

STATE OF MICHIGAN
DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY DIVISION

**Publication 35. Geological Series 29.
MINERAL RESOURCES OF MICHIGAN**

WITH
STATISTICAL TABLES OF PRODUCTION AND
VALUE OF MINERAL PRODUCTS
FOR
1923 AND PRIOR YEARS

PREPARED UNDER THE DIRECTION OF
R. A. SMITH, State Geologist
IN COOPERATION WITH THE UNITED STATES
GEOLOGICAL SURVEY



PUBLISHED AS A PART OF THE ANNUAL REPORT OF THE
GEOLOGICAL SURVEY DIVISION FOR 1923

PART I. METALLIC MINERALS

TABLE OF CONTENTS.

Letter of Transmittal	1
PART I. METALLIC MINERALS	
The Copper Industry. L. P. Barrett	1
General Review	2
Details of Actual Operations	3
The Iron Industry. L. P. Barrett.....	6
Production and former shipments by Districts and Counties.....	6
Average Cost of Production--Receipts and profits of Michigan Iron Mines	7
Labor Statistics of Iron Mines	7
Estimated Reserves and Assessed Valuation.....	7

LETTER OF TRANSMITTAL.

*To the Honorable, the Director and the Board of
Commissioners of the Department of Conservation of
the State of Michigan.*

Hon. John Baird, Director
Hon. W. H. Wallace, Chairman
Hon. Herman Lunden.
Hon. Chas. E. Lawrence.
Hon. T. F. Marston.
Hon. Geo. W. Millen.
Hon. Fred Z. Pantlind.
Hon. Howard B. Bloomer.

Gentlemen: Under authority of Act No. 7 Public Acts of Michigan, Session of 1911, I have the honor to present herewith Publication 35 Geological Series 29, the eleventh of a series of annual statements of the production and value of the mineral products of Michigan. This publication is a part of the Annual Report of the Geological Survey Division for 1923.

Very respectfully,
R. A. Smith,
State Geologist.

**COPPER INDUSTRY OF MICHIGAN
IN 1923**

The Michigan copper production in 1923 totaled 137,952,586 pounds. This production was derived from nine operating units; the Ahmeek and Conglomerate Mines and the Torch Lake Reclamation of the Calumet and Hecla Consolidated Copper Company; Baltic and Champion of The Copper Range Company and Isle Royale, Mohawk, Quincy and Wolverine. The Trimountain Mine of The Copper Range Company was closed except for a small production incidental to some development work. Table 1 gives the details of this production, by companies, for the years 1919 to 1923.

The average recovery, per ton of rock treated, amounted to 32.11 pounds per ton and the average price received from the copper totaled 14.95 cents per pound.

The most important event of the year in Michigan copper was the consolidation of The Calumet and Hecla Mining Company, Ahmeek Mining Company, Allouez Mining Company, Centennial Copper Mining Company and The Osceola Consolidated Mining Company, under the heading "Calumet and Hecla Consolidated Copper Company". This re-organization took place and became effective September 1, 1923. In addition to this consolidation, the Mohawk Mining Company acquired the property of the Wolverine and Michigan companies.

GENERAL CONDITIONS OF THE MICHIGAN COPPER DISTRICT

In 1912 Michigan had twenty operating properties, which produced a total of 216,000,000 pounds of copper. Of this total only 5,800,000 pounds or 2.7 per cent was produced at a loss. In 1923 the number of mines had been reduced to ten and the production to 138,000,000 pounds of which 71,000,000 pounds or approximately 54 per cent was produced at an actual loss to the mining company. If all of the mines active in 1912 had continued to 1923 the percentage of copper produced at a loss would of course have been much greater. While it is generally known that conditions in the copper country have been bad for the past five years, the statement given above serves to emphasize this condition.

It is necessary perhaps to point out that this condition is not confined to the single year 1923 but has been operative since the close of the War in 1918. Table III is a compilation of the average cost of producing copper in Michigan during each of the past five years and for the period as a whole. This table shows that the average profit of all producing units in the State during the past five years exclusive of depletion and Federal taxes amounted to slightly over three tenths of a cent per pound. In this computation no costs were included for Calumet and Hecla and subsidiaries during the period these properties were closed in 1921 and 1922. If these costs were included it would be found that the entire Michigan copper production was mined at a loss during the past five years.

