STATE OF MICHIGAN

MINES AND MINERAL STATISTICS

By James L. Nankervis
Commissioner of Mineral Statistics

BY AUTHORITY

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LETTER OF TRANSMITTAL

STATE OF MICHIGAN
OFFICE OF
Commissioner of Mineral Statistics

Calumet, April 1, 1906.

HON. FRED M. WARNER,
GOVENOR OF THE STATE OF MICHIGAN:

Sir:—In fulfillment of the duties of my office, I have the honor to submit herewith the following report upon the mines and mineral interests of the State for the year ending March 31, 1906.

Respectfully your obedient servant,
James L. Nankervis,
Commissioner of Mineral Statistics.

Commissioners of Mineral Statistics.

NAME	DATE OF APPOINTMENT	TERM EXPIRED
Charles E. Wright	Feb. 15, 1877	Jan. 12, 1883.
A. P. Swineford	Jan. 12, 1883	April 29, 1885.
Charles D. Lawton	April 29, 1885	Mar. 19, 1891.
James P. Edwards	Mar. 19, 1891	Jan. 10, 1893.
James B. Knight	Jan. 10, 1893	Mar. 28, 1895.
George A. Newett	Mar. 28, 1895	April 1, 1899.
James Russell	April 1, 1899	Mar. 31, 1901.
Thomas A. Hanna	April 1, 1901	Mar. 31, 1905.
James L. Nankervis	April 1, 1905	

INTRODUCTORY.

This is an age of decisive action and tremendous industrial activity. From forest and field and stream and rock beds, wealth is being recovered at an unprecedented rate. The world, particularly the United States, is growing richer by leaps and bounds. Capital is abundant, enterprise is on the alert and stands ready to take hold and develop any proposition that promises success. New projects are no sooner contemplated than financed, launched and in full operation. In the modern way of doing things, they are developed and put in condition to make returns, unless of gigantic magnitude, in an almost incredibly short period of time. Prices of copper, iron products and practically everything in the shape of manufactured articles are high and producing mines as well as other industrial enterprises are in a prosperous condition. In times like these, new concerns are constantly springing up; established ones are being expanded and put in condition to return bigger and better results; old ones, through exhaustion or other causes, are going out of business, and the face of the industrial field is ever changing.

So far as I know, there has been no report of the Statistics and Mineral Resources of the State of Michigan published since 1901. At the time of my appointment to this office there was, therefore, no work that could be continued with any degree of satisfaction. Under the circumstances, there was but one course to follow, which was to gather material and make a fresh start. This I decided to do. Looking up the vast number of enterprises scattered all over the State, their locations, organizations and what they were doing, proved no light task. I was engaged in no other occupaton and relatively speaking, spared neither time nor effort in securing the desired information for the work. Hundreds of letters and blanks were mailed to the managers of the various industrial institutions of the State. Many reached the parties to whom directed and brought back intelliegnt, satisfactory replies. Some were unanswered and others returned. Besides, I visited the salt producing properties and was through each iron district not less than twice. The copper district, I am always in. The result of these efforts is this report. As a beginning, it is largely descriptive. No one knows its weak points better than the writer. But it can be strengthened with continued effort. However, all figures regarding products, number of men employed, machine drills operated, depth of shafts, extent of openings and general data are official, up-to-date and may be relied upon as practically correct. Remarks on Iron and Copper mining and their allied interests and the condition of labor in the upper peninsula of Michigan, form the bulk of this report. Industrial enterprises, located in the lower part of the State and the condition of labor, are inspected and reported on annually to the Commissioner of Labor, at Lansing, by inspectors appointed for the work. These reports are very complete, contain a vast amount of valuable data and form a part of the Annual Report of the Michigan Bureau of Labor and Statistics. Copies of the reports may be secured by addressing applications to the Bureau of Labor, Lansing, Mich. Because of this provision, a compilation of the products made and the number of men employed, followed by a brief summary of results would appear all that is needed or expected from the

Commissioner of Mineral Statistics on the Coal, Salt and Cement industries of the State.

