. At the mill, which requires few changes to permit the efficient treatment of over 1,250 tons daily, an oil flotation plant for saving the fine copper now lost in the tailings, is in process of installation and will be ready to operate later in the year.

"Because of market conditions, the mine was closed temporarily early in February. During the suspension our new superintendent, who took charge November 15 last at Winona, is working out a plan for consolidating the widely separated power plants of the two original mines, upon an economical basis.

"Winona is not yet a mine but is rather a large prospect with a costly surface equipment and mill, besides houses and timberlands, all together worth much more than the present market price of the stock. Before it can be classed as either a success or a failure, new explorations must be undertaken at depth on the Winona bed and on the lodes in the Baltic horizon approximately 2,500 feet further east."

Wolverine Copper Mining Company

Office: 15 Williams Street, New York, New York.

Mine Office: Calumet, Michigan.

President: L. P. Yandell.

Secretary: F. G. Heumann.

Treasurer: R. E. Graver.

General Manager: Theodore Dengler.

Superintendent: William R. Bolley.

The fiscal year of the Wolverine Copper Mining Company ends June 30. The product for the year ending June 30, 1918 was 4,608,865 pounds and for the year ending June 30, 1919, 4,562,617 pounds. The yield per ton stamped for the former period, was 15.185 pounds and for the latter period 15.306. The total operating costs for 1917-18 were 13.839 cents and for 1918-19, 12.064 cents. The total cost including smelting, marketing, depreciation and depletion for 1917-18 before providing for income and excess profit taxes was \$241,920.36. Dividends for this same period amounted to \$570,000 and the company closed the year with a balance of current assets of \$875,713.81. The net profit for the year 1918-19 was \$10,553.57. Dividends during the year amounted to \$150,000 and the company closed the year with a balance of current assets, \$847,811.95.

During the past two years a production of 7,337 tons has been obtained from the "West vein" through stoping on the fourth, fifth and sixth levels opposite No. 2 shaft. The "West vein" at this part of the mine is 46 feet distant from the Kearsarge lode. It is mineralized along the hanging wall for an average of 415 feet, copper occurring in frequent bunches sufficient in quantity to warrant mining the "West lode" simultaneously with operations on the main lode. The profitable mineralized portion does not appear to extend more than 300 feet laterally.

Approximately 40 percent of the total rock hoisted was obtained from cutting out the Kearsarge lode along the foot in old and recent stopes throughout the mine.

Early in 1919 South Kearsarge mine which was working bordering the Wolverine on the south, discontinued pumping in the lower levels. To provide for the safety of the Wolverine mine it became necessary to make a raise of 70 feet from the 29th level Wolverine, to the 24th level South Kearsarge. In this raise there were cemented one three inch and one four inch pipe fitted with control valves and pressure gauges on the Wolverine side of the boundary. To handle the water it has been necessary to double the pumping facilities of the Wolverine Mine and to install a 1,400 gallon boiler in No. 3 shaft. As an additional safeguard, concrete dams were built at the 38th and 39th levels south of No. 4 shaft which would serve to prevent any large volume of water going to the bottom of No. 4 shaft. Up to July 1 Wolverine handled 12,600,000 gallons of South Kearsarge water and is now handling 110,000 gallons per day in addition to its own. Considerable new construction work at the mill is being undertaken jointly with the Mohawk Mining

Company. A concrete building 42 x 42 x 18 feet upon a concrete foundation 12 feet high with steel trusses and composition roof and necessary foundations for machinery was constructed adjacent to the mill to accommodate a 1,250 KW 60 cycle, 3 phase 2,200 volt mixed pressure turbine and generator. This turbine will utilize exhaust steam from the stamp heads and is intended to furnish power to drive all the mill machinery in addition to three 7,000-gallon electrically-driven centrifugal pumps which are to be installed at the old pump house thereby eliminating the present boiler pumping plant. At the pump house work on an intake shaft and tunnel under the lake has been started. A shaft 6 x 10 feet outside timbers, has been sunk to a depth of 110 feet below the level of the lake, or a depth of 125 feet below the surface of the ground at the pump house. At a depth of 9 feet below lake level a pump station 12 x 13 feet was cut and the tunnel proper 6 x 7 feet inside driven for a distance of 1,420 feet on July 1. This tunnel will be driven 220 feet where a depth of 30 feet of water will be attained.

Wyandot Copper Company

Office: 68 Devonshire Street, Boston, Massachusetts.

Mine office: Houghton, Michigan.

President: Ashley Watson.

Secretary and Treasurer: Charles E. Adams.

This exploration has been idle since March 31, 1918. All work during the year ending March 31, 1918 was confined to further development of No. 8 lode on the 10th level. Drifts were extended northeast and southwest of the winze approximately 300 feet in either direction. Drift stoping was done west of the winze for a distance of 250 feet and a stope was finally started 30 feet west of the winze and 200 feet in length.

MICHIGAN COPPER PRODUCTION BY COMPANIES IN 1918

Alhceek Mining Company.....	24,851,235 lbs.
Altouez Mining Company.....	7,071,218
Calumet & Hecla Mining Company (Conglomerate).....	43,329,816 lbs.
Calumet & Hecla Mining Company (Amygdaloid).....	15,393,153
Calumet & Hecla Mining Company (Reclamation Plant).....	9,245,388
Calumet & Hecla Mining Company (All Operations).....	67,968,357
Centennial Copper Mining Company.....	2,492,857
Champion Copper Company.....	21,748,514
Copper Range Company (Baltic).....	10,406,097
Copper Range Company (Baltic Trinountain and 1/2 Champion).....	26,623,940
Franklin Mining Company.....	2,827,313
Hancock Consolidated Mining Company.....	3,041,514
Isle Royale Copper Company.....	15,442,508
Lake Copper Company.....	717,403
La Salle Copper Company.....	1,832,665
Mass Consolidated Mining Company.....	3,403,827
Michigan Copper Mining Company.....	1,177,176
Mohawk Mining Company.....	10,781,041
New Arcadian Copper Company.....	164,794
Osceola Consolidated Mining Company (Osceola Branch).....	3,252,233
Osceola Consolidated Mining Company (N. Kearsarge Branch).....	9,395,968
Osceola Consolidated Mining Company (S. Kearsarge Branch).....	3,271,446
Quincy Mining Company.....	15,919,647
South Lake Mining Company.....	19,948,965
Superior Copper Company.....	365,936
Trinountain Mining Company.....	1,676,446
Victoria Copper Mining Company.....	5,343,586
White Pine Copper Company.....	1,533,536
Winona Mine, R. R. Seebor, Lessee.....	3,273,680
Winona Copper Company.....	756,826
Wolverine Copper Mining Company.....	819,857
.....	4,608,865
Total.....	228,173,863 lbs.

SUMMARY OF FINANCIAL STATEMENT MICHIGAN COPPER MINING COMPANIES FOR 1918
COMPILED FROM ANNUAL REPORTS TO STOCKHOLDERS

	Balance of Assets (+) Liabilities (-) Dec. 31, 1918	Total production cost	Dividends paid 1918	Receipts.		Expended for Construction
				Sales of copper	Silver and Miscellaneous	
Alhceek.....	+\$2,006,907.87	\$3,552,829.88	\$1,600,000.00	\$6,950,160.69	\$105,983.10	\$57,242.29
Altouez.....	1,892,556.56	1,394,250.21	500,000.00	1,779,253.32	39,895.08	4,652.05
Calumet & Hecla.....	+12,865,923.76	14,310,679.45	5,500,000.00	19,027,052.27	2,679,791.23	1,179,585.32
Centennial.....	+4,714,882	464,857.49	180,000.00	553,373.69	5,061.05	.....
Champion.....	+2,079,762.35	2,616,267.83	1,280,000.00	5,384,208.35	23,859.86	.....
Copper Range.....	+6,007,528.02	5,298,829.60	2,366,394.00	9,481,563.88	307,149.93	9,310.26
Franklin.....	.....	10,750.59	.....	660,111.93	13,288.73	.....
Hancock.....	+1,134,322.21	869,549.38	375,000.00	917,092.48	113,343.96	196,053.24
Isle Royale.....	+220,836.96	2,549,957.31	.....	3,611,385.11	9,457.33	.....
Lake.....	.....	269,319.90	.....	142,382.01	.....	.....
La Salle.....	401,457.78	399,648.20	.....	452,562.23	35,346.45	.....
Mass.....	295,773.01	810,957.81	.....	693,547.87	14,439.58	.....
Marquette—Old Colony.....	.....	81,889.87*	.....	.....	1,462.05	2,299.99
Michigan.....	.....	290,242.21	.....	290,923.17	974.92	18,729.68
Mohawk.....	+2,208,397.80	1,578,452.10	1,000,000.00	2,417,580.50	60,226.73	113,371.56
New Arcadian.....	.....	54,712.66*	.....	.....	2,514.42	.....
Osceola.....	+2,652,969.76	2,832,929.69	961,500.00	3,997,884.36	84,351.26	55,781.15
Quincy.....	+2,803,123.65	3,735,153.29	955,000.00	4,802,405.09	136,165.08	306,382.52
Superior.....	+692,609.11	420,146.37	500,000.00	487,443.38	38,210.79	18,561.85
Trinountain.....	+3,127,821.42	1,042,450.74	.....	1,322,894.00	.....	.....
Victoria.....	.....	323,737.06	.....	366,452.30	.....	10,582.60
White Pine.....	+402,039.66	794,612.18	4,375.00**	783,392.37	72,220.42	14,042.19
Winona.....	.....	284,029.04	.....	166,228.38	14,042.19	.....
Wolverine (1917-18).....	875,713.81	872,345.81	570,000.00	965,123.44	16,520.45	53,682.31

*Development expense
**Paid on preferred stock

MINERAL RESOURCES OF MICHIGAN

SUMMARY OF RESULTS OBTAINED BY MICHIGAN COPPER MINING COMPANIES 1913-1918—Concluded.

	Tons of Ore treated.	Cost of mining, transportation, and stamping per ton.	Pounds of concentrate obtained.	Pound of refined copper produced.	Per cent of refined copper in concentrate.	Pounds of refined copper per ton of ore treated.	Cost per pound at mine, excluding construction.	Other costs per pound.*	Total cost per pound.	Price received for copper sold.
South Lake:										
1918	76,947			365,936						
1917	48,331			533,091						
1916	20,057		476,280	285,600	15.4	11.03				
1915	3,998.5			61,637						
1914										
1913										
Superior:										
1918	106,213	2.68		1,676,446		15.78	16.99	8.55	25.54	24.22
1917	129,587	2.50		2,201,672		16.99	14.74	2.14	16.88	29.39
1916	185,315	2.07		3,034,656		16.38	12.62	1.99	14.61	24.67
1915	212,051	1.78		3,866,484		18.23	10.31	1.98	12.29	18.12
1914	191,628	1.53		3,217,635		16.79	10.41	2.02	12.43	12.645
1913	130,826	2.36		2,992,765		22.87	10.31	2.55	12.86	15.378
Trimountain:										
1918	201,433			5,343,586		20.52			18.42	24,757
1917	264,655			6,278,097		23.72			15.22	28,735
1916	349,504			8,720,558		24.02			11.10	25.28
1915	349,684	2.02		8,302,896		18.75	9.95	1.15	9.52	17.40
1914	227,251	2.01	8,546,070	5,048,306		18.51	8.38	1.14	12.21	13.38
1913	229,149	2.51		4,990,938		21.78	10.78	1.43	12.62	14.89
Victoria:										
1918	106,730		2,631,693	1,533,536						
1917	137,286		2,568,396	1,612,640						
1916	146,690		2,262,244	1,661,832						
1915	133,984		2,272,430	1,499,695						
1914	124,842		2,273,890	1,486,242						
1913	137,163			1,438,693					15.75	15.23

MICHIGAN COPPER INDUSTRY IN 1918

	Tons of Ore treated.	Cost of mining, transportation, and stamping per ton.	Pounds of concentrate obtained.	Pound of refined copper produced.	Per cent of refined copper in concentrate.	Pounds of refined copper per ton of ore treated.	Cost per pound at mine, excluding construction.	Other costs per pound.*	Total cost per pound.	Price received for copper sold.
White Pine:										
1918	194,568	2.984		3,273,680		16.83	17.73	7.05	24.78	24.34
1917	212,889	2.365		4,067,529		19.11	12.38	2.61	14.99	28.30C
1916	188,890	2.082		4,207,449		22.27	9.35	3.35	12.70	25.26
1915	114,039	2.182		2,824,145		24.76	8.80	7.84	16.64	18.353
1914										
1913										
Winona:										
1918	57,837		1,359,055	819,857*		14.157				26.00
1917	112,082.55		2,640,780	1,494,472		13.33				29.05
1916	161,828.55		3,700,180	2,167,255		13.39				28.03
1915	102,594.05		3,032,045	1,722,638		16.79				17.4
1914	123,339		2,239,170	1,352,085		10.96				14.2
1913	120,806		2,467,460	1,448,737		11.99				15.4
Wolverine:										
1917-1918	303,498	1.914	6,961,500	4,608,865		15.185	12.604	6.323	18.927	24.2
1916-1917	352,845	1.63	8,753,945	5,856,889		66.95	9.28	2.26	11.54	29.15
1915-16	388,898	1.39	9,127,790	6,641,492		72.74	8.11	1.43	9.54	12.81
1914-15	397,614	1.30	9,734,850	7,250,866		18.23	7.13		8.43	14.09
1913-14	182,127	1.92	4,606,015	3,435,459		18.86	9.85		11.30	14.09
1912-13	388,502	1.62	10,782,405	8,350,312		21.49	7.55		8.656	15.89

*717,403 pounds copper additional produced from Winona Mine during first four months of 1918 by R. R. Seaber, Lessee.

TABLE OF AVERAGE COSTS, RECEIPTS AND PROFIT THEREON, AND AVERAGE RECOVERY OF COPPER AND SILVER PER TON FOR PERIOD 1911 TO 1918 OF TWENTY-NINE MINERAL INCLUDING OTHER MINING COMPANIES.

(Compiled from reports of mining companies to Appraiser of Mines for Board of State Tax Commission)

General Expenses	1911								1912								1913								1914								1915								1916								1917								1918							
	1911								1912								1913								1914								1915								1916								1917								1918							
Clerks and attendants, state and local taxes, general officers, fire insurance, legal expenses.....	0.72394c								0.80963								1.59236								1.16722								.82484								0.95255								1.07485								1.20714							
Exploration, Development and Construction.....	6.06801c								6.46588								7.50364								6.59243								5.48433								6.69507								8.5165								9.88072							
Milling, Smelting and Refining.....	0.49325c								0.73961								1.45094								0.80225c								0.62112								0.65944								1.46636								0.95431							
Cost beyond smelter—Transportation, cargo insurance, selling commissions.....	2.28828c								2.29757								2.63984								2.26352c								2.31851								2.6445								3.49551								4.34628							
Interest, depreciation, depletion and Federal taxes	0.30017c								0.28983								0.32622								0.32236								0.39357								0.73083								.38493								0.44558							
Total cost per pound.....	0.37372c								0.40261								1.86262								1.74080								1.37311								1.41832								2.80209								3.11130							
Average price per pound received for copper sold.....	10.24737c								11.00513								15.43562								13.28027								17.01548								13.10071								17.74024								19.94523							
Average price per ounce received for silver produced.....	13.16869c								16.39138								15.34106								13.25935								17.77394								25.42562								28.16403								24.38838							
Profit per pound.....	55.2335c								62.100								58.9094								53.9525								45.091								71.4883								75.05405								106.578							
Average pounds of refined copper produced per ton treated.....	3.0227c								5.52470								0.03154								0.09092								6.86940								12.48843								10.65892								4.65416							
Average fine ounces of silver per ton.....	20.037 lbs.								19.43689								19.4318								18.19686								20.72711								20.76721								20.235								20.1614							
	0.3675 oz.								0.43332								0.41595								0.37719								0.50673								0.47502								0.38016								0.42184							

AVERAGE STOCK QUOTATIONS MICHIGAN COPPER MINES, 1911-1918

Name of Company.....	Almeek	Algonah	Altoz	Bohemia	C. & H.	Central	Contact	Copper Range	Franklyn	Hancock	Indiana	Isle Royale	Keweenaw	Lake	LaSalle	Mass	May-flwr-Old	Michigan
No. of Shares.....	200,000	100,000	100,000	100,000	100,000	100,000	100,000	400,000	200,000	200,000	100,000	150,000	400,000	100,000	400,000	100,000	200,000	100,000
No. Outstanding.....	200,000	70,000	100,000	24,000	100,000	90,000	10,000	394,309	166,519	100,000	80,000	150,000	213,871	100,000	302,977	100,000	200,000	100,000
1918.....	76.66	244	49.19	1.4135	444.08	12.52	25	45.05	4.46	7.00	0.669	23.98	1.05	5.974	2.51	5.08	2.65	2.328
1917.....	95.35	61	60.81	1.4135	518.51	17.24	205	37.23	6.50	13.36	2.09	29.32	2.23	10.98	3.23	11.041	2.00	2.5504
1916.....	101.37	1.30	68.13	2.41	553.10	17.79	59	64.77	8.70	14.73	3.61	29.92	4.47	16.90	4.33	13.740	.....	3.0829
1915.....	95.95	1.88	50.74	2.177	512.00	17.79	575	48.41	8.50	15.83	5.29	25.69	2.25	13.09	5.35	9.993	.....	1.67
1914.....	275.32*	1.10	39.13	1.473	414.15	16.34	.30	30.11	4.09	16.22	4.19	19.86	3.31	11.34	4.29	3.587	.....	0.74015
1913.....	282.60*	1.15	34.33	1.828	438.58	13.88	30	41.19	5.00	17.84	7.81	21.37	1.80	11.21	3.92	3.11	.....	1.105
1912.....	209.36*	5.37	43.30	3.47	507.01	21.12	.93	56.47	11.50	29.63	16.39	30.24	1.63	36.39	5.80	7.07	.....	2.519
1911.....	171.33*	6.33	31.02	3.144	440.78	11.10	.....	39.53	9.203	22.23	11.21	14.92	2.09	32.33	4.08	6.60	.....	2.01

*On 100,000 shares.