EXAMINATION OF THE ECONOMIC FACTORS RESPONSIBLE FOR THIS CONDITION

For the five year period prior to the World War the United States produced and imported in round figures 1,450,000,000 pounds of copper per year. Of this total production approximately one-half was consumed in the United States and the other half exported to foreign countries, principally Europe. At the outbreak of the War in 1914 a temporary curtailment was soon succeeded by an exceptional demand for the red metal and at no time from 1915 to 1918 did production catch up with the consuming requirements. This condition during the War period caused a tremendous expansion in the copper mining industry, an increasing search and rapid development of new mines, while the older properties were equipped for a greater production than ever before. The output of the United States increased from 1,250,000,000 pounds in 1912 to 1,900,000,000 pounds in 1918. In this connection it is significant that the Michigan production showed a relatively small increase in spite of this greatly stimulated demand. In 1912 Michigan production was 216,000,000 pounds, in 1917, 250,000,000 pounds and in 1918 only 228,000,000. During the same period the Arizona production increased from 359,000,000 pounds in 1912 to 769,000,000 pounds in 1918. At the close of the War production fell off rapidly and the average United States production since 1920 is less than the record of the five

years preceding the War period. On the other hand the imports of copper have increased. The United States consumption of copper during this period has been in excess of the pre-war record, while the exports have been slightly less. A complete tabulation of the data covering mine production, imports and exports, and the United States consumption is shown in Table IV. It is apparent that the present consumption of new copper in the United States has shown a healthy and normal increase if the exceptional consumption during the World War is discounted. What the World War did result in primarily was the development of a greatly increased capacity for copper production, particularly in the so-called porphyry coppers. It is the competition of the porphyry coppers located in the United States and in foreign countries which has adversely affected the Michigan district.

PORPHYRY COPPERS

In 1912, the production from porphyry coppers was 279,000,000 pounds and in 1922 the output was around 600,000,000 pounds. It is noteworthy for the most part that these porphyry coppers have immense reserves running into hundreds of millions of tons. They are easily mined by the use of open pit steam shovel methods, or relatively shallow underground operations. The average copper content of the porphyry deposits is around 1.75 per cent; the average copper content of the Michigan copper ores is around 1 per cent in addition the porphyries, like all sulphide coppers, carry appreciable amounts of gold and silver. These subsidiary metals which are obtained as a by-product tend to reduce the cost of operation. In Michigan the only by-product is a very small and almost inconsequential amount of silver. The development of this large group of cheap producers is one of the most important competitive factors with which the Michigan mines have to contend.

FOREIGN COMPETITION

Another important factor entering into the United States competitive field is the rapid increase in foreign competition, particularly from the South American field. The development of the Panama Canal has enabled the South American producers to bring their product into direct competition with the United States.

Table V shows for 1912 and 1922 the production of several of the larger foreign companies, of which costs and statistics are available. It is interesting to note that in 1912 the six companies listed produced 136,000,000 pounds of copper at an average cost of 9 cents per pound. In 1922 this same group produced 388,000,000 pounds of copper at an average cost of 9.56 cents per pound or an increase in cost of only five tenths of a cent. In 1912 the average cost of production of copper in Michigan was around 10.6 cents and in 1922 the average cost was 12.89 cents. In other words there is a differential in favor of these foreign producers at present of slightly over 3 cents per pound.

PHYSICAL CONDITIONS OF THE MINES

With one or two exceptions, the Michigan copper deposits do not show any indication of termination or diminution of their metallic content with depth. The problem confronting the Michigan producers is entirely one of cost of mining and not related to the geological occurrence of the ore. The long-history of mining in the copper country has amply demonstrated that the district is unique for its uniformity of mineralization and continuity with depth. The physical conditions, aside from those resulting from increased depth, remain practically the same. The problem confronting the Michigan producers is, therefore, strictly related to their ability to compete with foreign and western production.

DETAILS OF COMPANY REPORTS

Calumet-Hecla Consolidated Copper Co.

For the eight months previous to the consolidation, there was produced as follows:

Ahmeek Mine	17,811,031 lbs. of copper
Conglomerate Mine	24,413,600 lbs. of copper
Reclamation	10,634,200 lbs. of copper

Following the consolidation for the four months of the year, from September 1st the mines produced 21,259,000 pounds of copper and the Reclamation 6,267,000 pounds of copper. The price received for copper delivered during the four months' period from September 1 through December 31 was 13.58 cents per pound.

Reclamation Plant

The following table gives the results obtained during the last four months of the year, as well as the results to date since this operation started:

	Sept. 1-Dec. 31 1923	Since starting 7,955,518 712 %
Tons treated	664,550	125 %
Assay headings	597	203 %
Assay tailings	125	9.43
Pounds refined copper	6,267,000	82,102,924
Pounds refined copper per ton treated	9.43	10.32

Of the copper produced during the last four months of 1923, 1,417,000 pounds was from table treatment, 3,974,000 pounds was from leaching, and 876,000 pounds was from flotation.