And it might be pertinent and in place, at this time to remark, that from whatever standpoint or in whatever light certain parties may view the report of the Commissioner of Mineral Statistics, that there is a large, broad demand for the work. Applications for copies have been received from practically all over the country and in instances from towns in Cornwall, England, and from the city of London, England. They come from nearly all over Michigan, from Wisconsin, Minnesota, Illinois, Ohio, New York, Massachusetts, Washington, California, Arizona, and other parts of the United States. My experience in the office is very limited and whether the present demand for the work is greater than usual or not I am unable to state. It may be stimulated, somewhat, by the wonderful prosperity prevailing in practically every section of the country and a desire on the part of people interested in Iron and Copper industries to obtain reliable information regarding the physical condition of the iron and copper mines of Michigan and their outlook for the future. Of the iron ore produced in the United States, the mines of the Lake Superior region furnish about 75 per cent while the copper mines of Michigan furnish about 14 per cent of the copper produced and the best brand in the world. These products necessarily exert a powerful influence in the markets of the country and it is but natural that people interested in either of these industries should be anxious to secure any work published on the mineral statistics and resources of Michigan. It is pleasing to know the report is wanted and I sincerely trust it may prove interesting and furnish, at least, a portion of the information so much in demand. I wish to express my obligations to all those who have charge of the enterprises referred to in this report. In my visits to properties and intercourse with managers I experienced nothing but courteous treatment and was afforded every facility for gathering the necessary information for preparing this report. All have my sincere thanks.

COMMISSIONER.

IRON INDUSTRY.

The mining industry of the Upper Peninsula had a record year in 1905. All former achievements were eclipsed in the amount of iron ore produced. The demand for ores of the different varieties was continuous, enormous and unequalled in the history of the region. In the past generation or so, progress and expansion has been phenomenal. The output in 1905 was the largest ever made and stock piles had to be drawn upon to meet requirements. The tremendous business activities existing, particularly in the finished and raw material, structural iron, steel, copper and such metals as are used in building locomotives, ships, bridges, manufacturing steel rails and other similar products, are wholly unprecedented and without a parallel in the history of the State or of the Nation. The record of iron has been decidedly erratic and as a natural consequence, it has been aptly termed "a prince or a pauper." In the past, seasons of great prosperity have been followed by seasons of depression and hard times for the iron industry. Conditions at the present time, however, are wholly unique. Although the products of ore, and pig iron as well, made last year were the largest on record, yet stocks at the beginning of 1906 were smaller than at the beginning of 1905. This would indicate that the industries consuming iron products are expanding faster than the mines. And as to the future, the furthest seeing people in the business are unable to discern any sign indicating that the phenomenal demand for raw and finished products is likely to fall off in the near future or that the limit in the volume of business transactions has yet been reached. A recent table of iron ore shipment passing through the Sault Canal for each year, from 1855 to 1905, presents an interesting and instructive study. The amount carried in 1855 was only 1,449 tons, or less than one-seventh of a single cargo for the freighter Wolvin, of the United States Steel Corporation. Shipments last year amounted to the enormous total of 34,353,456 tons, as against 21,221,019 tons for 1904. In the past eleven years, shipments have nearly trebled in volume, and at the present rate of expansion, it won't be more than about three or four years before the volume will reach the 50,000,000 mark. From 38,000,000 to 40,000,000 tons are predicted for the present season. The total pig iron production of the United States in 1905, according to statistics issued by the American Iron and Steel associations was 22,992,380 long tons. The increase over 1904 was 6,498,347 tons or 39.4 per cent. Its estimated value is $382,666,694. And following is the production of steel in the United States for the two years past:

	1905.		1904.	
Class.	Tons.	Per Cent	Tons.	Per Cent.
Bessemer	10,941,375	54.6	7,859,140	56.6
Open Hearth	8,971,376	44.8	5,908,166	42.7
Crucible, etc.	121,000	.6	92,581	.7
	20,033,751	100.0	13,859,887	100.0

Some one has figured that if all this output were converted into 90 pound steel rails, there would be sufficient to lay a five-track railroad around the earth at the equator, with enough left over to run a branch line to the North pole. Carried in vessels of 1,000 tons capacity, the average of the Great Lakes craft twenty years ago, allowing for tow lines of usual length, the ore would fill a string of ships reaching from New York to Liverpool with a few million tons left over for a second trip.

It has been said that every ingenuity of man to increase the production of the mines will be put forward during the season of 1906. This may be true in a measure. A steady market at fair prices with continuous demand for supplies bring the most satisfactory results and operating companies are more likely to regulate the output to meet actual requirements than to force production regardless of needs and glut the market. The

outlook for the industry, however, was never brighter than at the present time.

Following are the products of iron ore, officially reported to me, produced by the iron ore mines operated in this state during 1905:

MARQUETTE RANGE.

Names of Mines.	Product in tons.
Oliver Iron Mining Co.—	
Lake Superior Iron Mine	755,392
Hartford Mine	336,853
Queen Group	262,011
Cleveland Cliffs Company—	
Cleveland Lake	551,304
Moro	76,244
Cliff Shaft	230,915
Ogden	6,806
Salisbury	149,664
Negaunee	242,617
Austin	61,813
South Jackson	23,143
Princeton	59,667
Pittsburgh & Lake Angeline	269,000
Republic Iron Company	151,065
Marie Charlotte	236,703
Richmond	86,130
Cambria	63,000
Lillie	55,000
	3,617,327
Shipments from stockpiles of idle mines	593,195
	4,210,522

The total number of men employed in and about the mines on this Range September 30th, 1905, was 5,060.