Name.....	Mohawk	North Lake	Ojibway	Oscoda	Quincy	Seneca	South Lake	Superior	Victoria	Winona	Wolverine
No. of Shares.....	100,000	100,000	100,000	100,000	150,000	200,000	200,000	100,000	100,000	200,000	60,000
No. Outstanding.....	100,000	100,000	84,000	96,150	110,000	200,000	104,863	100,000	100,000	166,667	60,000
1918.....	58.59	.55	1.69	53.51	69.71	12.10	1.28	5.01	2.64	1.38	26.13
1917.....	78.84	1.19	1.69	80.27	81.50	9.32	3.26	9.25	3.88	3.45	41.01
1916.....	93.94	1.66	1.71	91.09	91.23	.....	6.46	17.36	4.92	5.16	54.20
1915.....	71.0913	1.76	.....	80	75.08	.....	5.93	27.93	2.47	3.30	54.14
1914.....	44.03	1.43	.....	76.04	58.50	.....	3.98	27.96	1.68	3.12	42.01
1913.....	45.899	1.54	.....	82.03	63.31	.....	4.81	25.56	1.29	2.08	50.30
1912.....	62.50	5.31	.....	112.95	83.96	.....	7.02	37.78	3.66	5.76	96.50
1911.....	42.946	6.21	.....	99.11	66.50	.....	5.83	30.30	2.03	6.87	104.23

IRON INDUSTRY

O. R. HAMILTON

IRON ORE INDUSTRY OF MICHIGAN 1918

GENERAL REVIEW

Michigan iron mines shipped 17,492,365 tons of ore in 1918, thereby being second in production in the United States. The three leading States of the twenty-six States producing iron ore were, in order, Minnesota, Michigan and Alabama.

Michigan mines making initial shipments in 1918 are the Monongahela in Iron County; The Athens, Bunker Hill, Francis and Maitland in Marquette County. The following shippers were dropped from the list in 1918: The Ravenna and Wickwire mines in Iron County; Queen Group, Stegmiller and Washington in Marquette County; and the Mikado in Gogebic County.

The Iron Trade Review credits the Lake Superior District with a total shipment in 1918 of 62,836,082 tons, of which Michigan shipped 27.8 percent.

Publication 27, Geological Series 22, Michigan Geological and Biological Survey, pages 123 to 131 inclusive, is given over to tables of analyses of Lake Superior iron ore shipments, prepared by W. L. Tinker. The writer submits a table of analyses of 1918 iron shipments from Michigan by grades. The variance of percentages from the general trend indicated in Publication 27 is traced back to the unusual demand on the mines during War-time production.

No comparison can be made here between Mr. Tinker's tables and the following statement of the Michigan shipment as the figures given by Mr. Tinker for the Gogebic Range included the shipment from Wisconsin. Likewise the Menominee Range included the ore shipped from Iron County, Michigan, Dickinson County, Michigan, and Florence County, Wisconsin. The Marquette Range takes in Marquette County and Baraga County of Michigan.

The tables of cost and production including 1918 are brought up to date in this volume. Figure No. 1 presents in a graphical manner the salient features of the iron industry for the years 1906 to 1918 inclusive. The total cost to the operator is the sum of "A"—Cost at the mine, "B"—Cost of delivery to Lake Erie ports, and "C"—Royalty. The difference between that sum total and the receipts from the sale of ore is "D"—The profit to the operators. However the item of royalty is generally considered that part of the profit earned by the mines which is shared with the fee owner and

MINERAL RESOURCES OF MICHIGAN

ANALYSES OF 1918 IRON ORE SHIPMENTS FROM MICHIGAN BY GRADES

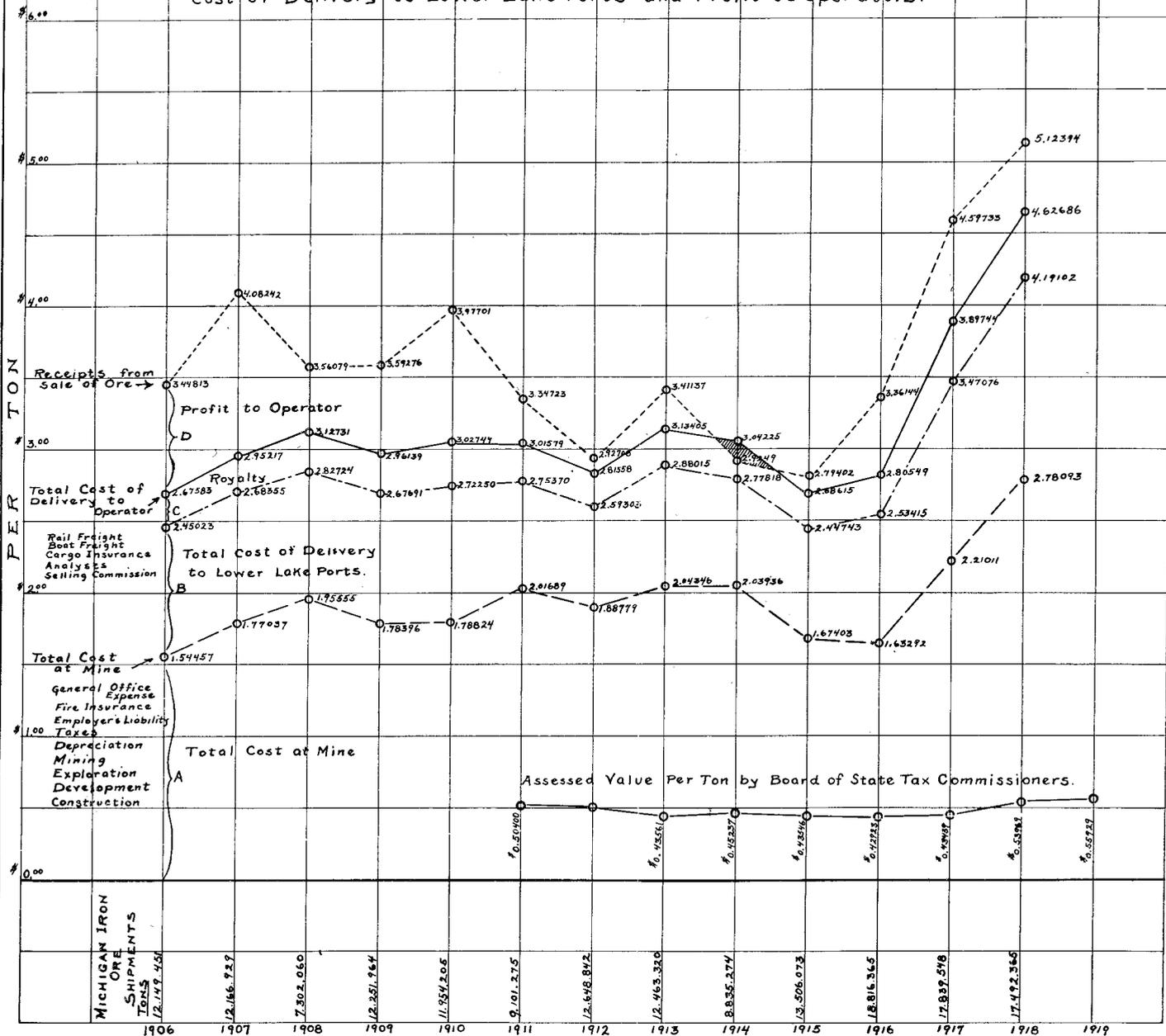
Range	Grade	Tons.	Highest		Lowest		Average**		Average of Totals	
			Iron (Natural).	Phosphorous (Natural).	Iron (Natural).	Phos (Nat.)	Iron (Nat.)	Phos (Nat.)	Iron (Nat.)	Phos. (Nat.)
Gogebic County.....	Bessemer.....	2,977,035	55.39	.041	38.77	.034	53.14	.037	52.06	.070
	Non-Bessemer.....	4,060,045	55.54	.079	42.48	.053	51.20	.094		
	*Unclassified.....	102,300								
	Total.....	7,139,380								
Iron County.....	Bessemer.....	None								
	Non-Bessemer.....	4,351,912	59.93	.350	35.46	.273	50.11	.421	50.11	.421
	*Unclassified.....	4,370,183								
	Total.....	4,370,183								
Dickinson County.....	Bessemer.....	428,197	56.87	.014	37.92	.016	47.47	.034	49.12	.046
	Non-Bessemer.....	1,180,600	55.42	.060	38.00	.046	49.82	.051		
	*Unclassified.....	1,193,989								
	Total.....	1,722,796								
Marquette and Baraga Counties.....	Bessemer.....	817,798	67.28	.038	46.31	.057	56.22	.042	52.20	.092
	Non-Bessemer.....	3,378,344	64.83	.064	37.22	.066	51.23	.104		
	*Unclassified.....	63,344								
	Total.....	4,259,396								
State of Michigan.....	Bessemer.....	4,292,940	67.28	.038	37.92	.016	53.16	.038	51.33	.162
	Non-Bessemer.....	12,971,501	64.83	.064	35.46	.273	50.73	.202		
	*Unclassified.....	207,321								
	Total.....	17,492,365								

*Unclassified as analyses were not available.

**Averages calculated from total units of iron and phosphorous.

MICHIGAN IRON MINES 1906 - 1919

Cost of Delivery to Lower Lake Ports and Profit to Operators.



ANALYSES OF 1918 IRON ORE SHIPMENTS FROM MICHIGAN BY GRADES

Range	Grade	Tons.	Highest		Lowest		Average**		Average of Totals	
			Iron (Natural).	Phosphorous (Natural).	Iron (Natural).	Phos. (Nat.)	Iron (Nat.)	Phos. (Nat.)	Iron (Nat.)	Phos. (Nat.)
Gogebic County.....	Bessemer.....	2,977,035	55.39	.041	38.77	.034	53.14	.037	50.00	...
	Non-Bessemer.....	4,060,645	55.54	.079	49.40	.033				
	*Unclassified									

is not allowed to the operator by the State Appraiser of Mines when calculating valuation of the mines for purposes of taxation.

From 1908 to 1914 the cost of production continued remarkably constant, then in 1914 to 1916 came the period of uncertainty due to the World War. However the years 1917 and 1918 express clearly the great confidence industry placed in the Government's supervision of the Steel Market and production was speeded up at a greatly increased cost as the army withdrew workmen from the mines and factories, thereby increasing the cost of labor and supplies while a similar effect was felt in the high rail and boat freights. Let us compare the costs of the normal year 1909 and those of 1918.

The figures compared represent average of total costs to all operators.

	1909	1918
<i>Cost of Mining per ton</i>		
1. General office expenses.....	\$0.05704	\$0.11259
2. Fire Insurance.....	.00409	.00525
3. Employers Liability Insurance.....	.00399	.02976
4. Taxes.....	.06869	.15165
5. Depreciation.....	.12421	.22317
6. Mining.....	1.30734	1.98474
7. Exploration and Development.....	.09864	.02724
8. Construction.....	.11996	.24651
9. Total "Cost at Mine".....	1.78396	2.78091
<i>"Beyond the Mine" Cost per ton</i>		
0. Rail freight.....	.34590	.63736
1. Boat freight.....	.49555	.72959
2. Cargo Insurance.....	.00150	.00191
3. Analyses at Lower Lake Ports.....	.00239	.00419
4. Selling Commissions.....	.04023	.03704
Unclassified.....	.00738	None
5. Total "Beyond the Mine" Cost.....	.89295	1.41009
6. Total Cost of Delivery.....	2.67691	4.19100
7. Royalty.....	.28448	.43584
8. Total Cost of Delivery to Operator.....	2.96139	4.62684
<i>Profit and Loss</i>		
9. Receipts from Sale of Ore.....	3.59276	5.12394
10. Net Profit to Operator.....	.63137	.49710
11. Total profit (Operator's profit plus royalty and depreciation)	1.04006	1.15611

Over the period 1908 to 1914 the fluctuation of costs of production was slight, the difference between the highest figure and the lowest being only thirty-two cents a ton, whereas the market price of iron ore varied from \$2.92 to \$3.97 a ton, in fact an actual loss of twelve cents a ton on the 1914 volume of business was sustained by the operators if we recognize royalty a part of the cost of production.

It will be noted that the royalty item jumped from \$0.27134 a ton in 1916 to \$0.42668 in 1917 and \$0.43584 in 1918. This increase due to the large output of certain large mines which pay a much higher royalty than the average of the Michigan producers prior to 1917. The other increases shown in the comparative table of costs are directly due to increased cost of labor and supplies.

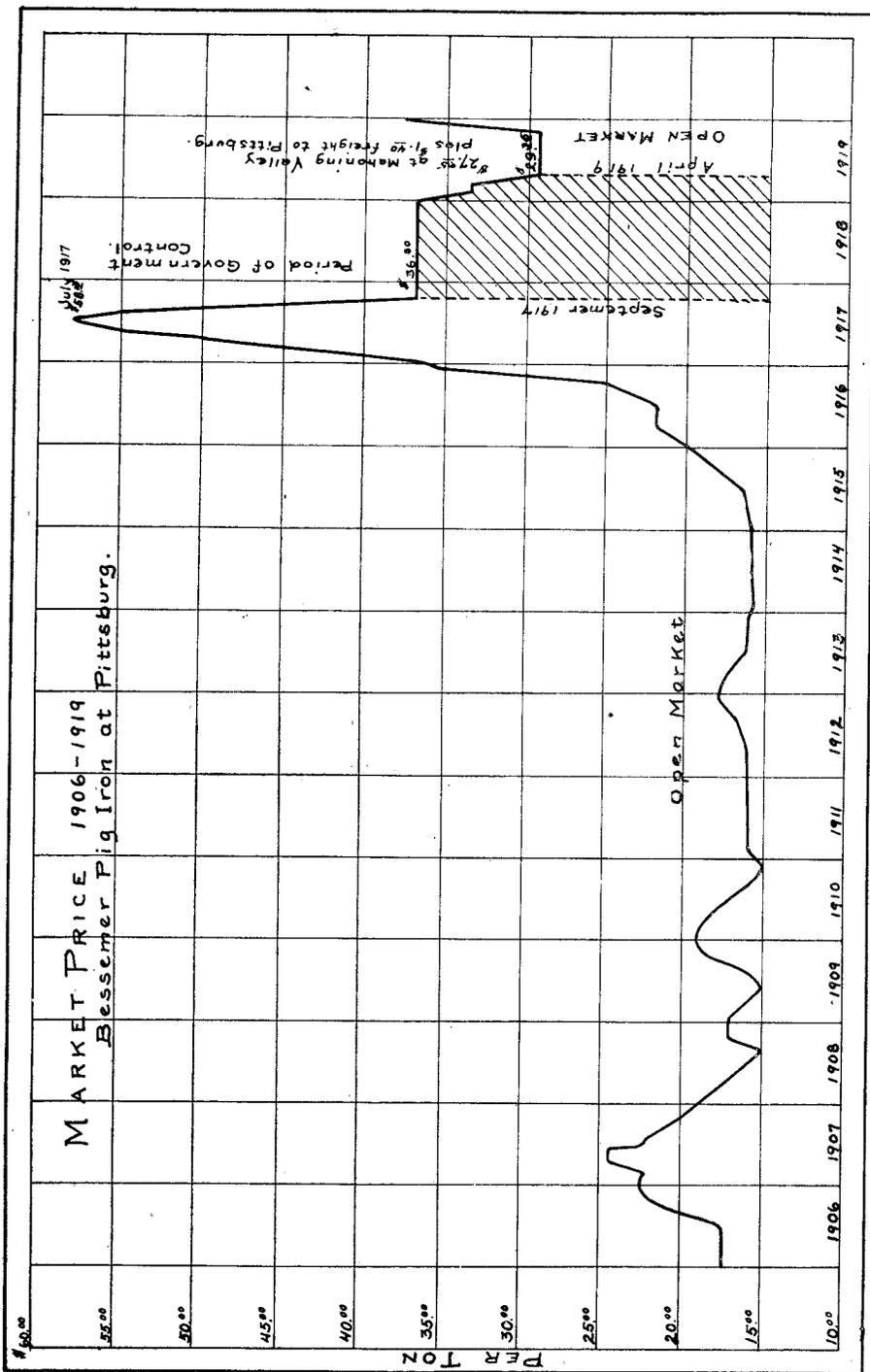


Fig. 2.