EARNINGS STATEMENT

September-December, 1923

Receipts	
Copper Sales	\$2,540,053.73
Custom Milling, Smelting and Refining	21,247.84
Dividends	21,559.65
Interest	77,254.13
Miscellaneous	23,371.42
	\$2,683,486.77
Disbursements	
Copper on hand September 1, 1923	\$3,672,555.02
Production, selling, administration and taxes	2,931,283.79
Depreciation and Depletion	1,219,930.48
Miscellaneous	172,709.59
	\$8,096,478.88
Less copper on hand end of year	4,816,494.63
Loss for period	\$596,497.48

BALANCE SHEET

December 31, 1923

Assets	
Current Assets:	
Cash	\$1,008,358.97
Liberty Loan Bonds at par	1,632,850.00
U. S. Certificates of Indebtedness	450,000.00
Notes Receivable	322,727.85
Accounts Receivable	2,678,485.68
Copper on hand	4,816,494.63
Prepaid Charges	87,228.70
Supplies at mine (book value)	4,034,266.94
	\$15,030,412.77
Investments in Other Companies (Book value)	
	2,034,865.33
Capital Assets (book value):	
Real Estate, Stumpage and Timber	\$4,460,034.36
Mine Lands	\$52,542,942.07
Less Reserve for Depletion	877,723.71
	51,665,218.36
Plant	\$28,414,853.97
Less Reserve for Depreciation	12,169,650.19
	16,245,203.78
Stamp Mill Patents	40,403.19
	\$72,410,859.69
Total Assets	\$89,476,137.79
Liabilities	
Current Liabilities:	
Accounts Payable	\$1,266,818.34
Capital Stock:	
Authorized	2,500,000 shares par value \$25.00 per share \$62,500,000.00
Less not issued	494,498 shares par value \$25.00 per share 12,362,450.00
	50,137,550.00
Issued	2,005,502 shares par value \$25.00 per share full paid \$50,137,550.00
	\$50,137,550.00
Surplus:	
Paid-in Surplus September 1, 1923	\$39,671,017.93
Loss by 1923 operations (4 months)	\$596,497.48
Dividend paid	1,002,751.00
	1,599,248.48
	38,071,769.45
Total Liabilities, Capital and Surplus	\$89,476,137.79

Investments in Other Companies as shown in Balance Sheet include stock holdings of Copper Companies located in Michigan, as follows:

28,785 shares Cliff Mining Company, of a total issue of	60,000 shares
35,000 shares Isle Royale Copper Company, of a total issue of	150,000 shares
152,977 shares LaSalle Copper Company, of a total issue of	302,977 shares
50,100 shares Superior Copper Company, of a total issue of	100,000 shares
10,000 shares White Pine Copper Company, Preferred, of a total issue of	10,000 shares
42,602 shares White Pine Copper Company, Common, of a total issue of	85,320 shares

A. D. NICHOLS,
Treasurer.

Copper Range Company

The 1923 production of all mines was 23,571,360 pounds, of which the Champion produced 18,412,630 pounds and the Baltic and Trimountain 5,851,730 pounds. Of the latter, all except a small percentage came from the Baltic Mine as the Trimountain was idle except for development work. The statements of the operations at the Baltic and Trimountain Mines are as follows:

Receipts	
5,158,730 lbs. of copper sold at 14.62 cents per lb.	\$754,518.30
Interest	24,047.51
	\$778,565.81
Expenditures	
Running expenses at the mines, and property taxes	\$891,712.43
Smelting, freight, cost of marketing copper and general expense	1,099,977.26
	1,991,689.69
Loss on operations	\$223,123.88
Trimountain shutdown expense, excluding property taxes of \$41,195.85 deducted above	\$107,320.80
Depletion and depreciation	309,289.14
	416,609.94
Deficit	\$639,733.82
Construction Charges for 1923	\$80,321.98

The statement of operations at the Champion is as follows:

Receipts	
18,412,630 pounds of copper produced and sold at (including silver) 14.86 cents per lb.	\$2,736,047.34
Interest	55,034.61
	\$2,791,081.95

Expenditures		
Running expenses at the mine, and property taxes	\$1,636,942.94	
Smelting, freight, cost of marketing copper and general expenses	415,267.03	2,052,209.97
Profit on operations		\$738,871.98
Depletion and depreciation		804,508.69
Deficit		\$65,636.71
Construction charges for 1923		\$9,392.42
Consolidated statement of the Copper Range Company for the year ending December 31st, 1923 is as follows:		
23,571,360 lbs. of copper produced and sold at average of 14.808 cents per pound	\$3,490,565.64	
Interest	185,515.87	
Atlantic Mining Company income from rents, interest, etc.	11,682.48	
	\$3,687,763.99	
Mining Expense, smelting, freight, sales department and all other expenses		2,797,158.47
Taxes paid by mining companies		\$890,605.52
		307,859.59
		\$582,745.93
Copper Range Railroad Company		
Operating Income	\$148,807.39	
Less interest on bonds	114,000.00	34,807.39
		\$617,553.32
Deduct one-half of net mining profit of Champion Copper Company which belongs to the St. Mary's Mineral Land Company		369,435.99
Operating Income		\$248,117.33
Depletion and depreciation for 2½ mines	\$711,543.49	
Trimountain shutdown expense	107,320.80	818,864.29
Deficit		\$570,746.96

CURRENT ASSETS AND TOTAL LIABILITIES

December 31, 1923

(Including Subsidiary Mining Companies)

Assets

Cash	\$1,059,787.87	
United States Liberty Loan Bonds	1,793,000.00	
U. S. and Short Term Securities	1,166,363.35	
Copper delivered and not paid for	168,738.55	
Copper on hand	759,256.11	
Copper Range Railroad Company bonds	870,000.00	
Supplies at Mines	\$435,698.00	
Cash at Mines	27,720.15	463,418.15
Accounts receivable	273,545.06	
Deferred Charges	1,529.66	
	\$6,556,238.75	

Liabilities

Current indebtedness at mines	\$151,526.81	
Accounts payable	68,903.74	220,430.55
Less one-half Champion		\$6,335,808.20
		1,320,358.81
Net excess of assets		\$5,015,449.39

The above statement does not include claim for \$92,966.29 filed against the United States Government on account of Railroad Guaranty under the Transportation Act of 1920.

The Copper Range Company now holds in its treasury the following:

97,288 shares Atlantic Mining Company stock.

50,000 shares Champion Copper Company stock.

42,443 shares Copper Range R. R. Co., entire stock issued.

9,200 shares Michigan Smelting Company stock.

Isle Royale Copper Company

Copper product for the year	8,002,244 lbs.
-----------------------------	----------------

PRODUCTION COSTS

Mining	9.87 c. per lb.	\$789,515.82
Smelting and Refining	.91 c. per lb.	73,012.15
Boston office and mine and corporation taxes	1.67 c. per lb.	133,987.73
Depreciation and Depletion	3.81 c. per lb.	304,592.96
Production cost of	8,002,244 lbs. at 16.26 c. per lb.	\$1,301,108.66
On hand January 1, 1923	1,180,980 lbs. at 14.19 c. per lb.	167,526.40
	9,183,224	\$1,468,635.06
Sold in year	6,158,182 lbs.	976,784.48
		\$491,850.58
		94,813.82
Less to reduce to market value		\$397,036.76
On Hand December 31, 1923	3,025,042 lbs. at 13.125 c. per lb.	

EARNINGS STATEMENT

Received for copper sold	6,158,182 lbs. at 14.84 c. per lb.	\$914,083.35
Cost of Copper Sold:		
Production cost at 15.86 c.	\$976,784.48	
Selling and delivery cost at .47 c.	29,155.42 lbs at 16.33 c. per lb.	1,005,939.90
Loss on copper sold	1.49 c. per lb.	\$91,856.55
Loss by reduction to market value		94,813.82
		\$186,670.37
Miscellaneous Receipts, Interest, etc.	\$23,545.45	
Miscellaneous Expenses	15,343.16	8,202.29
Loss for year		\$178,468.08

CHANGES IN NET CURRENT ASSETS

Balance of current assets January 1, 1923		\$1,245,365.33
Loss for year	\$178,468.08	
Less depreciation and depletion reserves	\$304,592.96	
Less depreciation on plant sold or obsolete	6,279.86	298,313.10
Net increase in reserves for year		\$119,845.02
Capital Assets:		
Plant increased, new construction	\$2,872.53	
Plant decreased by sales and obsolescence	11,089.50	
Net decrease in capital assets		\$8,216.97
Dividends paid:		
March 15, 1923	\$75,000.00	
June 15, 1923	75,000.00	
September 15, 1923	75,000.00	216,783.03
Net decrease in current assets		96,938.01
Balance of current assets December 31, 1923		\$1,148,427.32

COMPARATIVE RESULTS FOR THE PAST FOUR YEARS

	1920	1921	1922	1923
Tons of rock treated	591,971	116,576	246,641	308,940
Cost of mining, transportation, stamping and taxes per ton of rock	\$2.73	\$2.62	\$2.36	\$2.88
Pounds of refined copper produced	10,621,801	2,491,000	6,639,970	8,002,244
Pounds of refined copper per ton of rock treated	17.94	21.37	26.92	25.90

Mohawk Mining Company

The Mohawk Mine, of this company, produced 9,452,539 pounds or an average of 23.32 pounds of copper per ton of rock stamped. The Wolverine Mine, which was purchased by the Mohawk Mining Company, as of August 16, 1923, produced from that date to the end of the year 1,170,335 pounds of copper or an average of 16.82 pounds per ton. Underground work at the Wolverine Mine consisted only of scrambling in the old workings as the virgin ground in this property is practically exhausted to the property lines. The detailed financial statements of the Mohawk Mining Company are as follows:

BALANCE SHEET DECEMBER 31ST, 1923

Assets			
Current Assets:			
Cash in Bank and on Hand		\$678,246.35	
Accounts Receivable		161,648.14	
Notes Receivable—Timber Accounts		52,500.00	
Copper on hand, at cost		572,139.18	
Supplies at Mines		315,824.77	
Interest Accrued on Securities Owned		2,229.95	
Unexpired Insurance		1,127.95	
		\$1,783,716.34	
Investment in Smelting Company and Miscellaneous Securities			192,997.00
Capital Assets:			
Mines and Mine Development:			
Mining Properties		\$1,080,644.00	
Development of Mines		2,050,575.26	
Ore body enhancement, as of March 1, 1913		9,468,508.35	
		\$12,599,727.61	
Other Real Estate and Undeveloped Mineral Lands		458,923.40	
Buildings, Machinery and Equipment		3,424,487.24	16,483,138.25
			\$18,459,851.59