Figure No. 2 shows the trend of the market for Bessemer pig iron, given here for the benefit of those who wish to follow the iron ore beyond the Lake Erie ports. The curve was plotted from the average market prices of Bessemer pig iron for each month in the years 1906 to 1918 inclusive. Government control extended over the time from September 1917 to April 1919. Bessemer pig iron was chosen as a representative grade for which the standard specifications are:

1. Not more than 0.10 percent of phosphorus.
2. At least 1.00 percent of silicon.
3. Not over 0.05 percent of sulfur.

For this purpose then Bessemer pig iron must be made from Bessemer iron ores which average less than 0.05 percent phosphorus as it requires approximately 1.8 tons of ore to produce one ton of pig iron.

Quoting from the Report of the Commissioner of Corporations on the Steel Industry, Part III, printed in 1913, the average book cost of Bessemer pig iron produced by the furnaces of the Steel Trust 1902 to 1906 inclusive, are given, representing a production of 51,902,699 tons.

Average costs per gross ton	
Net metallic mixture.....	\$ 7.30 (\$3.97 ÷ .544)
Coke.....	3.89
Limestone.....	.43
Labor.....	.77
Steam.....	.12
Materials in repairs and maintenance.....	.16
Supplies and tools.....	.13
Miscellaneous and general works expense.....	.26
Relining and renewals.....	.18
Contingent fund.....	.02
Total furnace cost.....	\$13.26
Additional cost.....	
General and miscellaneous.....	.36
Depreciation.....	.39
Total book cost.....	\$14.01
Total cost in 1906 was.....	\$14.50 per gross ton.
For the above the price of gross metallic mixture was.....	\$4.07
Price of net metallic mixture was.....	3.97
Percent of yield.....	54.4
Pounds of coke used per ton of product.....	2,311
Price of coke per net.....	\$3.37

The price of Old Range Bessemer Ore delivered at Lake Erie ports in 1906 ranged from \$4.00 to \$4.25 per ton. Average of \$4.15 per ton. Price of net metallic mixture, \$4.05. $4.05 \div .537 = \$7.55$, the price of net metallic mixture to produce one ton of Bessemer pig iron in 1906.

The Steel Corporation's profit on Bessemer pig iron 1902-1906 was \$4.48 a ton, figuring from the book cost of \$13.54 which was reduced to \$11.61 by excluding transfer profits.

A comparison of the data presented by Figure No. 1 and Figure No. 2 indicates that the iron mining business has not received its share of the earnings of the steel business. The raw material is delivered to Lower Lake Ports at a market price relatively lower than that received for the product of the furnaces.

Figure No. 3 anticipates the 1919 shipment which can be only estimated at this time. The Lake Superior shipment for 1919 is not expected to exceed 50,000,000 tons, of which Michigan will ship approximately 13,500,000 tons. Plotting that amount in the production chart, the resulting curve expresses the impetus given the steel industry by War conditions.

IRON INDUSTRY

STATISTICAL TABLES

IRON ORE SHIPMENTS FROM THE MARQUETTE RANGE⁷

Name of Mine.	1909 and prior years.	1910.	1911.	1912.
Adams (D. S. S. & A. Rt. of Way)				
American (Sterling)	240,336	163,290	195,197	122,211
Ames	6,298			
Athens				
Barnum (Cliff Shaft) ¹	801,851			
Bay State	16,637			
Bessemer (See Lillie)				
Bessie	59,097			
Beaufort (Ohio)	566,705	23,427	2,683	
Blue (See Queen Group)				
Boston (with American)	62,542			
Braastad	136,636			
{ Mitchell				
{ Winthrop	831,445			
Breitung No. 1			63,497	57,085
Breitung Hematite No. 2	346,583	114,202	72,688	63,995
Buffalo ²	217,730			
Cambria	2,037,717	150,422	85,954	69,904
Champion	4,394,385	18,746		
Chase				
Chester (See Rolling Mill)				
Chicago	9,012			
Cleveland ³	2,806,298			
Cleveland Hematite (Included under Cleveland)				
Cleveland Cliffs Group ⁴	15,239,906	955,374	514,305	1,032,836
Columbia (Kloman)	94,813			
Curry	16,671			
Dalliba (Phoenix)	59,114			
Detroit	140,841			
Dexter	118,512			
Dey	2,709			
East Champion	76,002			
East New York	327,604			
Edison	893			
Edwards (See Sampson)				
Empire	203,095	53,687	16,954	33,124
Erie	8,136			
Etna	1,091			
Fitch	31,817			
Foster ⁵	171,893			
Foxdale	31,447			
Gibson	16,357			
Goodrich	49,754			
Grand Rapids (Davis)	110,736			
Green Bay (See Bay State)				
Hartford	1,766,951	183,471		
Himrod				
Holmes				
Hortense (North Champion)	30,574			
Home (P. and L. S.) (Now Volunteer)	26,022			
Humboldt (Washington)	713,961			
Imperial	376,691	83,404	86,959	53,943
Indiana (See Bay State)				
Iron Cliffs ⁶	1,700,537			
Iron Mountain	393			
Isabella				
Jackson	3,879,513	40,320	22,303	53,559
Keystone (See East Champion)				
Lake ¹⁰				
Lake Angeline	8,285,459	244,923	167,258	151,910
Lake Superior	14,931,563	271,445	167,352	169,326
Lillie	1,748,490	10,121	25,597	26,119
Lloyd (See Morris-Lloyd) ⁴				
Lucy (McComber)	519,031	11,257	16,676	72,724
Maas	220,611	208,103	24,926	46,664
Magnetic (Stock Pile)	292			
Maitland				
Manganese (Negaunee)	6,359			

See foot notes 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 on page 72.

IRON ORE SHIPMENTS FROM THE MARQUETTE RANGE

1913.	1914.	1915.	1916.	1917.	1918.	Total.
162,253	84,845	87,514	246,163	22,560	32,924	55,484
				142,488	120,714	1,565,011
					23,096	6,298
						23,096
						801,851
						16,637
		21,139	40,007	108,901	3,229	59,097
						766,091
						62,542
						136,636
						831,445
30,994	49,590	74,107	70,328	109,962	95,568	551,131
83,280	27,705	76,620	80,655	80,073	98,182	1,043,983
169,153	132,834	159,443	195,612	114,283	143,305	217,730
						3,258,627
						4,413,131
52,930	19,708	39,059	72,344			184,041
						9,012
						2,806,298
922,005	672,428	631,358	1,022,461	933,803	954,542	22,879,018
						94,813
						16,671
						59,114
						140,841
						118,512
						2,709
						76,002
						327,604
						893
38,348			47,110	38,393	45,947	476,658
						8,136
						1,091
						31,817
						171,893
						31,447
						16,357
						49,754
						110,736
						1,950,422
	14,466	44,669	65,029	80,092	65,358	269,614
		17,373	3,379	53,726	117,957	192,435
						30,574
						26,022
						713,961
37,543						638,540
						1,700,537
		10,807	5,893			17,093
		36,255	97,368	63,276	84,133	281,032
1,519	20,241	56,026		47,836	15,879	4,137,196
102,762	128,073	19,513		54,673	50,947	9,205,518
164,834	133,519	199,920	422,473	312,500	345,708	17,118,640
						1,810,327
						619,688
171,475	55,903	267,190	259,897	313,399	354,410	1,922,578
						292
					19,580	19,580
						6,359

See foot notes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 on page 73.

IRON ORE SHIPMENTS FROM THE MARQUETTE RANGE

Name of Mine.	1909 and prior years.	1910.	1911.	1912.
Marquette ¹	152,847			
Mary Charlotte	1,057,184	197,522	340,335	250,700
Mesabi's Friend	16,043			
Michigamme ⁶	880,362			
Miller	4,756			
Milwaukee-Davis	375,451		7,781	11,536
Mitchell	29,319	23,428	21,387	21,141
Moore	68,131			
Morris-Lloyd			28,003	45,749
National	150,216			
Negaunee	3,562,127	348,818	140,040	442,190
Negaunee Construction Works	12,708			
New York (York)	1,123,071			
New York Hematite	37,587			
North Champion (See Hortense)				
North Republic	289			
Nonpareil (St. Lawrence)	23,395			
Northwest	1,687			
Norwood	5,753			
Ogden	986			
Pascoe	59,806			
Pendill	45,993			
Palmer	14,172			
Palmer (Cascade) (See Volunteer)				
Pioneer	15,409			
Pittsburgh & Lake Angeline (See Lake Angeline)				
Platt	73,844			
Portland	79,652	49,584		
Primrose	6,040			
Prince of Wales	32,415			
Quartz	491			
Queen ²	180,866			
Queen Groups ³	5,315,998	230,119	295,962	224,862
Republic	6,193,469	150,732	113,137	156,867
Republic Reduction Co.	47,174			
Richards	8,261			
Richmond	688,455	95,772	47,293	117,873
Riverside	16,160			
Rolling Mill	578,916	115,193	96,584	115,784
Saginaw	451,424			
Salisbury ⁵	686,411			
Sam Mitchell (See Mitchell)				
Sampson (Argyle)	267,805			
Schadt	1,261			
Section 12	21,887			
South Buffalo ²	245,412			
Spurr	165,244			
Star West (Wheat)	204,649			
St. Lawrence (See Nonpareil)				
Sterling (See American)				
Taylor	32,970			
Teal Lake (See Cambria)				
Titan	90,371			
Volunteer (See also Home)	1,393,175		51,240	9,008
Washington	65,341	96,769	62,010	66,540
Webster	34,905			
West Republic	133,077			
Wetmore	50,870			
Wheeling	433,771			
Winthrop ²	1,335,839			
Wheat (See Star West)				
Totals	89,914,555	3,840,129	2,666,121	3,415,650

See foot notes 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 on page 72.

IRON ORE SHIPMENTS FROM THE MARQUETTE RANGE—Concluded

1913.	1914.	1915.	1916.	1917.	1918.	Total.
						152,847
262,431	57,138	159,817	164,447	165,461	213,023	2,868,058
						16,043
						880,362
						4,756
						411,650
10,310		6,572				111,245
15,970						68,131
154,140	152,274	276,521	339,598	303,253	315,540	1,615,078
						150,216
327,447	247,484	480,521	523,735	573,760	501,968	7,148,090
						12,708
						1,123,071
						37,587
						289
						23,395
						1,687
						5,753
						986
						59,806
						45,993
						14,172
						15,409
						73,844
						272,036
						6,040
						32,415
						491
						180,866
						7,327,077
235,648	178,574	473,961	283,775	88,178		7,546,308
135,879	52,562	215,182	209,059	168,250	151,171	
						47,174
						8,261
						1,866,580
						16,160
138,394	129,551	177,304	181,154	147,824	142,960	1,552,617
163,287	98,010	130,900	253,943			
						451,424
						686,411
						267,805
						1,261
						21,887
						245,412
						165,244
						204,649
						32,970
						90,371
						1,688,725
47,220	38,438	118,851	106,987	23,806		371,727
60,171	1,659		6,631	12,606		
						34,905
						133,077
						50,870
						433,771
						1,335,839
3,487,993	2,340,326	3,778,098	4,698,048	3,959,103	3,896,141	121,996,164

See foot notes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 on page 73.

- ¹Under Iron Cliffs 1890-1895; under Cleveland-Cliffs group after 1895.
²Under Queen group after 1890.
³Under Cleveland-Cliffs group after 1883.
⁴Includes Cleveland after 1883; includes Barnum, Foster, Iron Cliffs, Michigamme and Salisbury after 1895. 1911 on Cliffs Shaft, Lake and Salisbury.
⁵Under Iron Cliffs 1891-1895; under Cleveland-Cliffs group after 1895.
⁶Under Cleveland-Cliffs group after 1895.
⁷Under Winthrop after 1892.
⁸Includes Buffalo, Prince of Wales, Queen and South Buffalo after 1890.
⁹Prior to 1890, see Braastad; includes Marquette after 1892.
¹⁰Included in Cleveland-Cliffs group.

- ¹Iron Trade Review reports 152,063 tons shipped in 1915 by Breitung Hematite No. 1 and No. 2 combined.
²See foot note No. 1.
³Iron Trade Review reports 634,837 tons shipped in 1915.
⁴Iron Trade Review reports 203,922 tons shipped in 1915 by Mary Charlotte. Figure includes Himrod shipment.
⁵See foot note No. 4.
⁶Isabella shipment not reported by Iron Trade Review.
⁷Does not include Gwinn district. Does not include west end of range in Baraga County.
⁸Iron Trade Review figure.
⁹Iron Trade Review reports 177,000 tons shipped in 1915.
¹⁰Iron Trade Review reports 130,902 tons shipped in 1915.
¹¹Iron Trade Review reports 18,850 tons shipped in 1915.
Total for Marquette range 1915, Iron Trade Review, 3,748,951 tons. See foot note No. 7.

IRON ORE SHIPMENTS FROM THE GWINN DISTRICT. (GROSS TONS)

	1909 and prior years.	1910.	1911.	1912.
(Austin).....	433,037	188,588	110,839	102,530
Francis.....			203	
Gwinn.....				143,519
(Princeton) Swanzy or Chesire.....	1,271,171	89,441	54,442	50,963
Stegmiller.....	39,869	48,842	45,122	214,386
(Stephenson).....	122,968	225,726	135,474	
Total.....	1,867,045	552,597	346,107	511,398

IRON ORE SHIPMENTS FROM THE GOGEBIC RANGE, MICHIGAN

	1909 and prior years.	1910.	1911.	1912.
Ada (included in Ironton).....			310	55,610
Anvil and North Anvil (*).....	721,272	7,235		211,927
Ashland.....	5,387,156	231,506	151,478	70,239
Asteroid.....			20,569	
Aurora (Norrie-Aurora Group after 1904).....	3,961,684			
Bessemer.....	20,889			
Blue Jacket.....	1,799			
Brotherton.....	1,752,498	102,626	65,015	148,930
Castile.....	35,247	20,197	23,597	136,703
Chicago.....	68,727			
Colby.....	2,450,348	194,754	41,673	245,195
Davis (Wisconsin).....	103,961			
Eureka.....	462,134	41,611	98,609	65,723
Federal.....	36,443			
First National.....	1,997			
Geneva.....	7,108			
Imperial (See Federal).....				
Iron Chief.....	12,199			
Iron Chief No. 2.....	551			
Iron King (See Newport).....				
Ironton.....	849,885	109,025	63,359	173,135
Jack Pot.....	99,090			
Meteor (Comet).....	216,367			
Mikado.....	997,085	52,715		
New Davis (See Davis).....				
Newport and Bonnie.....	5,845,039	1,182,324	555,853	966,435
Norrie-Aurora Group (after 1904).....	17,744,658	1,333,006	883,910	1,500,758
Palms (See Aurora) Norrie- Aurora Group).....	2,366,583			39,152
Pike.....	1,284,489	3,324		
Plymouth.....	98,732			
Puritan (Ruby).....	109,572	50,019		90,683
Royal.....				
Section 13, North Newport.....				
South Chicago.....				
Sparta.....	4,862			
Sunday Lake.....	1,306,975	115,486	56,096	155,485
Tilden.....	5,088,635	99,937	138,387	158,181
Townsite (formerly Norrie).....				
Vaughan (See Aurora) Norrie- Aurora Group after 1904).....				
Wakefield.....				
Wisconsin (See Davis).....				
Yale (West Colby).....	373,173	108,253	154,944	76,772
Total.....	51,409,158	3,652,018	2,253,800	4,094,938

*Iron Trade Review.

†Iron Trade Review reports 112,932 tons shipped 1915. The figure includes 17,692 tons shipped from the Minnewawa (Wisconsin).

‡Iron Trade Review reports 1,408,516 tons shipped 1915.

§Iron Trade Review reports 838,875 tons shipped 1915.

¶Iron Trade Review reports 442,422 tons shipped 1915.

‡North Anvil operates under the name of Keweenaw. Shipped 141,756 tons in 1918.