Liabilities

Current Liabilities:			
Accounts payable		\$142,347.39	
Federal Tax Adjustments, paid in 1924		124,266.07	
Notes payable due 1924		220,000.00	
Unclaimed dividends		8,070.50	
Interest Accrued on Notes Payable		2,983.62	\$497,667.58
Notes Payable for Purchase of Mineral Lands, Due 1925 and 1926			160,135.00
Reserves for Depletion and Depreciation:			
Depletion of Ore Bodies and Timber		\$6,694,805.18	
Depreciation of Buildings, Machinery and Equipment		2,483,750.31	9,178,555.49
Unrealized Appreciation of Ore Bodies at December 31, 1923			4,601,160.53
Capital Stock:			
Authorized—115,000 shares at \$25.00 each		\$2,875,000.00	
Issued—115,000 shares at \$18.00 per share paid			2,070,000.00
Surplus, per annexed statement:			
General		\$1,369,513.56	
Capital		582,819.43	1,952,332.99
			\$18,459,851.59

SURPLUS ACCOUNT, DECEMBER 31, 1923

Balance, December 31, 1922	\$1,609,589.04
Profit for the year 1923 before depletion and depreciation	150,297.73
Appreciation realized during year 1923	166,436.56
Capital surplus representing premium on stock issued for acquisition of Assets—	
Excess of valuation over amount credited as paid up on shares issued	582,819.43
Transfer from Reserve for Contingencies, no longer considered necessary	52,736.75
	\$2,561,879.51
Less:	
Depletion during year 1923	\$204,244.06
Depreciation for year 1923	90,302.46
Dividends paid during year 1923—Numbers 38 to 40	315,000.00
	609,546.52
Balance December 31, 1923	\$1,952,332.99

STATEMENT OF INCOME AND PROFIT AND LOSS FOR THE YEAR ENDED

DECEMBER 31, 1923		
Sales:		
8,613,745 pounds of copper at 14.2072 cents per pound		\$1,223,771.77
Cost of Sales:		
Copper on hand January 1, 1923	\$271,686.69	
Copper purchased from Wolverine Copper Mining Company, August 16, 1923	84,981.67	
Operating Expenses at Mines	1,057,018.33	
Smelting, Freight and New York Expenses	216,547.29	
Taxes	75,047.77	
	\$1,705,281.75	
Less—Copper on hand December 31, 1923, at cost	572,139.18	
Net cost of copper sold		1,133,142.57
Profit on sales of copper		\$90,629.20
Miscellaneous Income:		
Interest and dividends	\$29,977.67	
Rents Received, etc.	24,034.46	
Sale of timber	5,656.40	59,668.53
Profit for the year before providing for Depreciation and Depletion		\$150,297.73

Quincy Mining Company

The directors submit the following report of the business and operations of the Quincy Mining Company for 1922:

The mine yielded 15,402,726 lb. of refined realized copper, for which has been received		
Profits on silver	\$2,159,034.88	
	73,571.34	
	<u>\$2,232,606.22</u>	
Mining expense	\$1,671,295.16	
Opening mine expense	171,189.65	
Taxes paid in Michigan	102,748.33	
Capital stock tax	8,313.00	
Smelting and transportation, etc.	254,998.46	2,208,544.60
		<u>\$24,061.62</u>
Other Receipts		16,009.14
Total		<u>\$40,070.76</u>
Construction	\$81,883.64	
Accident account	24,000.00	105,883.64
Deficit		<u>\$65,812.88</u>
The statement of assets and liabilities in the last report showed a balance on hand:		
January 1, 1922	\$1,611,320.84	
Deficit for 1922	65,812.88	
Balance of assets January 1, 1923		<u>\$1,545,507.96</u>

The loss for the year was due entirely to the increased cost of producing copper during the last half of the year through the shortage of underground labor, caving of No. 6 shaft in July, cost of repairs to the shaft, and the higher price for coal due to the coal strike, as operations were conducted at a slight profit during the first half of the year.

Underground conditions continue favorable, with a good showing for copper in the deepest openings, and there was a slight increase in the yield of refined copper per ton of ore hoisted during the year.

The copper was sold at an average of slightly over 14 cents. The recovery of silver was 150,139 fine ounces, all of which was sold to the government under the Pittman Act on the basis of \$1 per oz., netting a profit of \$73,571.34.

During the year the mine produced 674,499 tons of copper ore and mass copper which yielded 22.83 lbs. of refined copper per ton. A total of 1,786,140 lbs. was recovered by the regrind section of the stamp mill.

DEVELOPMENT PROJECTS

Active development operations were carried on at the Seneca, Gratiot, Mayflower and Arcadian Mines but no attempt was made to carry on mining operations at any of the properties mentioned. The largest development project in the district is the Seneca, which is pursuing active development operations on the Kearsage lode on the underlay from the Mohawk Mine.