IRON ORE SHIPMENTS FROM THE GWINN DISTRICT. (GROSS TONS)

1913.	1914.	1915.	1916.	1917.	1918.	Total.
107,365	30,493		64,521	44,420	8,533	1,090,326
					30,775	30,775
	20,159	57,910	143,708	188,070	182,541	592,618
53,479	13,607	817,171		150,375	66,244	1,859,449
45,431	40,972	40,272	65,420	41,526		418,417
96,298	93,796	243,458	368,739	496,712	75,162	2,072,719
302,573	199,027	358,811	642,388	921,103	363,255	6,064,304

IRON ORE SHIPMENTS FROM THE GOGEBIC RANGE, MICHIGAN

1913.	1914.	1915.	1916.	1917.	1918.	Total.
238	5,771	744,749	120,355	183,525	156,033	1,295,098
2,635	123,702	794,622	70,466	27,636	41,486	6,342,614
42,419	135,120	13,468	88,867	93,265	121,153	585,100
						3,961,684
						20,889
						1,799
70,138	47,662	107,244	107,814	84,524	6,904	2,493,355
57,595	36,569	675,596	131,422	82,248	73,065	672,239
		30,977				99,704
305,744	291,947	315,913	423,553	353,880	324,731	4,937,738
14,562	23,430	128,414	206,319	191,631	2,820	1,422,129
					36,443	1,997
31,303		34,416	86,922	113,804	126,250	399,803
						12,199
						551
166,123	51,138		148,200	244,517	184,627	1,990,009
						99,090
33,111	2,094	1,044	23,741	30,833		216,367
		5,434	4,997	28,234		1,140,623
1,139,666	702,861	4835,058	1,310,595	998,193	1,035,673	14,571,697
1,503,451	985,199	1,407,770	1,855,863	1,646,606	1,550,802	30,412,023
88,644	173,792	444,673	528,746	475,352	677,415	2,366,583
						3,712,263
						102,056
			330,496	655,284	821,867	1,810,647
64,463	58,410	80,367	305,534	224,082	218,243	1,204,373
10,659	11,686	8,004	11,527	30,302	33,561	105,739
3,844		32,356	48,070	13,737	728	98,735
		1,274				1,274
110,374	54,327	136,211	188,771	198,144	131,426	4,862
97,686	114,777	99,516	110,733	108,641	126,149	2,453,285
				25,965	83,428	6,142,652
15,261	313,050	651,302	1,061,753	1,116,802	1,130,432	4,288,600
59,482	19,074	42,632	149,155	73,633	103,491	1,190,609
3,847,398	3,150,609	4,591,040	7,316,899	7,003,838	7,139,980	94,449,678

†Iron Trade Review reports 76,702 tons shipped 1915.

‡Iron Trade Review reports 45,171 tons shipped 1915.

§Iron Trade Review reports 40,248 tons shipped 1915.

¶Total for Gogebic range 1915 Iron Trade Review 4,595,498 tons.

‡Total for Gwinn district 1915 Iron Trade Review 358,787 tons.

IRON ORE SHIPMENTS FROM THE MENOMINEE DISTRICT, MICHIGAN

	1909 and prior years.	1910.	1911.	1912.
Antoine.....	1,353,792			
Aragon.....	5,836,279	241,046	201,269	244,812
Breen.....	75,425			
Briar Hill.....	14,981			
Chapin.....	16,182,416	465,543	357,598	327,999
Clifford & Traders.....	103,626	91,081	90,940	74,144
Cornell.....	49,302			
Cuff.....	58,419			
Cundy.....	814,889			
Curry.....	416,928			
Cyclops.....	286,093			
Eleanor (Appleton).....	18,719			
Emmett.....	66,655			
Forest.....	11,988			
Half and Half.....	7,524			
Hamilton.....	96,072			
Hersel.....	955			
Indiana.....	17,871			
Keel Ridge.....	93,101			
Loretto.....	1,195,020	116,048	18,579	135,177
Ludington.....	1,001,518			
Millie (Hewitt).....	368,265		18,556	
Munro.....	278,556	20,022	9,303	20,100
Norway.....	1,291,352			
Penn Iron Mining Co.....	4,837,348	344,760	377,026	426,743
Perry.....	3,138			
Pewabic.....	6,917,740	380,376	352,598	279,771
Quinnesec.....	502,903	744		
Saginaw (Perkins).....	501,985			
Stephenson.....	39,350			
Sturgeon River.....	19,404			
Verona.....	130,975			
Vivian.....	405,412	14,827	5,971	28,800
Vulcan (with Penn Mines).....	1,668,654			
Walpole.....	19,089			
Total.....	44,685,744	1,674,447	1,431,840	1,537,546
METROPOLITAN TROUGH.				
Groveland.....	74,092	26,462	33,758	12,468
Metropolitan.....	107,027			
Northwestern.....	35,810			
Total.....	216,929	26,462	33,758	12,468
CALUMET TROUGH.				
Calumet.....	121,354			35,587

IRON ORE SHIPMENTS FROM THE MENOMINEE DISTRICT, MICHIGAN

1913.	1914.	1915.	1916.	1917.	1918.	Total.
						1,353,792
230,958	188,765	302,275	244,478	276,434	305,726	8,072,042
						75,425
369,822	341,493	385,174	557,485	682,349	705,803	14,931
						20,375,682
95,311	66,329		113,362	115,823	118,494	869,110
						49,302
						58,419
						814,889
						416,928
						286,093
						18,719
						66,655
						11,988
						7,524
						96,072
						955
		52,570	44,162	46,479	59,220	220,302
158,257	45,449	68,806	174,173	193,951	155,891	93,101
						2,261,351
						1,001,518
18,509	361		17,622	46,960	53,031	387,182
						464,103
416,410	214,827	368,451	419,340	459,844	210,632	1,291,352
						8,075,381
364,176	299,228	178,013	301,125	153,256	113,999	3,138
						9,340,282
						503,647
						501,985
						39,350
						19,404
27,177						130,975
						482,187
						1,668,654
						19,089
1,680,620	1,156,452	1,355,289	1,871,747	1,975,096	1,722,796	59,091,577
9,251						156,031
						107,027
						35,810
9,251						298,868
18,976						175,917

¹Iron Trade Review reports 384,654 tons shipped 1915.

²Iron Trade Review reports 411,393 tons shipped 1915.

Total for Menominee range 1915 Iron Trade Review 1,397,711 tons.

IRON ORE SHIPMENTS FROM THE CRYSTAL FALLS DISTRICT, MICHIGAN

	1909 and prior years.	1910.	1911.	1912.
Alpha.....	1,370			
Amasa Porter.....				
Armenia.....	311,608	65,473	51,862	150,808
Balkan.....				
Bristol (Clair).....	2,185,367	270,742	322,729	438,900
Carpenter.....				
Columbia.....	942,703			
Crystal Falls.....	1,735,251			
Delphic.....	33,770			
Dunn.....	1,521,871	136,144	232,092	242,304
Fairbanks.....	8,500			
Genesee (Ethel).....	471,439	66,185	25,342	4,248
Gibson.....	57,151	45,202	56,528	
Great Western.....	1,872,229	80,709	84,338	3,342
Hemlock.....	1,589,818	115,407	107,753	126,132
Hilltop.....	20,229			
Hollister.....	46,982	49,434	5,022	
Hope.....	28,530			
Judson.....				
Kimball.....	16,224			
Lamont (Monitor).....	555,341	3,183		
Lee Peck.....	2,844			
Lincoln.....	241,627			
Magnate.....	6,844			
Mansfield.....	1,102,998	114,357	54,646	
Mastodon.....	425,708			
McDonald.....	1,114	6,022	5,240	1,384
Michigan.....	153,787	17,922		
Monongahela.....	9,310			
Oggers.....				
Paint River (Fairbanks).....	371,289			
Ravenna.....			127	18,303
Richards.....				
Sheldon & Shafer (Union) (See Columbia).....	8,203			
South Mastodon.....	1,394,737	235,812	308,346	319,318
Tobin.....				
Victoria.....				
Warner.....				
Youngstown.....	151,425			
Total.....	15,268,269	1,206,592	1,254,135	1,304,739

IRON ORE SHIPMENTS FROM THE CRYSTAL FALLS DISTRICT, MICHIGAN

1913.	1914.	1915.	1916.	1917.	1918.	Total.
			80,492	116,762	65,325	1,370
						262,579
83,202	50,501					713,454
		144,284	229,195	261,014	262,293	896,786
379,169	172,006	378,831	462,801	188,688	245,280	5,044,513
	51,147	284,187	240,114	269,178	384,234	1,228,860
						942,703
						1,735,251
						33,770
61,080	52,883	8,304				2,254,678
						8,500
		1,184				568,398
						158,881
50,464		35,759		7,692	63,449	2,197,982
113,201	46,449	28,172				2,126,932
	8,223			19,341	32,164	79,957
						143,119
25,251	16,430					28,530
	6,619		162,519	60,236	197,091	426,465
		19,533				35,757
						558,524
						2,844
						241,627
						6,844
190,503						1,462,504
						425,708
						30,259
16,499		112,721	28,483			350,301
27,917	9,471		21,920		25,739	56,969
			53,176	169,668	257,637	480,481
						371,289
70,766	49,308	116,735	3,476	37,848		296,563
	7,069	92,807	29,381	43,890	56,087	229,234
						8,203
						3,034,672
154,896	65,351	18,624	146,113	188,590	202,775	16,946
			46	33,751	74,814	78,855
						187,466
						151,425
1,172,948	535,457	1,241,187	1,491,421	1,454,667	1,870,929	26,800,344

¹Iron Trade Review reports 378,786 tons shipped 1915.

²Iron Trade Review reports 284,088 tons shipped 1915.

³Iron Trade Review reports 116,724 tons shipped 1915.

⁴Not reported by Iron Trade Review.

⁵Not reported by Iron Trade Review.

⁶Iron Trade Review reports Hemlock 28,172 tons, Michigan 112,680 tons shipped 1915.

Total for Crystal Falls district 1915 Iron Trade Review 1,240,946 tons.

IRON ORE SHIPMENTS FROM THE IRON RIVER DISTRICT, MICHIGAN

	1909 and prior years.	1910.	1911.	1912.
Baker.....	45,003	39,417	3,290	
Baltic.....	1,168,663	171,930	66,502	100,736
Bates.....				
Bengal.....				
Berkshire.....	37,735	97,999	22,272	33,422
Beta.....	4,211			
Caspian.....	527,971	171,334	165,660	306,914
Cortland.....				17,499
Cottrell.....				
Chatham-Riverton.....	129,439	51,988	58,054	135,298
Davidson No. 1.....			215	27,614
Davidson No. 2.....			45,219	98,760
Chicago.....			108,947	149,619
Fogarty.....	117,865	51,071	67,616	84,074
Forbes.....				
Hiawatha.....	485,612	128,884	116,633	220,106
Homer.....				
Iron River.....	904,587			
James (Osana).....	152,971	78,388	50,439	75,702
*Dober-Isabella.....	65,192			
Nanaimo.....	373,765			
Riverton (Dober and Isabella).....	1,141,098	84,269	200,142	171,493
Rogers.....				
Selden.....	2,092			
Sheridan.....	116,299			
Spies.....				
Tully.....		2,726	8,323	
Virgil.....				3,750
Wapama.....				
Wauseca.....			749	
Wickwire.....			1,919	40,417
Youngs.....	375,385	98,399	89,450	83,528
Zimmerman.....	12,135	25,555	110,084	187,584
Total.....	5,660,023	1,001,960	1,115,514	1,736,516

*Riverton.

IRON ORE SHIPMENTS FROM THE IRON RIVER DISTRICT, MICHIGAN

	1913.	1914.	1915.	1916.	1917.	1918.	Total.
	24,286	113,733	41,378				267,107
	130,631	29,206	10,078	110,965	89,679	141,903	2,020,293
			45,171	72,275	155,703	98,194	371,843
	23,259	5,539	39,615	140,961	261,350	302,815	775,539
		23,826	15,413	38,470	57,791	38,439	365,367
							4,211
	295,841	279,379	479,083	448,631	412,313	345,420	3,432,546
	26,823	15,316					59,639
			45	75,089			75,134
	107,604	19,455	132,664	188,807	245,744	245,842	1,341,895
							564,278
	115,499	70,881	86,103	96,518	115,132	52,316	579,991
	79,948	51,686	66,327	67,731	108,858	61,462	966,825
	137,002	114,849	155,411	100,640	90,785	109,572	639,644
	124,568	15,329	27,718	89,506	37,291	24,606	367,624
	69,435	77,960	99,219	121,010			
	160,511	91,370	93,453	187,070	62,847	126,962	1,673,448
			102,511	156,528	202,592	213,249	674,880
	176,634	73,832	102,294	136,645	171,001	158,903	904,587
							1,176,809
							65,192
	160,818	176,274	262,382	174,992		100,496	373,765
		27,081	53,155	81,842	117,324	84,193	2,471,964
							363,595
							2,092
							116,299
					6,310	48,781	55,091
	16,650	63,411	242,049	236,302	121,426	125,087	815,974
	48,395	5,972		35,948		39,918	133,983
					16,033	5,070	21,103
	12,377		19,361	30,470		42,187	105,144
	40,322	25,584		12,890		242	121,374
	43,649			53,691		23,197	769,900
	149,309	172,720	108,218	138,881	230,123	131,248	1,265,857
Total.....	1,943,561	1,453,403	2,181,648	2,795,862	2,525,741	2,499,264	22,913,492

¹Iron Trade Review reports 132,779 tons shipped 1915.²Iron Trade Review reports 155,711 tons shipped 1915.³Iron Trade Review reports 99,650 tons shipped 1915.

Total for Iron River district 1915, Iron Trade Review 2,182,934 tons.

MINERAL RESOURCES OF MICHIGAN

SUMMARY OF IRON ORE SHIPMENTS FROM MICHIGAN RANGES (GROSS TONS)

	1905 and Prior Years.				1908.
	1909.	1910.	1911.	1912.	
Marquette.....			3,935,293	3,907,955	2,214,782
Gwinn.....			166,894	380,118	199,850
Menominee.....			2,953,131	2,498,784	1,254,110
Crystal Falls.....			10,186,021	1,631,484	629,602
Iron River.....			2,718,337	589,946	630,745
Gogebic.....			39,813,558	3,093,083	2,348,626
Metropolitan.....			68,060	13,913	9,123
Calumet.....			28,913	51,646	15,222
Total.....		165,720,738	12,149,451	12,166,929	7,302,060
	1909.	1910.	1911.	1912.	1913.
Marquette.....	3,983,436	3,840,120	2,666,121	3,415,650	3,487,993
Gwinn.....	273,736	552,507	346,107	511,398	302,573
Menominee.....	1,991,108	1,674,447	1,431,840	1,537,546	1,680,620
Crystal Falls.....	1,425,260	1,206,592	1,254,135	1,304,739	1,172,948
Iron River.....	1,152,076	1,001,960	1,115,514	1,736,516	1,943,561
Gogebic.....	3,402,415	3,652,018	2,253,800	4,094,938	3,847,398
Metropolitan.....	24,933	26,462	33,758	12,468	9,251
Calumet.....				35,587	18,976
Total.....	12,251,964	11,954,205	9,101,275	12,648,842	12,463,320

STATISTICAL TABLES—IRON ORE

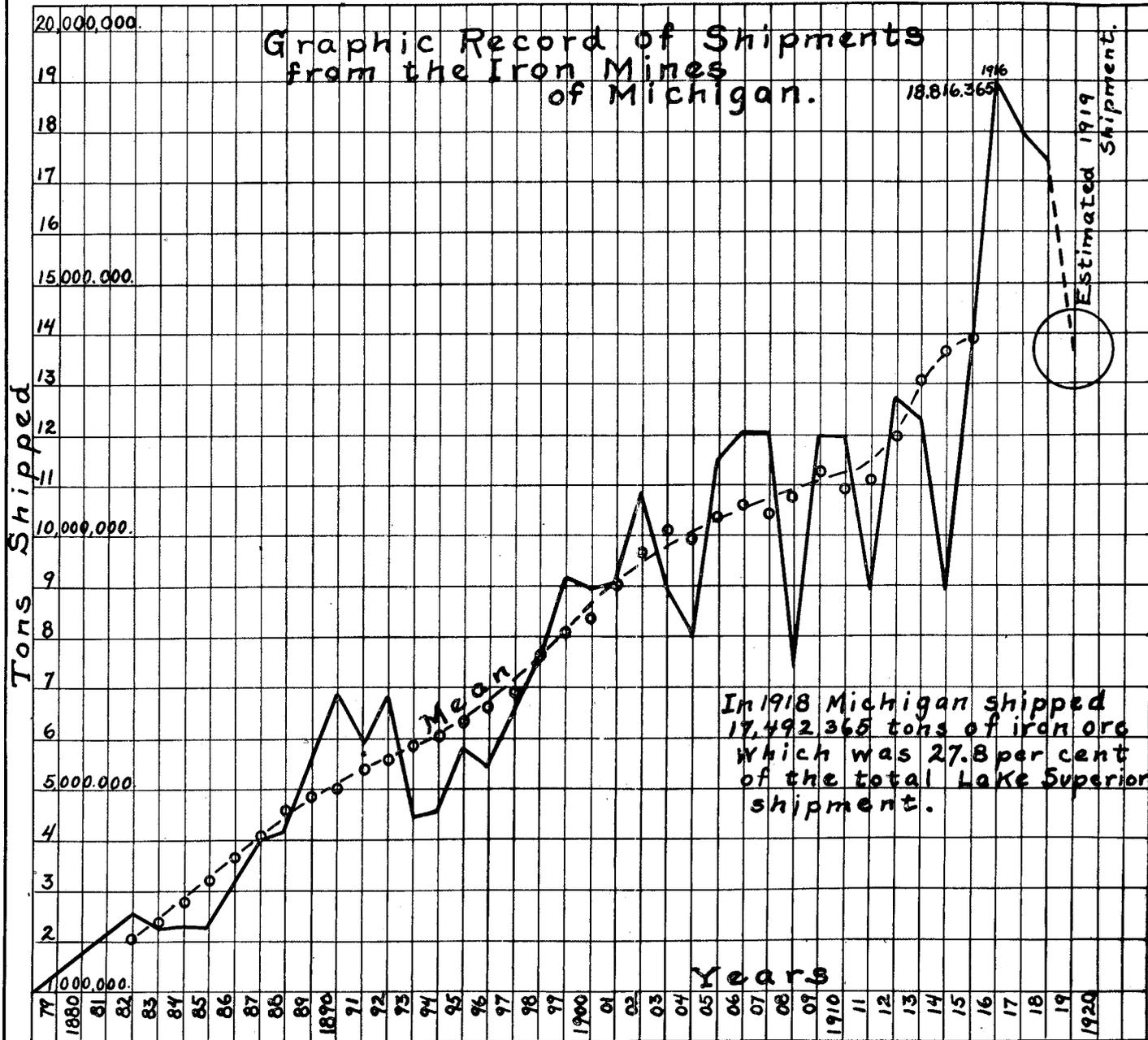
	1905 and Prior Years.						Total.
	1914.	1915.	1916.	1917.	1918.	1919.	
Marquette.....			4,698,048	3,959,103	3,896,141	121,996,164	
Gwinn.....	2,340,326	3,778,098	642,388	921,103	363,255	6,064,304	
Menominee.....	199,027	358,811	1,871,747	1,975,096	1,722,796	59,091,577	
Crystal Falls.....	1,155,452	1,355,289	1,871,747	1,454,667	1,870,929	26,800,344	
Iron River.....	535,457	1,241,187	1,491,421	1,454,667	1,870,929	26,800,344	
Gogebic.....	1,453,403	2,181,648	2,795,862	2,525,741	2,499,264	22,913,492	
Metropolitan.....	3,150,609	4,591,040	7,316,899	7,003,838	7,139,980	94,449,678	
Calumet.....						298,868	
Total.....	8,835,274	13,506,073	18,816,365	17,839,548	17,492,365	331,790,344	

MINERAL RESOURCES OF MICHIGAN

SHIPMENTS OF IRON ORE FROM MICHIGAN RANGES BY COUNTIES (GROSS TONS)

County.	1905 and Prior Years.	1906.	1907.	1908.		
Gogebic.....		3,113,981	3,093,083	2,348,626		
Iron.....	39,813,558	1,964,379	2,221,430	1,260,347		
Dickinson.....	12,904,358	2,968,904	2,564,343	1,278,455		
Marquette.....	36,225,344	4,097,111	4,154,288	2,305,366		
Baraga.....	75,966,010	5,076	133,785	109,366		
	811,468					
Total.....	165,720,738	12,149,451	12,166,929	7,302,060		
County.	1909.	1910.	1911.	1912.	1913.	
Gogebic.....		3,652,018	2,253,800	4,094,938	3,847,398	
Iron.....	3,402,415	2,208,552	2,369,649	3,041,255	3,116,509	
Dickinson.....	2,577,336	1,700,909	1,465,598	1,585,601	1,708,847	
Marquette.....	2,016,041	4,236,311	2,922,586	3,873,105	3,753,023	
Baraga.....	3,838,055	156,415	89,642	53,943	37,543	
	368,117					
Total.....	12,251,964	11,954,205	9,101,275	12,648,842	12,463,320	
County.	1914.	1915.	1916.	1917.	1918.	Total.
Gogebic.....		4,591,040	7,316,899	7,003,838	7,139,980	94,449,678
Iron.....	3,150,609	3,422,835	4,287,283	3,980,408	4,370,193	49,713,836
Dickinson.....	1,988,860	1,352,289	1,871,747	1,975,096	1,722,796	59,566,362
Marquette.....	1,156,452	4,018,294	5,300,429	4,771,305	4,256,167	125,979,137
Baraga.....	2,494,029	118,613	40,007	108,901	3,229	2,081,331
	45,324					
Total.....	8,835,274	13,506,073	18,816,365	17,839,548	17,492,365	331,790,344

Graphic Record of Shipments from the Iron Mines of Michigan.



In 1918 Michigan shipped
17,492,365 tons of iron ore
which was 27.8 per cent
of the total Lake Superior
shipment.

County.	1905 and Prior	1906.	1907.	1908.

AVERAGE NUMBER OF MEN EMPLOYED IN THE IRON MINES OF MICHIGAN IN 1918 BY COUNTIES

	Gogebic.	Iron.	Dickinson.	Marquette.	Total.
Total employed in producing mines	7,017	3,429	2,284	4,413	17,143
Total in idle mines and explorations -	56	93	13	91	253
Total -	7,073	3,522	2,297	4,504	17,396

LIST OF THE ACTIVE IRON MINES OF MICHIGAN.

Name of Mine.	Location.				First shipment.	No. of men employed 1918.
	County.	Section.	Twp.	Rge.		
MARQUETTE RANGE:						
American and Boston.....	Marquette	32	48	28	1880	260
Athens.....	Marquette	5, 6	47	26	1918	37
Barnes & Heckler.....	Marquette	2	47	28		39
Breitung Hematite No. 1.....	Marquette	6	47	26	1903	250
Breitung Hematite No. 2.....	Marquette	8	47	26		80
Cambria.....	Marquette	35, 36	48	27	1875	124
Champion.....	Marquette	31, 32	48	29	1867	0
Cliff Shaft.....	Marquette	9, 10	47	27	1887	335
Empire.....	Marquette	19	47	26	1907	20
Hartford (Cambria N. 2).....	Marquette	36	48	27	1889	
Himrod (see Mary Charlotte).....	Marquette	7	47	26	1914	87
Holmes.....	Marquette	9	47	27	1915	156
Imperial.....	Baraga	25	48	31	1890	
Isabella.....	Marquette	29, 32	47	26	1915	142
Jackson.....	Marquette	1	47	27	1846	11
Lake and Moro.....	Marquette	10	47	27	1892	300
Lake Sal y.....	Marquette	14	47	27	1915	2
Lake Superior (Hard Ore).....	Marquette	9, 10	47	27	1858	422
Lake Superior (Soft Ore).....	Marquette	10	47	27	1858	3
Lake Angeline (Angeline).....	Marquette	15	47	27	1864	32
Lucy (with Jackson).....	Marquette	6, 7	47	26	1878	
Maas.....	Marquette	31	48	26	1907	300
Maitland (Volunteer).....	Marquette	30	47	26		25
Mary Charlotte.....	Marquette	8	47	26	1903	200
Morris and Lloyd.....	Marquette	1	47	28	1911	236
Moro with Lake.....	Marquette	10	47	27	1881	
Negaunee.....	Marquette	5, 6	47	26	1887	400
Ohio.....	Baraga	22	48	31	1882	
Portland.....	Baraga	26	48	31	1896	
Queen Group.....	Marquette	5	47	26	1888	
Republic.....	Marquette	7	46	29	1872	222
Richmond.....	Marquette	28	47	26	1896	80
Rolling Mill.....	Marquette	7	47	26	1872	12
Salisbury.....	Marquette	15	47	27	1872	124
Volunteer.....	Marquette	30	47	26	1871	
Washington (Barron).....	Marquette	11	47	29	1865	
SWANZY DISTRICT:						
Austin.....	Marquette	20	45	25	1907	4
Francis.....	Marquette	27	45	25	1918	80
Gardner.....	Marquette	(2-35)	44, 45	25		47
Gwinn.....	Marquette	28	45	25	1914	160
Jopling.....	Marquette	28	45	25		7
Mackinaw.....	Marquette	35	45	25		50
Princeton.....	Marquette	18, 20	45	25	1872	223
Stegmiller.....	Marquette	17	45	25	1909	
Stephenson.....	Marquette	20	45	25	1907	34
MENOMINEE RANGE:						
Aragon.....	Dickinson	8, 9	39	29	1889	415
Chapin.....	Dickinson	25, 30	40	31, 30	1880	849
Cyclops & Norway (Penn Group).....	Dickinson	5	39	29	1878	
East Vulcan (Penn Group).....	Dickinson	10, 11	39	29	1877	696
Indiana.....	Dickinson	27	40	30	1915	68
Loretto.....	Dickinson	7	39	28	1893	176
Millie (Hewitt).....	Dickinson	31	40	34	1881	1
Munroe.....	Dickinson	6	39	29	1903	12
Pewabic.....	Dickinson	32	40	30	1890	
West Vulcan, Curry & Brier Hill.....	Dickinson	9, 10	39	29	1879	
Clifford and Traders.....	Dickinson	20	40	30		80

*Not reported.
 †Undeveloped.

1918 WITH LOCATION, OWNERSHIP, ETC.

Operators.	Address of Home Office.
American Boston Mining Co.....	1300 Leader-News Building, Cleveland, Ohio.
Athens Mining Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Breitung Hematite Mng. Co.....	Marquette, Mich.
Breitung Hematite Mng. Co.....	Marquette, Mich.
Republic Iron & Steel Co.....	Youngstown, Ohio.
Champion Iron Co.....	Wolvin Building, Duluth, Minnesota.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Empire Iron Co.....	Rector Building, Chicago, Illinois.
Republic Iron & Steel Co.....	Youngstown, Ohio.
Mary Charlotte Mng. Co.....	Marquette, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cascade Mining Co.....	Hibbing, Minn.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Jones & Laughlin Ore Co.....	Pittsburg, Penn.
Oliver Iron Mining Co.....	Wolvin Building, Duluth, Minn.
Oliver Iron Mining Co.....	Wolvin Building, Duluth, Minn.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Volunteer Ore Co.....	1400 Alworth Bldg., Duluth, Minn.
Mary Charlotte Mining Co.....	Marquette, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Niagara Iron Mining Co.....	North Tonawanda, N. Y.
Niagara Iron Mining Co.....	North Tonawanda, N. Y.
Oliver Iron Mining Co.....	Wolvin Bldg., Duluth, Minn.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Richmond Iron Co.....	1300 Leader-News Bldg., Cleveland, Ohio.
Jones & Laughlin Ore Co.....	3d Ave. & Try St., Pittsburg, Pa.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Volunteer Ore Co.....	1400 Alworth Bldg., Duluth, Minn.
Washington Iron Co.....	Marquette, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
American Mining Co.....	Western Reserve Building, Cleveland, Ohio.
Cleveland Cliffs Iron Co.....	Ishpeming, Mich.
National Tube Works Co.....	Frick Bldg., Pittsburg, Pa.
Chapin Mining Co.....	Wolvin Bldg., Duluth, Minn.
Penn Iron Mining Co.....	1703 Morris Bldg., Philadelphia, Pa.
Penn Iron Mining Co.....	1703 Morris Bldg., Philadelphia, Pa.
Thomas Furnace Co.....	Milwaukee, Wis.
Loretto Iron Co.....	1400 Fulton St., Chicago, Ill.
Dessau Mining Co.....	Care B. J. Clergue, Montreal, Que.
Munroe Iron Mining Co.....	55 Erie Co. Bank Bldg., Buffalo, N. Y.
Pewabic Co.....	910 Wells Bldg., Milwaukee, Wisconsin.
Penn Iron Mining Co.....	1703 Morris Bldg., Philadelphia, Pa.
Antoine Ore Company.....	Republic Building, Youngstown, Ohio.

LIST OF THE ACTIVE MINES OF MICHIGAN.

Name of Mine.	Location.				First shipment	No. of men employed 1918.
	County.	Section.	Twp.	Rge.		
CRYSTAL FALLS DISTRICT:						
Amasa Porter	Iron	22, 33	44	33	1916	143
Balkan	Iron	13	42	33	1915	161
Bristol	Iron	19	43	32	1892	130
Carpenter	Iron	31	43	32	1914	254
Dunn-Richards	Iron	1	42	33	1887	92
Genesee (with Tobin)	Iron	29,30,31	43	32	1902	1
Great Western	Iron	21	43	32	1882	1
Hilltop and Victoria	Iron	22	43	32	1914	136
Judson	Iron	13	42	33	1914	105
Odgers	Iron	30	43	32	1916	73
Ravenna	Iron	19	43	32	1911	115
Tobin	Iron	30	43	32	1901	169
Warner	Iron	9	44	33	1915	119
IRON RIVER DISTRICT:						
Baker-Tully	Iron	31	43	34	1909	86
Baltic and Fogarty	Iron	7	42	34	1901	244
Bates	Iron	19	43	34	1915	42
Bengal	Iron	36	43	35	1913	23
Berkshire	Iron	6	42	34	1908	368
Cardiff	Iron	22	43	35	1903	139
Caspian	Iron	1	42	35	1903	55
Chatham-Riverton	Iron	1	42	35	1903	46
Chicagon	Iron	35	43	35	1907	60
Cottrell (with Berkshire)	Iron	26	43	34	1911	9
Davidson No. 1	Iron	1	42	35	1915	2
Davidson No. 2	Iron	14	43	35	1912	63
Davidson No. 3	Iron	23	43	35	1912	132
Fogarty (see Baltic)	Iron	14	43	35	1907	149
Forbes	Iron	1	42	35	1907	178
Hlawatha	Iron	14	43	35	1913	107
Homer	Iron	35	43	35	1893	85
Osana (James)	Iron	22, 23	43	35	1915	149
Dober Isabella (Riverton)	Iron	23	43	35	1907	178
Rogers	Iron	1, 35, 36	42, 43	35	1898	107
Spies	Iron	29	43	34	1914	85
Tully (see Baker)	Iron	24	43	35	1917	1910
Virgil	Iron	36	43	35	1910	1912
Wapama	Iron	24	43	35	1912	30
Wauseca	Iron	14	43	35	1917	36
Youngs	Iron	23	43	35	1910	1
Zimmerman	Iron	12	42	35	1905	168
Zimmerman	Iron	7	42	34	1908	
GOGERIC RANGE:						
Anvil	Gogebic	14	47	46	1887	22
Asteroid	Gogebic	13	47	46	1906	150
Ashland	Gogebic	22	47	47	1885	111
Brotherton	Gogebic	9	47	45	1886	88
Castile	Gogebic	10	47	45	1906	131
Colby and Ironton	Gogebic	16	47	46	1884	771
Davis, Geneva, Royal, Puritan	Gogebic	17, 18, 19, 20	47	46	1886	345
Eureka	Gogebic	13	47	46	1890	243
Ironton (see Colby)	Gogebic	17	47	46	1886	134
Keweenaw	Gogebic	11	47	46	1914	0
Mikado	Gogebic	18	47	45	1895	34
Morgan	Gogebic	11	47	45	1895	939
Newport and Bonnie	Gogebic	24	47	47	1886	
Norrie-Aurora Group	Gogebic	22, 23	47	47	1884	1884
Palms	Gogebic	14	47	46	1912	556
Plymouth	Gogebic	18	47	45	1916	382
Puritan (see Davis)	Gogebic	17	47	46	1886	236
Sunday Lake	Gogebic	10	47	45	1885	227
Tilden	Gogebic	15	47	46	1891	126
Townsite	Gogebic	23	47	47	1917	441
Wakefield	Gogebic	16, 17	47	45	1913	253
Yale	Gogebic	16	47	46	1901	