TABLE I—PRODUCTION OF COPPER BY COMPANIES—1919 TO 1923 INCLUSIVE

	1919	1920	1921	1922	1923
Ahmeek	17,223,111	20,489,438	6,255,200	14,885,081	†17,811,031
Allouez	3,749,984	2,499,239			
Calumet-Hecla (old company)					
Calumet-Hecla Consolidated	52,859,146	57,627,883	15,167,136	40,493,000	‡35,047,800
Centennial	1,365,148	561,284			=27,526,000
Copper Range Company:					
Baltic	7,864,653	6,613,918	7,608,847	5,239,586	4,877,248
Champion	19,886,917	13,610,324	20,719,307	19,583,806	18,412,630
Trinmountain	5,274,387	3,532,025	4,341,584	4,116,100	281,482
Franklin	1,062,879				
Isle Royale	13,007,647	10,621,801	2,491,000	6,639,970	8,002,244
La Salle	340,719	59,713			
Maas	1,963,178				
Michigan	1,697,107	1,075,492			
Mohawk	12,857,392	10,269,824	14,054,235	11,209,396	9,452,539
Osceola	10,824,231	7,465,773			
Quincy	19,476,320	19,219,070	16,960,265	15,402,726	13,000,733
Superior	563,935	322,871			
Victoria	1,245,590	1,060,829			
White Pine	1,979,268	1,850,787			
Winona	561,238	3,932,225			
Wolverine	4,562,617		3,924,270	3,544,879	3,544,879
Development Projects		531,384	466,323	272,182	
Total	178,365,567	161,343,880	92,262,083	121,386,726	137,952,586

†Seven months prior to consolidation as part of Calumet and Hecla Consolidated Copper Company.
‡Five months production of Consolidated Company.

TABLE II

Showing average recovery of copper per ton of rock treated. Average price received for copper produced and value per ton of rock treated.

Year.	Pounds copper, recovered, per ton treated.	Average price received per pound.	Value per ton.
1919	23.48	19.3605 c.	\$4.545
1920	27.35	17.8023 c.	4.869
1921	28.69	12.8881 c.	3.698
1922	34.07	13.5462 c.	4.615
1923	32.11	14.9543 c.	4.802

TABLE III

Average Cost per Pound of Producing Copper in Michigan 1919 to 1923 Inclusive. Exclusive of Depletion and Federal Income and Excess Profits Tax.

Items.	1919.	1920.	1921.	1922.	1923.	Average for Five Year Period.
General Expense	5637	6768	4933	5866	6803	6173
State taxes	8302	9321	6196	7351	8030	7942
Cost of Mining	9.9737	9.4815	7.1913	6.1938	6.6624	8.1487
Milling Smelting	3.2912	4.4098	4.1016	3.3347	3.1596	3.6361
Marketing Expense	5448	6321	5757	5180	5365	6596
Depreciation	1.8872	1.8452	1.3284	1.8009	1.5278	1.7153
Total Gross Cost	17.1208	17.9775	14.3099	13.1691	13.3786	15.5702
Silver Credit	.2975	.2980	.2822	.2694	.1061	.2520
Net Cost	16.8233	17.6795	14.0277	12.8997	13.2725	15.3182
Receipts per lb.	19.3605	17.8023	12.8881	13.5463	14.9543	15.6851
Net cost	16.8233	17.6795	14.0277	12.8997	13.2724	15.3182
Profit (+) or (-) loss	+2.5372	+1.1228	-1.1396	+6.6465	+1.6818	+3.3669

Note—The small profit indicated on the weighted 5 year average as against an arithmetic 5 year average is due to the fact that the bulk of high cost copper had to be sold at low prices.

TABLE IV. Figures Show Pounds of Copper.

Year.	Mine Production of Copper in U. S.	Imports into United States.	Exports from United States.	U. S. Consumption of new Copper.
1900	606,117,166	105,176,808	348,402,853	
1901	602,072,519	137,826,406	222,137,911	
1902	659,225,014	194,501,757	354,668,849	
1903	729,943,131	168,707,995	310,729,524	
1904	812,537,267	181,292,205	554,550,030	
1905	888,784,267	210,724,685	534,907,619	
1906	916,971,387	225,843,281	454,752,018	686,265,987
1907	847,151,015	252,620,054	508,924,401	487,771,625
1908	956,840,578	218,705,427	661,876,127	480,000,000
1909	1,126,521,126	321,801,115	682,846,726	688,500,000
1910	1,088,237,432	344,435,771	708,316,514	732,400,000
1911	1,114,764,197	334,607,538	786,553,208	681,753,279
1912	1,249,094,891	410,240,295	775,000,658	775,078,332
1913	1,235,569,727	408,778,954	926,241,092	812,068,639
1914	1,148,431,437	306,350,827	840,080,922	681,917,955
1915	1,488,071,528	315,698,449	681,953,301	1,043,497,328
1916	2,005,875,312	462,335,980	784,006,486	1,429,755,266
1917	1,895,434,349	556,420,297	1,125,647,336	1,394,829,715
1918	1,910,022,841	575,805,115	744,243,481	1,661,669,576
1919	1,212,334,041	429,387,594	515,595,019	914,471,572
1920	1,224,550,151	485,670,691	623,158,489	1,053,838,538
1921	466,190,853	350,472,611	628,415,714	610,988,744
1922	1944,024,741	541,013,220	742,755,957	800,372,627

†Smelter production figures.