Operators.	Address of Home Office.
Bristol Mining Co.	Wade Building, Cleveland, Ohio.
Balkan Mining Co.	Cleveland, Ohio, Western Reserve Bldg.
Nevada Mining Co.	Duluth, Minnesota.
Hollister Mining Co.	1300 Leader-News Bldg., Cleveland, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Jos. E. Thropp	Everett, Pa.
Judson Mining Co.	First National Bank Bldg., Chicago, Illinois.
Hudson Iron Mining Co.	Wickliffe, Ohio.
Hollister Mining Co.	1300 Leader-News Bldg., Cleveland, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Hemlock River Mining Co.	Western Reserve Bldg., Cleveland, Ohio
Corrigan, McKinney Co.	Wickliffe, Ohio.
Verona Mining Co.	Cleveland, Ohio, Western Reserve Bldg.
Bates Iron Co.	New York City, 25 Broad St.
Verona Mining Co.	Cleveland, Ohio, Western Reserve Bldg.
Brule Mining Co.	76 Wade Building, Cleveland, Ohio.
Wickwire Mining Co.	Buffalo, N. Y.
Verona Mining Co.	Cleveland, Ohio, Western Reserve Bldg.
Brule Mining Co.	76 Wade Bldg., Cleveland, Ohio.
Munro Mining Co.	55 Erie Co., Bank Bldg. Buffalo, N. Y.
Oliver Iron Mining Co.	Duluth, Minn., Wolvin Bldg.
Davidson Ore Mining Co.	403 White Bldg., Buffalo, N. Y.
Davidson Ore Mining Co.	403 White Bldg., Buffalo, N. Y.
Davidson Ore Mining Co.	403 White Bldg., Buffalo, N. Y.
Verona Mining Co.	Western Reserve Bldg., Cleveland, Ohio
Jones & Laughlin Ore Co.	3d Ave. & Try St., Pittsburg, Pa.
Munro Mining Co.	55 Erie Co., Bank Bldg., Buffalo, N. Y.
Buffalo Iron Mining Co.	Buffalo, N. Y., Station B.
Mineral Mining Co.	910 Wells Bldg., Milwaukee, Wis.
Oliver Iron Mining Co.	Wolvin Bldg., Duluth, Minn.
Munro Iron Mining Co.	55 Erie Co. Bank Bldg., Buffalo, N. Y.
Cleveland Cliffs Iron Co.	Ishpeming, Mich.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Wickwire Mining Co.	Buffalo, N. Y.
Wapama Iron Co.	Iron River, Mich.
Mineral Mining Co.	910 Wells Bldg., Milwaukee, Wis.
Huron Iron Co.	Iron River, Mich.
Miami Metals Co.	Tower Building, Chicago, Ill.
Newport Mining Co.	First National Bank Bldg., Milwaukee, Wis.
Castile Mining Co.	76 Wade Bldg., Cleveland, Ohio.
Hayes Mining Co.	1st National Bank Bldg., San Jose, Cal.
Brotherton Iron Mining Co.	808 Western Reserve Bldg., Cleveland, Ohio.
Castile Mining Co.	76 Wade Bldg., Cleveland, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Oliver Iron Mining Co.	Wolvin Bldg., Duluth, Minn.
Castile Mining Co.	76 Wade Bldg., Cleveland, Ohio.
Corrigan, McKinney Co.	Wickliffe, Ohio.
Newport Mining Co.	First National Bank Bldg., Milwaukee, Wis.
Verona Mining Co.	Western Reserve Bldg., Cleveland, Ohio.
Thomas Furnace Co.	Milwaukee, Wisconsin.
Newport Mining Co.	First National Bank Bldg., Milwaukee, Wis.
Oliver Iron Mining Co.	Wolvin Bldg., Duluth, Minn.
Dunn Iron Mining Co.	First National Bank Bldg., Milwaukee, Wis.
Verona Mining Co.	Western Reserve Bldg., Cleveland, Ohio.
Oliver Iron Mining Co.	Wolvin Bldg., Duluth, Minn.
Sunday Lake Iron Co.	Western Reserve Bldg., Cleveland, Ohio.
Oliver Iron Mining Co.	Wolvin Bldg., Duluth, Minn.
Townsite Mining Co.	Care of Coates and Tweed, Duluth, Minn.
Wakefield Iron Co.	1300 Leader-News Bldg., Cleveland, Ohio.
Charcoal Iron Co. of America	312 Union Trust Bldg., Detroit, Mich.

IRON ORE RESERVES OF MICHIGAN

Range.	1911 ¹		1913 ²		1914 ³	
	Developed. Tons.	Prospective. Tons.	Developed. Tons.	Prospective. Tons.	Developed. Tons.	Prospective. Tons.
Gogebic County.....	18,296,721	13,308,279	23,813,191	7,754,388	23,765,158	21,113,192
Iron County: (Iron River District) (Crystal Falls District)....	7,934,687	25,689,155	13,249,683	47,536,233	13,337,913	45,045,227
Menominee: (Dickinson County).....	9,082,750	2,567,700	9,682,994	3,100,458	11,062,700	2,129,950
Marquette: (Marquette County) (Baraga County).....	36,228,742	56,473,068	34,692,034	51,529,275	33,095,467	47,919,718
State.....	71,542,900	98,038,202	81,437,902	109,920,354	81,261,238	116,208,087
Total.....	169,581,102		191,358,256†		197,469,325*	

*Of date January 1, 1914 in addition to which there was in stock 4,954,830 tons of ore, making a grand total of 202,424,155 tons.

†Of date January 1, 1913 in addition to which there was in stock 4,366,349 tons of ore, making a grand total of 195,724,605 tons.

‡Estimated by C. K. Leith for Board of State Tax Commissioners.

§Estimated by R. C. Allen and O. R. Hamilton for Board of State Tax Commissioners.

IRON ORE RESERVES OF MICHIGAN—Continued

Range.	1915 ¹		1916 ²		1917 ³	
	Developed. Tons.	Prospective. Tons.	Developed. Tons.	Prospective. Tons.	Developed. Tons.	Prospective. Tons.
Gogebic County.....	33,764,457	12,838,990	31,150,667	13,496,137	29,458,730	16,896,310
Iron County: (Iron River District) (Crystal Falls District)....	19,258,369	42,961,778	17,051,882	42,096,186	15,274,255	42,217,450 ^d
Menominee: (Dickinson County).....	10,134,241	1,701,540	8,035,306	1,671,055	7,506,771	2,710,080 ^d
Marquette: (Baraga County) (Marquette County).....	28,629,708	50,235,260	30,671,677	49,289,115	31,481,814	46,130,241 ^d
State.....	91,786,775	107,737,568	86,909,542	106,502,493	83,721,570	107,954,081 ^d
Total.....	199,524,843†		193,412,035**		191,675,651***	

*Of date January 1, 1914 in addition to which there was in stock 4,954,830 tons of ore, making a grand total of 202,424,155 tons.

†Of date January 1, 1915 in addition to which there was in stock 6,596,195 tons of ore, making a grand total of 206,120,538 tons.

**Of date January 1, 1916 in addition to which there was in stock 5,008,465 tons of ore, making a grand total of 199,020,500 tons.

***Of date January 1, 1917 in addition to which there was in stock 5,152,343 tons of ore, making a grand total of 196,750,502 tons.

§Estimated by R. C. Allen and O. R. Hamilton for Board of State Tax Commissioners.

IRON ORE RESERVES OF MICHIGAN—Concluded

Range.	1918 ^a		1919 ^b	
	Developed. Tons.	Prospective. Tons.	Developed. Tons.	Prospective. Tons.
Gogebic County.....	42,115,292	12,970,233	35,984,470	26,788,251
Iron County: (Iron River District) (Crystal Falls District).....	15,129,721	39,931,634	16,252,738	37,053,245
Menominee: (Dickinson County).....	5,634,660	3,048,671	6,768,492	1,684,030
Marquette: (Baraga County) (Marquette County).....	30,900,191	45,363,518	36,799,568	37,537,447
State.....	93,779,864	101,314,056	95,805,268	103,062,973
Total.....	195,093,920****		198,868,241 ^c	

****Of date January 1, 1918 in addition to which there was in stock 5,049,589 tons of ore, making a grand total of 200,143,509 tons.
^a Estimated by R. C. Allen and O. W. Wheelwright for Board of State Tax Commissioners.
^b Estimated by O. W. Wheelwright and compiled by O. R. Hamilton for Board of State Tax Commissioners.
^c Of date January 1, 1919 in addition to which there was in stock 4,708,468 tons of ore, making a grand total of 203,571,709 tons.

APPRAISED VALUE OF MICHIGAN IRON MINES:

Range.	Previous appraisals.				
	1911	1912	1913	1914	1915
Gogebic.....					
Iron County: (Iron River District) (Crystal Falls District).....	\$28,338,100	\$27,226,300	\$25,849,873	\$34,667,028	\$34,210,394
Menominee: (Dickinson County).....	15,018,475	15,359,664	20,978,709	21,275,945	20,856,919
Marquette: (Baraga County) (Marquette County).....	7,427,500	7,240,625	6,641,925	6,413,003	5,906,443
State.....	34,745,000	*31,270,500	29,063,714	29,216,139	28,616,453
	\$85,529,075	\$81,097,089	\$82,534,221	\$91,572,115	\$89,757,607
					\$90,737,608
					\$34,288,150
					21,992,968
					5,816,867
					30,092,923
					\$92,190,908

*Ten per cent cut from 1911 assessment (approximate figure).

APPRAISED VALUE OF MICHIGAN IRON MINES.—Concluded

Range.	1918	1919 appraisal.		Total tonnage in mine and in stock Jan. 1, 1919.	Assessed value per ton.
		Mine.	Ore in stock.		
Gogebic.....					
Iron County: (Iron River District) (Crystal Falls District).....	\$43,996,011	\$40,663,247	\$7,421,151	\$63,497,143	\$.75727
Menominee: (Dickinson County).....	25,654,157	19,320,629	7,069,407	55,014,715	.47969
Marquette: (Baraga County) (Marquette County).....	5,799,102	3,714,590	2,283,720	9,239,911	.64917
State.....	32,568,169	26,607,410	6,777,135	75,819,940	.44031
	\$108,017,439	\$90,305,876	\$23,551,413	\$203,571,709	\$.55929

^bBy Board of State Tax Commissioners.

VALUE OF MICHIGAN IRON ORE SHIPMENTS 1918 FROM REPORT OF APPRAISER OF MINES TO BOARD OF STATE TAX COMMISSIONERS 1919*

Range.	Gross receipts.	† "Beyond the Mine" charges.	Net receipts f. o. b. at the mine. †‡	Shipment. Tons. 1918.	Value per ton f. o. b. 1918.	Value per ton f. o. b. mine 1917.
Gogebic—Gogebic County.....	\$35,728,411.13	\$10,443,276.09	\$25,285,135.04	7,139,980	\$3,54134	\$3,61090
Iron River.....	21,592,341.45	6,060,372.47	15,531,968.98	4,370,193	3,72772	3,18498
Crystal Falls.....	8,372,659.76	2,316,263.30	6,056,396.46	1,722,796	3,89287	3,54709
Menominee—Dickinson County.....	21,616,864.13	5,208,049.44	16,408,814.69	4,259,396	3,92809	3,19083
Marquette.....						
Marquette County.....						
Baraga County.....						
State of Michigan.....	\$87,310,276.47	\$24,027,961.30	\$63,282,315.17	17,492,365	\$3,67382	\$3,39590

†Includes: 1. Rail freight.
2. Boat freight.
3. Cargo insurance.
4. Lower lake analyses.
5. Selling commissions.

*From report of Appraiser of Mine to Board of State Tax Commissioners 1919.

†‡Of which the Lake Superior District produced 60,092,000 tons, or 86 per cent of the total.

Tonnage mined during 1918 is given by U. S. G. S. as 69,712,000 gross tons of which Michigan mined..... 41,870,000

Alabamā mined..... 17,131,000
Wisconsin mined..... 5,745,000
New York mined..... 1,091,000
All other states mined..... 3,000,000

Total..... 69,712,000

+ 4. Incomplete returns. Under shipments 1918, the total shipments are given. Cost data was available for the following tonnage upon which the value per ton is based.

Gogebic County.....	7,139,980
Iron River.....	4,166,610
Dickinson County.....	1,555,766
Marquette Range.....	4,177,296
Total.....	17,039,652

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MARQUETTE RANGE, MARQUETTE AND BARAGA COUNTIES, MICH.

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators.

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
Cost of Mining.						
1. General office expenses.....						
2. Fire insurance.....	\$0.08148	\$0.11454	\$0.06125	\$0.05057	\$0.05898	\$0.08927
3. Employers liability insurance.....	0.78446	1.14116	0.6121	0.4730	0.5768	0.8603
4. Taxes.....	0.0075	0.0044	0.0546	0.0397	0.0328	0.0351
5. Depreciation.....	0.0037	0.0042	0.0344	0.0378	0.0338	0.0338
6. Mining.....			0.0441	0.0339	0.0510	0.1152
7. Exploration and development.....	0.5630	0.6870	0.8099	0.8039	0.9209	0.1119
8. Construction.....	0.5567	0.6863	0.7922	0.7867	0.7394	1.5193
9. Total cost at mine.....	1.63112	1.79137	1.89756	1.87008	1.72944	2.01223
	1.58438	1.78526	1.88550	1.84893	1.68613	1.96943
Beyond the Mine Cost.						
10. Rail freight.....						
11. Boat freight.....	26842	27659	29435	29444	29841	25228
12. Cargo insurance.....	49696	48986	44747	46945	48127	22936
13. Analysis at lower lake ports.....	0.0140	0.0192	0.0021	0.0085	0.0088	0.0113
14. Selling commissions.....	0.0047	0.0031	0.0022	0.0069	0.0089	0.0180
15. Total "Beyond the Mine" cost.....	0.0915	0.1198	0.1629	0.1373	0.1852	0.2815
	77640	78066	75864	78419	80007	61797
			73854	78402	80007	61466

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MARQUETTE RANGE, MARQUETTE AND BARAGA COUNTIES, MICH.—Continued

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators.

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
Beyond the mine cost.— <i>Con.</i>						
16. Total cost of delivery.....	\$2. 40752	\$2. 57203	\$2. 65620	\$2. 65427	\$2. 53951	\$2. 63020
17. Royalties.....	2. 36078	2. 56592	2. 64404	2. 63265	2. 48620	2. 58409
18. Total cost of delivery to operator.....	2. 12239	2. 13238	2. 21741	1. 83385	2. 17752	2. 24763
	2. 12239	1. 3238	2. 20704	1. 7744	2. 20591	2. 24037
	2. 52991	2. 70441	2. 87361	2. 83812	2. 74753	2. 87783
	2. 48317	2. 69830	2. 85108	2. 81039	2. 69211	2. 82445
Profit and Loss.						
19. Receipts from sale of ore.....	3. 37320	3. 77856	3. 80000	3. 51487	3. 70991	3. 59091
20. Profit or loss to operator.....	84329	1. 07415	92369	67675	96288	71308
	89003	1. 08027	94892	70448	1. 01780	74846
21. Total profit (operator's profit or loss plus royalty and depreciation).....	96568	1. 20653	1. 24052	95140	1. 23339	1. 09035
22. Assessed valuation per ton by Board of State Tax Commissioners.....	1. 01242	1. 21265	1. 25588	97272	1. 27578	1. 09602
						37480

a. Total of all operations.
 b. Total of all operations excluding non-producers.
 Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
 In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 inclusive and item 19 on tons shipped.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MARQUETTE RANGE, MARQUETTE AND BARAGA COUNTIES, MICH.—Continued

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Cost of Mining.							
1. General office expenses.....	\$0. 09194	\$0. 07932	\$0. 07754	\$0. 05827	\$0. 06977	\$0. 09545	\$0. 14356
2. Fire insurance.....	0.8885	0.6680	0.7091	0.5686	0.6977	0.9375	1.4383
3. Employer's liability insurance.....	0.0370	0.0357	0.0435	0.0378	0.0292	0.0371	0.0480
4. Taxes.....	0.1135	0.1850	0.0389	0.343	0.0272	0.0267	0.0470
	0.1135	0.1840	0.1824	0.2069	0.1827	0.1735	0.2366
	1.4140	1.2160	1.2630	1.3616	1.1830	1.2925	1.6355
5. Depreciation.....	1.3837	1.1820	1.1917	1.3074	1.0877	1.2397	1.6581
6. Mining.....	0.8570	0.6817	1.4911	1.1265	1.0551	0.9152	0.6788
	0.8570	0.6803	1.3785	1.1074	1.0473	0.9109	0.6752
	1.46207	1.45000	1.31975	1.13464	1.26168	1.60130	2.20351
	1.45260	1.44664	1.30840	1.13367	1.26014	1.60130	2.20351
7. Exploration and development.....	0.7939	0.6080	0.7550	0.6522	0.8823	0.8474	0.8442
8. Construction.....	0.7912	0.8205	0.8229	0.5274	0.9356	0.9537	0.9342
	0.4476	0.4476	1.2717	0.5266	1.7690	2.2327	3.2142
9. Total cost at mine.....	1.95512	1.87401	1.92951	1.61115	1.68130	1.6681	2.8007
	1.91138	1.81794	1.82292	1.57401	1.68130	2.22881	3.01351
					1.64756	2.12630	2.93930
"Beyond the Mine" Cost.							
10. Rail freight.....	2.6284	3.0700	2.8232	2.9318	3.0783	3.0957	5.8474
11. Boat freight.....	2.5878	3.0367	2.7765	2.9318	3.0783	3.0957	5.8474
12. Cargo insurance.....	2.9943	3.8732	3.1371	3.2504	3.0783	3.0957	5.8474
13. Analysis at lower lake ports.....	2.9858	3.8265	3.0677	3.2504	3.0783	3.0957	5.8474
14. Selling commissions.....	0.0191	0.0091	0.0091	0.0127	0.0176	0.0369	0.0222
	0.0094	0.0465	0.0411	0.0375	0.0423	0.0493	0.0570
	0.0094	0.0465	0.0411	0.0375	0.0423	0.0493	0.0570
15. Total "Beyond the Mine" cost.....	0.1477	0.2040	0.1599	0.1373	0.1631	0.1631	0.1510
	5.7987	7.2142	6.1854	6.3699	7.6933	1.01671	1.31668
	5.7478	7.1251	6.0341	6.3697	7.6920	1.01671	1.31668

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MARQUETTE RANGE, MARQUETTE AND BARAGA COUNTIES, MICH.—Continued.

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912	1913	1914	1915	1916	1917	1918
	Per ton.	Per ton.	Per ton.	Per ton.	Per ton.	Per ton.	Per ton.
"Beyond the Mine" Cost.—Con.							
16. Total cost of delivery.....	(a) \$2.53501	\$2.59543	\$2.54805	\$2.24814	\$2.45063	\$3.24552	\$4.33019
17. Royalties.....	(b) 2.48616	2.53045	2.42833	2.21098	2.41676	3.14601	4.27593
	(a) .19117	.19221	.21773	.18120	.19079	.26494	.24069
18. Total cost of delivery to operator.....	(b) 18478	18469	21772	17913	18575	25391	24097
	(a) 2.72618	2.78764	2.76578	2.42934	2.64142	3.51046	4.56288
	(b) 2.67094	2.71514	2.64555	2.39011	2.60251	2.39992	4.56597
Profit and Loss.							
19. Receipts from sale of ore.....	2.90551	3.15906	2.82446	2.52302	3.17105	4.19400	5.17485
20. Profit or loss to operator.....	(a) 17933	37142	65868	99368	52963	68354	50107
	(b) 23447	44392	17891	13291	56874	79408	66898
21. Total profit (operator's profit or loss plus royalty and depreciation).....	(a) 45647	63180	42552	38753	82627	1.04000	89894
22. Assessed valuation per ton by Board of State Tax Commissioners*.....	(b) 50505	69664	53398	42278	85902	1.13908	1.01264
		34464	35034	34913	36090	0.31409	0.41660

a. Total of all operations.

b. Total of all operations excluding non-producers.

Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.

* Assessed valuation per ton by Board of State Tax Commissioners in 1919 was \$0.44031.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE GOGEBIC RANGE, GOGEBIC COUNTY, MICH.

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators.

	1906.	1907.	1908.	1909.	1910.	1911.
	Per ton.	Per ton.	Per ton.	Per ton.	Per ton.	Per ton.
Cost of Mining.						
1. General office expense.....	(a) \$0.07006	\$0.06827	\$0.07218	\$0.06973	\$0.05213	\$0.08225
2. Fire insurance.....	(b) .06908	.06754	.07092	.06901	.05119	.08225
	(a) .00226	.00256	.00431	.00378	.00415	.00708
3. Employer's liability insurance.....	(b) .00218	.00245	.00419	.00374	.00413	.00708
	(a) .....	.....	.00379	.00495	.00664	.00721
4. Taxes.....	(b) .05509	.05834	.06429	.00379	.00664	.00721
	(a) .05486	.05809	.06389	.07387	.07565	.07711
5. Depreciation.....	(b) .00648	.00898	.12199	.14554	.12335	.15555
	(a) .00648	.00898	.12199	.14554	.12335	.15555
6. Mining.....	(b) 1.22206	1.37212	1.46021	1.38712	1.32950	1.43033
	(a) 1.21186	1.35435	1.45340	1.36994	1.32950	1.43033
7. Exploration and development.....	(b) .08821	1.2328	.08133	.12984	.14909	.20058
	(a) .08821	1.2328	.08133	.12984	.14909	.20058
8. Construction.....	(b) .20230	.22745	.24725	.19922	.08334	.12038
	(a) .20230	.22745	.24725	.19922	.08334	.12038
9. Total cost at mine.....	(b) 1.64646	1.86100	2.05535	2.01451	1.82385	2.22039
	(a) 1.63497	1.84194	2.04676	1.91483	1.82246	2.22039
Beyond the Mine Cost.						
10. Rail freight.....	(a) .39625	.39142	.39280	.39047	.39285	.37326
	(b) .39625	.39142	.39280	.39047	.39285	.37326
11. Boat freight.....	(a) .73723	.73122	.64708	.63525	.70098	.48302
	(b) .73723	.73122	.64708	.63525	.70098	.48302
12. Cargo insurance.....	(a) .....	.....	.....	.00340	.00319	.00290
	(b) .....	.....	.....	.00340	.00319	.00290
13. Analysis at lower lake ports.....	(a) .....	.....	.....	.00873	.00210	.00138
	(b) .....	.....	.....	.00873	.00210	.00138
14. Selling commissions.....	(a) .03915	.03983	.04572	.05470	.04795	.03548
	(b) .03915	.03983	.04572	.05470	.04795	.03548
15. Total "Beyond the Mine" cost.....	(a) 1.17263	1.16197	1.08560	1.08955	1.14707	.89604
	(b) 1.17263	1.16197	1.08560	1.08955	1.14707	.89604

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE GOGEBIC RANGE, GOGEBIC COUNTY, MICH.—Continued
 Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
Beyond the Mine Cost.—Con.						
16. Total cost of delivery.....	\$2.81909	\$3.02297	\$3.14095	\$3.10406	\$2.97092	\$3.11643
17. Royalties.....	2.80760	3.00391	3.13236	3.00438	2.96953	3.11643
18. Total cost of delivery to operator.....	36805	43373	43762	45323	42650	32388
	36788	43762	43762	43089	42568	32277
	3.18714	3.45670	3.57857	3.55729	3.39743	3.44031
	3.17548	3.43740	3.56877	3.43527	3.39521	3.43920
Profit and Loss.						
19. Receipts from sale of ore.....	4.05982	4.73564	3.90683	4.07636	4.69212	3.87255
20. Profit or loss to operator.....	87268	1.27893	41826	.51907	1.29470	.43224
21. Total profit (operator's profit or loss plus royalty and de- preciation).....	88433	1.29815	42780	.64109	1.29691	.43335
22. Assessed valuation per ton by Board of State Tax Commis- sioners.....	1.24721	1.72164	.97787	1.11784	1.84455	.91167
	1.25569	1.74070	.98646	1.21752	1.84594	.91167
						.89663

a. Total of all operations.
 b. Total of all operations excluding non-producers.
 Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
 In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17, and item 19 on tons shipped.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE GOGEBIC RANGE, GOGEBIC COUNTY, MICH.—Continued
 Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Cost of Mining.							
1. General Office expenses.....	\$0.06157	\$0.05763	\$0.06841	\$0.05757	\$0.07140	0.08594	\$0.11458
2. Fire insurance.....	.06157	.05760	.06837	.05757	.07138	.08594	.11458
3. Employer's liability insurance.....	.06593	.05526	.06517	.05514	.06434	.06414	.06529
4. Taxes.....	.01913	.02207	.02667	.01998	.01898	.02294	.02864
5. Depreciation.....	13478	12522	14182	16451	11574	12294	15194
6. Mining.....	11307	12644	14122	16340	11412	12244	15155
7. Exploration and development.....	1.19161	1.37673	1.18169	1.18309	1.13900	1.42215	1.83912
8. Construction.....	1.2864	1.17977	1.17605	1.16489	1.13580	1.42215	1.83912
9. Total cost at mine.....	1.70154	2.18690	1.94400	1.77601	1.60941	2.31650	2.87759
		2.07685	1.93032	1.76875	1.58558	2.32600	2.87720
Beyond the Mine Cost.							
10. Rail freight.....	.38032	.44526	.40792	.40970	.43369	.44573	.65061
11. Boat freight.....	.46717	.55204	.40087	.43081	.54064	.91217	.65061
12. Cargo insurance.....	.00075	.00192	.00097	.00153	.00153	.00195	.00192
13. Analysis at lower lake ports.....	.00222	.00248	.00287	.00289	.00336	.00317	.00313
14. Selling commissions.....	.04801	.05374	.04889	.04929	.05261	.05656	.03895
15. Total "Beyond the Mine" cost.....	.89847	1.05484	.86153	.89405	1.03183	1.41958	1.46263

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE GOGEBIC RANGE, GOGEBIC COUNTY, MICH.—Concluded
Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operator

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Beyond the Mine Cost.—Con.							
16. Total cost of delivery.....	\$2.60001	\$3.19174	\$2.80553	\$2.66406	\$2.64124	\$3.73608	\$4.34022
17. Royalties.....	{ a b	3.13162 3.04559	2.79115 3.19611	2.66280 2.29208	2.61741 3.21584	3.73558 5.32203	4.32083 5.23074
18. Total cost of delivery to operator.....	{ a b	3.02755 3.49633	3.1882 3.12514	2.9154 2.95614	3.2067 2.96308	5.31166 4.26800	4.89204 4.89229
Profit and Loss.							
19. Receipts from sale of ore.....	3.30027	4.11367	3.32900	3.13869	3.73400	4.88694	5.00399
20. Profit or loss to operator.....	{ a b	.43520 .43581	.20386 .21903	.18255 .18435	.77092 .79592	.61865 6.1950	1.1173 1.1173
21. Total profit (operator's profit or loss plus royalty and depreciation).....	{ a b	.81333 .81333	1.04837 1.10799	.62292 .63656	1.23663 .69883	1.44843 1.44893	1.03462 1.03501
22. Assessed valuation per ton by Board of State Tax Commissioners*.....		.81887	.75715	.71260	.74478	.73405	\$0.78826

a. Total of all operations.
b. Total of all operations excluding non-producers.
Note.—All items in 1906 and 1907 figured on bases of tons shipped, tons mined not available.
In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 and item 19 on tons shipped.
*Assessed valuation per ton by Board of State Tax Commissioners in 1919 was \$0.75727.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MENOMINEE RANGE, DICKINSON COUNTY, MICH.
Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operators.

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
Cost of Mining.						
1. General office expenses.....	{ a b	\$0.06131 0.61115	\$0.07640 0.7604	\$0.06687 0.6655	\$0.04570 0.4570	\$0.04250 0.4250
2. Fire insurance.....	{ a b	.00102 .00098	.00121 .00114	.00768 .00758	.04570 .00551	.00701 .00701
3. Employer's liability insurance.....	{ a b	..........	..........	..........	..........	..........
4. Taxes.....	{ a b	.04875 .04844	.06366 .06331	.11040 1.0967	.00143 1.0260	.00605 1.0141
5. Depreciation.....	{ a b	.00528 .00528	.00691 .00691	.16494 1.16123	.14697 1.4697	.14071 1.4071
6. Mining.....	{ a b	.98118 .07647	1.21721 1.21721	1.20207 1.20110	1.21584 1.21584	1.26711 1.26711
7. Exploration and development.....	{ a b	.07647 .14287	.08296 .13769	.09243 .13769	.09243 .13769	.13863 .16300
8. Construction.....	{ a b	.13598 .13598	.16885 .16885	1.9086 1.9086	1.0095 1.0095	.07037 .07037
9. Total cost at mine.....	{ a b	1.31688 1.30948	1.61720 1.61642	1.88392 1.87809	1.71143 1.71143	1.77209 1.77209
"Beyond the Mine" Cost.						
10. Rail freight.....	{ a b	3.2025 3.2025	3.1908 3.1908	3.0214 2.9914	3.2006 3.2006	3.0832 3.1444
11. Boat freight.....	{ a b	3.4010 3.4010	3.3683 3.3683	3.7593 3.7445	3.7786 3.7786	3.9087 3.9260
12. Cargo insurance.....	{ a b	.00081 .00081	.00063 .00063	..........	.00207 .00207	.00205 .00205
13. Analysis at lower lake ports.....	{ a b	..........	..........	..........	..........	..........
14. Selling commissions.....	{ a b	.01403 .01403	.01336 .01336	.00920.....	.01645.....	.02251
15. Total "Beyond the Mine" Cost.....	{ a b	7.1259 7.1259	7.1345 7.1345	7.0049 6.9516	7.6037 7.6037	8.0337 8.0337
Unclassified.....		.03740	.04355	.01322	.04393	.07789

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MEMONINEE RANGE,
DICKINSON COUNTY, MICH.—Continued.

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operators.

	1903. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1913. Per ton.	1911. Per ton.
Beyond the Mine Cost.— <i>Con.</i>						
16. Total cost of delivery.....	{ a b	\$2.02947 2.02207	\$2.33065 2.32957	\$2.58441 2.57325	\$2.47180 2.47180	\$2.57546 2.57546
17. Royalties.....	{ a b	.22039 2.2039	.28258 2.8258	.23856 2.3856	.25298 2.5298	2.1478 2.1478
18. Total cost of delivery to operator.....	{ a b	2.24986 2.24246	2.61323 2.61245	2.82297 2.81181	2.72478 2.72478	2.85254 2.84420
Profit and Loss.						
19. Receipts from sale of ore.....		3.13222	3.89632	2.93813	3.32263	2.79390
20. Profit or loss to operator.....	{ a b	.88236 1.28309	1.28309 1.28386	1.15116 1.5632	.59785 .59785	.05864 .05030
21. Total profit (operator's profit or loss plus royalty and de- preciation).....	{ a b	1.10803 1.11542	1.57258 1.57335	.51866 .52611	.99780 .99780	.31351 .32266
22. Assessed valuation per ton by Board of State Tax Commis- sioners.....	{ a b	1.10803 1.11542	1.57258 1.57335	.51866 .52611	.99780 .99780	.31351 .32266

a. Total of all operations.
b. Total of all operations excluding non-producers.
Note.—All items in 1903 and 1907 figured on basis of tons shipped, tons mined not available.
In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 inclusive and item 19 on tons shipped.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MEMONINEE RANGE,
DICKINSON COUNTY, MICH.—Continued.

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators.

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Cost of Mining.							
1. General office expenses.....	{ a b	\$0.06289 .06284	\$0.04758 .04667	\$0.06062 .05911	\$0.06662 .06192	\$0.06507 .06381	\$0.06248 .06181
2. Fire insurance.....	{ a b	.00749 .00684	.00595 .00571	.00763 .00732	.00714 .00682	.00455 .00458	.00516 .00516
3. Employer's liability insurance.....	{ a b	.01080 .01074	.01826 .01823	.00682 .01801	.01670 .01670	.02046 .02046	.02959 .02959
4. Taxes.....	{ a b	1.5124 1.7775	1.6329 1.6248	1.7651 1.7534	1.7430 1.6985	1.3316 1.3154	1.3825 1.3805
5. Depreciation.....	{ a b	1.5657 1.4465	1.4460 1.3500	1.2758 1.2758	1.4988 1.3211	1.4266 1.6071	.06864 .06863
6. Mining.....	{ a b	1.54642 1.54135	1.42418 1.42418	1.56567 1.56472	1.54777 1.54777	2.01925 2.01861	2.44949 2.44949
7. Exploration and development.....	{ a b	1.6610 1.6598	1.4462 1.4462	1.5022 1.4617	1.0856 1.0856	.01847 0.01847	.....
8. Construction.....	{ a b	.07908	1.5735	1.3618.....	.06971.....	.02249	1.1207
9. Total cost at mine.....	{ a b	2.21059 2.18726	2.10683 2.09182	2.24246 2.23443	2.14317 2.11344	1.99461 1.99107	2.86568 2.86380
"Beyond the Mine" Cost.							
10. Rail freight.....	{ a b	.25654 2.7718	.33679 3.3176	.31258 3.1258	.42976 4.2968	.43243 4.3243	.74689 7.4689
11. Boat freight.....	{ a b	.23712 2.3061	.29436 2.8994	.25476 2.5476	.31703 3.1703	.40788 4.0788	.69730 6.9730
12. Cargo insurance.....	{ a b	.00038 0.0036	.00045 0.0047	.00076 0.0076	.00068 0.0068	.00084 0.0084	.00114 0.0114
13. Analysis at lower lake ports.....	{ a b	.00010.....	.00083.....	.00110.....	.00207.....	.00244.....	.00226
14. Selling Commissions.....	{ a b	.01117 0.0949	.01677 0.1654	.00110 0.1165	.02063 0.2014	.00244 0.2905	.04124 0.4080
15. Total "Beyond the Mine" cost.....	{ a b	.58939 5.7172	.72872 7.1899	.61438 6.1431	.77017 7.7960	.87272 8.7242	1.48882 1.48882
Unclassified.....	{ a b	.05408.....	.07939.....	.03353.....	.07960.....	.08724.....	.....