TABLE V.
Copper Production of Several of Certain Foreign Mines in 1912 and 1922.

Company.	Copper Produced 1912.	Cost per lb.	Copper Produced 1922.	Cost per lb.
Braden	7,735,079	.....	93,876,794	10.66
Cerro de Pasco	45,272,000	9.00	73,168,247	7.65
Chile .....	.....	.....	134,568,506	8.5
Granby	13,231,121	11.1	31,963,365	13.55
Green Cananea	48,157,847	10.49	10,577,387	18.27
Kennecott Alaska	22,366,478	5.00	44,172,060	8.67
Total	136,762,525	.....	388,326,559	9.56
Estimated average cost	9.07 c.	.....	9.56 c.	.....
Michigan average cost	10.600 c.	.....	12.899 c.	.....

MICHIGAN IRON ORE PRODUCTION IN 1923

GENERAL DESCRIPTION.

Shipments of Michigan iron mines for the year, 1923, totalled 13,962,769 tons with an average value of \$3.8858 per ton f. o. b. mine, or a gross value of \$54,256,527.78. The average Lake Erie value, which is the f. o. b. mine value plus transportation costs, amounted to \$5.5142, or a gross value at Lake Erie, of \$76,993,500.81.

The estimated ore reserves as determined for the Board of State Tax Commissioners, January 1, 1924, totalled 191,889,100 tons or a decrease of 3,753,978 tons from the estimate of January 1st, 1923. New discoveries did not keep pace with depletion of ore reserves. This condition has been true since 1921, depletion of ore reserves proceeding at a rate of about four million tons per year. Shipments from Michigan average from twelve to fifteen million tons per annum. It is therefore apparent that we are mining out old deposits faster than new discoveries are coming in.

At the present time there is undoubtedly a surplus in the Lake Superior district as a whole, particularly of high phosphorous ores such as are produced in Iron County, but if the present rate of shipment continues, the surplus ore will be wiped out in a few years and there will be a genuine shortage of ore. Just how long this will take is questionable. Various estimates have been made, varying from a minimum of five, to a maximum of fifteen years. During 1923, five mines were exhausted and abandoned. These were as follows:

Clifford Mine, Antoine Ore Company, Breitung Township, Dickinson County.

Munro Mine, Munro Iron Mining Company, City of Norway, Dickinson County.

Brotherton Mine, Brotherton Iron Mining Co., City of Wakefield, Gogebic County.

Castile Mine, Castile Mining Company, City of Wakefield, Gogebic County.

Meteor Mine, Castile Mining Company, City of Wakefield, Gogebic County.

The Castile and Meteor properties were abandoned largely because of the failure to discover sufficient ore to warrant profitable operation. It is possible that future discoveries might bring them into the list of producers again. In addition to the mines listed above, the Indiana property located in Breitung Township, Dickinson County, which produced a low grade of siliceous ore was abandoned as unprofitable.

Explorations during the year resulted in the development of two new reserves; one, in Stambaugh Township, Iron County, and the other in Marinesco Township, Gogebic County.

The usual statistical information is incorporated in the following tables:

[Production and former shipments by Districts and Counties]

TABLE I.
Production and Shipments of Michigan Iron Mines in 1923.
Compiled by L. P. Barrett from information furnished Board of State Tax Commissioners by Mining Companies.

Dickinson County.

Mine.	Tons Mined.	Tons Shipped.
Aragon	269,168	257,738
Chapin	457,275	564,251
Loretto	82,235	41,570
Penn.	165,622	383,381
Total	974,303	1,246,940

Gogebic County.

Mine.	Tons Mined.	Tons Shipped.
Anvil	10,067	10,192
Ashland	19,471	35,405
Asteroid	122,497	107,083
Eureka	277,799	280,347
Ironton	348,073	369,179
Keweenaw	189,354	174,811
Morgan	24,301	28,362
Newport	691,301	660,947
Norrie Gr.	1,449,153	1,559,318
Palms	368,927	330,066
Plymouth	827,410	827,410
Puritan Gr.	93,573	155,421
Sunday Lake	226,652	171,588
Tilden	196,433	204,700
Townsite	114,666	108,664
Yale	140,822	118,824
Wakefield	392,144	360,509
Total	5,492,643	5,505,721

Iron County.

Mine.	Tons Mined.	Tons Shipped.
Balkan	140,567	128,244
Baltic-Fogarty	127,440	120,536
Bates	95,457	49,288
Bengal	248,419	157,310
Berkshire	189,790	209,512
Bristol	429,856	455,025
Buck	4,536	4,685
Cardiff	94,403	93,459
Carpenter	149,075	132,617
Caspian	256,759	234,109
Davidson No. 1	117,011	104,325
Davidson No. 2	75,924	49,400
Davidson No. 3	42,328	48,861
Delta	13,087	11,508
Dunn-Richards .....	.....	17,206
Forbes	84,591	119,035
Hiawatha	159,291	145,257
Homer	224,265	251,355
James	99,629	63,143
Judson	80,765	69,064

Iron County--Concluded.

	Tons Mined.	Tons Shipped.
Spies		8,839
Monongahela	174,720	164,107
Odgers	407,309	295,951
Porter	88,611	77,699
Riverton Gr.	172,608	210,596
Rodgers	237,324	198,984
Tobin	68,877	49,874
Warner	82,343	59,917
Zimmerman	71,522	51,722
Total	3,938,987	3,581,768

Marquette Range.

Mine.	Tons Mined.	Tons Shipped.
Athens	245,545	169,477
Austin	82,976	67,674
Barnes-Hecker	36,228	16,849
Cambria	143,994	141,361
Cliffs Shaft	290,615	426,533
Francis	110,550	5,394
Gwinn		27,957
Holmes	276,672	307,519
Imperial	178,730	211,302
Isabella	158,241	177,813
Jackson	12,812	15,239
Maas	219,240	210,477
Mackinaw-Gardner		10,028
Maitland	98,966	98,966
Mary Charlotte	164,907	120,319
Morris Lloyd	280,335	216,892
Negaunee	364,930	336,474
Princeton		19,227
Republic	104,804	149,374
Richmond	271,492	271,492
Rolling Mill	193,869	177,593
Salisbury		29,793
Stephenson	247,212	69,464
Section 16	315,351	369,123
Total	3,777,409	3,646,340

County.	Tons Mined.	Tons Shipped.
Dickinson	974,303	1,246,940
Gogebic	5,492,643	5,505,721
Iron	3,938,989	3,581,768
Marquette Range	3,777,409	3,646,340
Grand Total	14,183,342	13,980,769

[Average Cost of Production--Receipts and profits of Michigan Iron Mines]

TABLE II.

Comparison of Michigan Iron Ore Shipped with Remainder of Lake Superior District.

	Tons Shipped.	Per cent of Total.
Michigan†	13,980,769	23.05
Minnesota=	45,313,806	75.02
Wisconsin=	1,168,833	1.93
Total	60,463,408	100.00

†As reported to Board of State Tax Commissioners.
=Figures from Iron Trade Review for Feb. 7, 1924.

TABLE III.

Average Costs, Receipts and Profits of Michigan Iron Mines During 1923. Compiled by L. P. Barrett from reports submitted by Mining Companies to Board of State Tax Commissioners.

Items.		
Cost of Mining:		
Labor	1.1882	
Supplies .....	.5838	
Total	1.7720	1.7720
Deferred Mining Costs:		
New shafts .....	.0183	
Development† .....	.0644	
Total .....	.0827	.0827
Taxes except Federal Income Tax:		
State and local general property tax .....	.2824	
State Corporation .....	.0039	
Federal Taxes except Income Tax .....	.0033	
Total .....	.2896	.2896
Depreciation .....	.1097	.1097
Overhead Expense:		
General superintendence .....	.0448	
Contingent expense .....	.0075	
Fire insurance .....	.0055	
General expense .....	.0088	
Total .....	.1266	.1266
Transportation:		
Rail freight .....	.7896	
Boat freight .....	.8369	
Cargo insurance .....	.0019	
Total	1.6284	1.6284
Analysis and selling expense:		
Analysis .....	.0042	
Selling commission .....	.0454	
Total .....	.0496	.0496

†*cludes stripping.

[Labor Statistics of Iron Mines]

TABLE IV.
Labor Statistics of Iron Mines.

	Dickinson Co.	Gogebic Co.	Iron Co.	Marquette Co.	State.
Average No. of men	1,290	4,380	2,947	3,251	11,868
Average No. of days worked	304	293	289	296	295.5
Tons mined	974,303	4,273,089	3,830,443	3,394,139	12,471,974
Tons per man per day	2.48	3.32	4.49	3.53	3.55
Total labor	1,746,805.00	5,951,975.00	3,911,251.46	4,576,029.00	16,186,090.00
Average yearly	1.353	1.358	1.324	1.405	1.362
Average daily	4.46	4.63	4.58	4.75	4.62

[Estimated Reserves and Assessed Valuation]

TABLE V.

Michigan Iron Ore Reserves and Assessed Valuation by Board of State Tax Commissioners. Ore Reserves estimated by L. P. Barrett for Board of State Tax Commissioners.

	1923.		1924.	
	Ore Reserves, Tons.	Total Value.	Ore Reserves, Tons.	Total Value.
Dickinson County	9,348,321	\$5,994,000	8,129,803	\$5,507,000
Gogebic County	58,314,512	46,496,818	54,949,558	45,932,758
Iron County	56,065,508	25,924,025	58,425,590	25,945,145
Marquette Range	71,914,737	35,560,753	70,384,149	35,987,650
Total	195,643,078	\$113,675,596	191,889,100	\$113,372,553