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE MENOMINEE RANGE,
DICKINSON COUNTY, MICH.—Continued

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912 Per ton.	1913 Per ton.	1914 Per ton.	1915 Per ton.	1916 Per ton.	1917 Per ton.	1918 Per ton.
"Beyond the Mine" Cost.—Con.							
16. Total cost of delivery.....	\$2.79998	\$2.85555	\$2.85684	\$2.91334	\$2.80733	\$3.64624	\$4.35450
17. Royalties.....	2.75898	2.81081	2.84774	2.88304	2.86354	3.63722	4.35262
18. Total cost of delivery to operator.....	19541	21612	18070	19852	24707	43431	48371
	19313	21406	17810	18853	24513	43395	48371
	2.99539	3.05167	3.03754	3.11186	3.11440	4.08055	4.83821
	2.95211	3.02487	3.02584	3.07157	3.10867	4.07117	4.83633
Profit and Loss.							
19. Receipts from sale of ore.....	2.61715	3.08203	2.50720	2.83601	3.48817	4.76762	5.20430
20. Profit or loss to operator.....	37824	03036	53034	27585	37377	68707	36609
21. Total profit (operator's profit or loss plus royalty and depreciation).....	33496	05716	51864	23256	37950	69645	36797
22. Assessed valuation per ton by Board of State Tax Commissioners*.....	00282	40622	21296	07355	78798	1.26404	91844
		51957	46544	46981	55920	1.26404	91931
							0.63835

a. Total of all operations.
 b. Total of all operations excluding non-producers.
 Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
 * Assessed valuation per ton by Board of State Tax Commissioners in 1919 was \$0.64917.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE IRON RIVER AND CRYSTAL FALLS DISTRICTS, MICH.
 Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1906 Per ton.	1907 Per ton.	1908 Per ton.	1909 Per ton.	1910 Per ton.	1911 Per ton.
Cost of Mining.						
1. General office expenses.....	\$0.02142	\$0.03991	\$0.06483	\$0.05912	\$0.07662	\$0.09376
2. Fire insurance.....	01914	03893	06270	05847	07328	08036
3. Employer's liability insurance.....	00502	00546	00701	00367	00494	00576
4. Taxes.....	00499	00539	00597	00334	00449	00492
			00522	00551	00653	00626
			00510	00618	00618	00586
5. Depreciation.....	01892	01942	03521	02133	02625	09472
6. Mining.....	01634	01937	03398	02091	02502	08124
7. Exploration and development.....	01089	01409	12240	13189	11837	15102
	01089	01409	12113	13123	11837	15052
	00419	05856	1.25692	98412	1.17976	1.21732
	93729	05850	1.25692	98617	1.17976	1.20463
	26340	34431	23709	10502	25900	20459
8. Construction.....	14520	18955	10211	07084	13150	17734
	24753	30177	24661	11833	17559	10170
	20844	25780	23143	11135	14882	07781
9. Total cost at mine.....	1.57137	1.78346	1.96529	1.42899	1.84706	1.87503
	1.34229	1.58363	1.81934	1.38182	1.68742	1.79168
"Beyond the Mine" Cost.						
10. Rail freight.....	38136	39229	37714	38548	38549	36687
11. Boat freight.....	38134	39229	37714	38548	38549	36687
12. Cargo insurance.....	56819	57313	37474	43736	47241	32513
13. Analysis at lower lake ports.....	56814	57313	37474	43736	47241	30934
14. Selling commissions.....				00079	00114	00070
15. Total "Beyond the Mine" cost.....	08732	08288	09856	00509	00074	00058
	08732	08288	09856	00509	00074	00058
	1.03687	1.04830	85044	07241	07734	06732
	1.03679	1.04830	85044	90113	93712	76080
				90113	93712	72707

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE IRON RIVER AND CRYSTAL FALLS DISTRICT, MICH.—Continued

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1906 Per ton.	1907 Per ton.	1908 Per ton.	1909 Per ton.	1910 Per ton.	1911 Per ton.
"Beyond the Mine" Cost.— <i>Con.</i>						
16. Total cost of delivery.....	\$2. 60824	\$2. 83176	\$2. 81573	\$2. 33012	\$2. 78418	\$2. 63583
17. Royalties.....	2. 37908	2. 63193	2. 66978	2. 28295	2. 62454	2. 51875
18. Total cost of delivery to operator.....	2. 20623	2. 76628	2. 51170	2. 28345	2. 62454	2. 53094
	2. 19862	2. 70322	2. 40005	2. 23202	2. 48174	2. 23370
	2. 81447	3. 10804	3. 06743	2. 56857	3. 05585	2. 50687
	2. 57770	2. 90225	2. 90983	2. 51497	2. 87328	2. 74245
Profit and Loss.						
19. Receipts from sale of ore.....	3. 10194	3. 95240	3. 01281	3. 27907	3. 66809	2. 80477
20. Profit or loss to operator.....	28747	84436	54462	71050	61224	92790
21. Total profit (operator's profit or loss plus royalty and depreciation).....	52424	1. 05015	1. 0298	76410	79481	15232
22. Assessed valuation per ton by Board of State Tax Commissioners.....	50459	1. 13473	3. 1948	1. 08084	1. 00228	4. 9996
	73375	1. 33456	4.6416	1. 12735	1. 16192	5.2634
						44606

a. Total of all operations.
b. Total of all operations, excluding non-producers.
Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 and item 19 on tons shipped.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE IRON RIVER AND CRYSTAL FALLS DISTRICTS, MICH.—Continued

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912 Per ton.	1913 Per ton.	1914 Per ton.	1915 Per ton.	1916 Per ton.	1917 Per ton.	1918 Per ton.
Cost of Mining.							
1. General office expenses.....	\$0. 07995	\$0. 08637	\$0. 11919	\$0. 06907	\$0. 05838	\$0. 08193	\$0. 10175
2. Fire insurance.....	0. 07387	0. 07266	1. 0635	0. 05591	0. 05825	0. 08164	1. 01225
3. Employers' liability insurance.....	0. 00386	0. 00732	0. 00916	0. 00512	0. 00410	0. 00427	0. 00555
4. Taxes.....	0. 01008	0. 00647	0. 02533	0. 04404	0. 03857	0. 00427	0. 03469
5. Depreciation.....	0. 00962	0. 01803	0. 02766	0. 01897	0. 01873	0. 02620	0. 03469
6. Mining.....	0. 08153	0. 06690	1. 0031	1. 0879	0. 8226	1. 0379	1. 4127
7. Exploration and development.....	0. 06482	0. 08180	1. 1462	1. 0718	0. 7460	0. 9465	1. 2998
8. Construction.....	1. 1376	1. 2833	1. 5660	1. 0348	1. 0348	1. 2376	1. 5240
9. Total cost at mine.....	1. 1157	1. 2308	1. 2660	0. 8795	1. 14334	1. 43898	1. 5240
	1. 07502	1. 18229	1. 29722	0. 9718	1. 14334	1. 43898	1. 5302
	1. 26915	1. 4967	1. 31585	0. 9632	1. 15966	1. 43898	1. 83302
	1. 6903	2. 8649	2. 1772	1. 6197	1. 7641	0. 07098	0. 05648
	1. 9337	3. 0065	2. 1772	1. 567	1. 7641	0. 05789	0. 03697
	1. 1781	2. 8782	1. 6341	0. 6802	0. 8335	0. 07396	0. 03389
	1. 86122	2. 40835	2. 26982	1. 48878	1. 49913	1. 92957	2. 35910
	1. 63211	1. 81136	2. 05625	1. 40396	1. 45506	1. 90473	2. 32642
"Beyond the Mine" Cost.							
10. Rail freight.....	37014	42886	44558	43875	49851	47523	79749
11. Boat freight.....	36338	41676	41958	42901	43851	47523	79749
12. Cargo insurance.....	23496	27170	26330	27266	36345	71340	77677
13. Analysis at lower lake ports.....	2310	26135	24333	26691	36345	71340	77677
14. Selling commissions.....	0. 00028	0. 00992	0. 0097	0. 0113	0. 0140	0. 0200	0. 0228
15. Total "Beyond the Mine" cost.....	0. 00046	0. 00204	0. 00291	0. 00302	0. 00370	0. 00495	0. 00621
	0. 00046	0. 00204	0. 00291	0. 00302	0. 00370	0. 00495	0. 00621
	0. 06269	0. 05415	0. 04882	0. 05226	0. 05442	0. 06641	0. 06225
	0. 6150	0. 76054	0. 76650	0. 77198	0. 80048	1. 20199	1. 64500
	6.6853	7.3022	7.1553	7.5419	8.0048	1. 26199	1. 61500

COSTS, PROFITS, LOSSES AND ASSESSMENTS, IRON MINES OF THE IRON RIVER AND CRYSTAL FALLS DISTRICTS, MICH.—Concluded

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports by the operators

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Beyond the Mine Cost.—Con.							
16. Total cost of delivery.....	\$2.52975	\$2.86919	\$3.02741	\$2.26076	\$2.34961	\$3.19186	4.00410
17. Royalties.....	2.29283	2.54658	2.77178	2.15815	2.80554	3.16572	3.97142
18. Total cost of delivery to operators.....	22019	23898	28250	25014	29443	40217	27935
	21170	22326	25786	21777	28315	38892	36932
	2.74994	3.15817	3.30991	2.51090	2.64404	3.50403	4.38335
	2.50453	2.77284	3.02964	2.37592	2.58769	3.55564	4.34124
Profit and Loss.							
19. Receipts from sale of ore.....	2.61385	3.00103	2.63285	2.62411	2.90039	4.43539	4.98044
20. Profit or loss to operator.....	13609	15709	67706	11321	25635	84136	59700
21. Total profit (operator's profit or loss plus royalty and depreciation).....	19786	22824	39679	24819	31270	87975	63920
22. Assessed valuation per ton by Board of State Tax Commissioners*.....	43259	26042	25896	46103	65226	1.37329	1.12874
		.57758	.01233	.55589	.69899	1.39843	1.16142
		.34512	.35776	.32927	.35185	.37201	\$0.44952

a. Total of all operations.
 b. Total of all operations excluding non-producers.
 Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
 In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 and item 19 on tons shipped.
 *Assessed valuation per ton by Board of State Tax Commissioners in 1919 was \$0.47969.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, MICHIGAN IRON MINES

Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from the reports of the operators

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
Cost of Mining.						
1. General office expenses.....	\$0.06368	\$0.08084	\$0.06619	\$0.05704	\$0.05792	\$0.08405
2. Erie insurance.....	.06206	.08021	.06539	.05663	.05652	.08177
3. Employer's liability insurance.....	.00190	.00206	.00579	.00409	.00419	.00545
4. Taxes.....	.00174	.00200	.00550	.00394	.00407	.00517
5. Depreciation.....	.....	.....	.00418	.00399	.00599	.01280
6. Mining.....	.....	.....	.00415	.00399	.00592	.01258
7. Exploration and development.....	.04807	.05599	.07330	.06869	.06968	.15022
8. Construction.....	.04731	.05583	.07222	.06794	.06898	.14592
9. Total cost at mine.....	.00481	.00636	.12043	.12421	.10092	.12972
	1.16233	1.29348	1.40644	1.30734	1.31023	1.39408
	1.14413	1.28889	1.40057	1.30143	1.30544	1.38582
	1.06833	1.14406	1.20097	1.09864	1.09337	1.2575
	1.56995	1.13999	1.00666	.07897	1.11335	1.5218
	1.4374	1.8758	1.5741	1.1996	.09994	1.4150
	1.54457	1.7959	1.95555	1.0275	.08804	.08261
	1.48812	1.72687	1.92386	1.78396	1.78824	2.01689
				1.73872	1.74092	1.98112
"Beyond the Mine" Cost.						
10. Rail freight.....	33341	33639	34304	34590	34547	31765
11. Boat freight.....	33340	33639	34244	34401	34547	31266
12. Cargo insurance.....	53102	53428	48666	49555	53537	37546
13. Analysis at lower lake ports.....	63101	53428	48638	49555	53537	37108
14. Selling commissions.....	00066	00080	00006	00150	00182	00159
15. Total "Beyond the Mine" Cost.....	00015	00012	00009	00239	00114	00109
	03078	03221	03933	04023	03920	03834
	90564	91318	87169	89265	93426	73681
Unclassified.....	00964	00938	00251	00738	01126	00152

COSTS, PROFITS, LOSSES AND ASSESSMENTS, MICHIGAN IRON MINES.—Continued
Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operators

	1906. Per ton.	1907. Per ton.	1908. Per ton.	1909. Per ton.	1910. Per ton.	1911. Per ton.
"Beyond the Mine" Cost.—Con.						
16. Total cost of delivery.....	\$2. 45023	\$2. 68355	\$2. 82724	\$2. 67691	\$2. 72950	\$2. 75370
17. Royalties.....	2. 39376	2. 64005	2. 79451	2. 62981	2. 67518	2. 70740
18. Total cost of delivery to operator.....	2. 25660	2. 26862	3. 0007	2. 8448	2. 9039	2. 9220
19. Receipts from sale of ore.....	2. 2434	2. 26750	2. 29479	2. 27457	2. 29632	2. 29755
20. Profit or loss to operator.....	2. 67583	2. 95217	3. 12731	2. 96130	3. 02749	3. 01579
21. Total profit (operator's profit or loss plus royalty and de- preciation).....	2. 61810	2. 90755	3. 08930	2. 90438	2. 97150	2. 96495
22. Assessed valuation per ton by Board of State Tax Commis- sioners.....	3. 44813	4. 08242	3. 56079	3. 59276	3. 97701	3. 34723
	77230	1. 13025	4. 3348	63137	94052	33444
	83003	1. 17487	47149	68838	1. 0052	38228
	1. 00271	1. 40523	85482	1. 04006	1. 36543	72325
	1. 05918	1. 44873	88671	1. 08702	1. 40243	70555
						.504

a. Total of all operations.
b. Total of all operations excluding non-producers.
Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 inclusive and item 19 on tons shipped.

COSTS, PROFITS, LOSSES AND ASSESSMENTS, MICHIGAN IRON MINES.—Continued
Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operators

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
Cost of Mining.							
1. General office expenses.....	\$0. 07639	\$0. 06700	\$0. 08053	\$0. 06163	\$0. 06625	\$0. 08509	\$0. 12599
2. Fire insurance.....	07408	06275	07648	05995	06380	08449	12253
3. Employer's liability insurance.....	00543	00531	00541	00495	00589	00585	00525
4. Taxes.....	00494	00503	00502	00465	00369	00557	00521
5. Depreciation.....	01312	01990	02369	01664	01872	02208	02976
6. Mining.....	12900	12216	14069	10954	10842	12208	02973
7. Exploration and development.....	10969	11623	13310	14314	10912	17088	15105
8. Construction.....	10759	11038	12570	15784	10912	17088	14813
9. Total cost at mine.....	1. 30084	1. 10815	1. 20482	1. 07526	1. 22452	1. 58743	2. 2317
	29085	1. 35494	1. 28172	1. 07070	1. 22352	1. 58503	2. 22294
	12452	1. 16333	1. 19263	1. 12908	0. 83274	1. 58449	1. 88474
	10014	1. 19552	1. 17562	0. 8040	0. 8540	0. 6959	1. 98489
	07357	1. 13872	1. 05110	0. 8954	1. 0237	1. 8534	0. 20934
	1. 88779	2. 04246	2. 08930	1. 67403	1. 63292	2. 70153	2. 3207
	1. 81197	1. 93298	1. 95886	1. 64699	1. 60236	2. 17788	2. 75574
"Beyond the Mine" Cost							
10. Rail freight.....	32962	38361	36805	38349	39717	42055	63736
11. Boat freight.....	32606	37900	36082	38120	39717	42055	63736
12. Cargo insurance.....	32874	39878	36629	34823	35780	42055	72959
13. Analysis at lower lake ports.....	00095	00106	00091	00120	00149	00239	00191
14. Selling commissions.....	00112	00282	00300	00310	00360	00393	00419
15. Total "Beyond the Mine" cost.....	03619	03837	03457	03737	04117	04562	03704
Unclassified.....	70524	83669	73882	77340	80123	84502	85703
	69959	82665	79332	76893	80117	1. 20069	1. 41009
	00653	01105	00445		90117	1. 20065	1. 41008

COSTS, PROFITS, LOSSES AND ASSESSMENTS, MICHIGAN IRON MINES.—*Concluded*
 Compiled by the Appraiser of Mines for the Board of State Tax Commissioners from reports of the operators

	1912. Per ton.	1913. Per ton.	1914. Per ton.	1915. Per ton.	1916. Per ton.	1917. Per ton.	1918. Per ton.
"Beyond the Mine" Cost.— <i>Con.</i>							
16. Total cost of delivery.....	\$2.59303	\$2.88015	\$2.77818	\$2.44743	\$2.53415	\$3.47076	\$4.19102
17. Royalties.....	2.51156	2.75063	2.68238	2.41592	2.50403	3.43853	4.16582
18. Total cost of delivery to operator.....	2.22255	2.93382	2.64077	2.33872	2.71134	4.26668	4.33584
	2.18000	3.33882	3.25783	2.33196	2.66648	4.20822	4.32777
	2.81358	3.38405	3.04225	2.68615	2.80549	3.89744	4.62686
	2.72956	2.99545	2.94021	2.64728	2.77051	3.85935	4.59859
Profit and Loss.							
19. Receipts from sale of ore.....	2.92708	3.41187	2.92249	2.79402	3.36144	4.59733	5.12394
20. Profit or loss to operator.....	.11150	.27732	.11976	.10787	.55595	.69989	.49708
21. Total profit (operator's profit or loss plus royalty and depreciation).....	.19750	.41592	.01772	.14674	.59093	.73798	.52535
22. Assessed valuation per ton by Board of State Tax Commissioners*.....	.44374	.75989	.27001	.49665	.95298	1.31471	1.15609
	.52309	.43561	.36020	.52380	.98185	1.34625	1.38106
			.45237	.43546	.42923	.43439	\$0.53969

a. Total of all operations.
 b. Total of all operations excluding non-producers.
 Note.—All items in 1906 and 1907 figured on basis of tons shipped, tons mined not available.
 In all other years items 1 to 9 inclusive figured on tons mined, items 10 to 17 inclusive and item 19 on tons shipped.
 *Assessed valuation per ton by Board of State Tax Commissioners in 1919 was \$0.55929.

PART II. NON-METALLIC MINERALS

H. M. MARTIN