MENOMINEE RANGE.

Names of Mines.	Product in Tons.
Oliver Iron Mining Company—	
Chapin	956,968
Agagon	430,134
Riverton	111,749
Mansfield	39,875
Michigan	43,609
Penn Iron Mining Company	424,669
Pickands, Mather & Company—	
Vivian	110,000
Baltic	133,000
Caspian	10,000
Hemlock	125,000
Corrigan, McKinney & Company—	
Tobin	243,000
Great Western	211,000
Crystal Falls	152,000
Lamont	75,000
Dunn	21,000
Pewabic	493,655
Mineral Mining Company	90,722
Breen	16,625
Bristol	214,000
Loretto Mining Company	100,162
Antoine Ore Company	138,395
Saginaw	3,031
	4,143,594
Shipments from stockpiles, idle mines and Wisconsin properties	351,857
Total	4,495,451

Total number of men employed in and about the mines of this Range, Sept. 30th, 1905, 4,621.

GOGEBIC RANGE.

Names of Mines.	Product in Tons.
Oliver Mining Company—	
Aurora (Aurora)	482,551
Norrie	802,136
Tilden	207,252
Cleveland-Cliffs Company—	
Ashland mine	346,694
Newport Mining Company—	
Newport mine	359,222
Anvil	38,875
Brotherton	136,023
Mikado	150,000
Sunday Lake	79,208
Pike	11,000
Yale	60,913
Meteor	823
Ironton	39,107
Colby	75,913
	2,789,207
Shipments from stockpiles, idle mines and Wisconsin properties	915,490
Total	3,705,207

The total number of men employed in and about the mines of this Range, Sept. 30th, 1905, was 3,437.

RECAPITULATION.

Total shipments from Marquette Range in 1905	4,210,522
Total shipments from Menominee Range in 1905	4,495,451
Total shipments from Gogebic Range in 1905	3,705,207
Total	12,411,180

Besides the foregoing summary for 1905, in some instances as noted elsewhere in this work, shipments were made from stockpiles of idle mines. These shipments, however, are not specified individually for the reason that they rightly belong to the work of former years.

Lake Superior Iron Ore shipments for the past fifteen years:

1891	7,071,053
1892	9,070,554
1893	6,067,403
1894	7,748,312
1895	10,429,037
1896	9,934,828
1897	12,464,574
1898	14,024,673
1899	18,251,804
1900	19,059,393
1901	20,593,507
1902	27,571,121
1903	24,289,878
1904	21,822,839
1905	34,353,456

IRON MINES.

In 1905 the iron ore mines located throughout the Iron Region of the Lake Superior district were operated to their full capacity or practically so and record-breaking products were made. There was a larger force employed and bigger sums of money paid out for wages and supplies than ever before in a single season. Established producers had a profitable year, men received good wages, were paid every 30 days and prosperity prevailed everywhere. All the people or nearly so appear satisfied with their lot in life and the relations existing between employer and employe is of the best. A short time ago, a conference was held at Ishpeming by the representatives of the Steel Corporation and other Companies operating in the Lake Superior iron region and announcement has been made that a re-adjustment of the wage scale has been agreed to that will increase the pay of the majority of men employed in the mines. A year ago last January, the Corporation granted a ten per cent increase in wages to the employes at all its mines on the several ranges. The advance was unsolicited and came as a complete surprise to the men. The present increase came in a similar way. No demand had been made nor hinted at by anybody connected with the company. Men know, or at least most of them, when they are used well and labor disturbances have been rare. There was something for all to do who wanted work. New mines and other enterprises were started. Established mines have been stretching out for bigger and more satisfactory results and substantial progress has been made. Shafts have been sunk deeper, levels extended and fresh reserves of ore opened up. Additional up-to-date equipment has been installed in various mines and the positions of the properties improved and strengthened in practically every department. Idle mines have been re-opened for further investigation and new trial. Developing propositions have been pushed to rapid completion, in order that the fruits of maturity may be realized. A few mines are getting old and exhausted; their products are beginning to fall off. Continuous draft upon the reserves have resulted in depleting ore bodies and unless new ones can be found, their days are numbered. There are only a few such cases, however. New mines are springing up to take their places. Upon the whole, the growth of the industry all over the Iron district has been wonderful and there are better things ahead for it still. New ore deposits have been discovered and old ones opened up more extensively than ever before and are better understood. For every ton of ore taken out more than another has been developed and the general physical condition of the mines is better now than at any previous time in the history of the district. Although the demand for the products were pressing and continuous prices were only advanced to fair, reasonable values and not carried to figures that would in any way interfere with consumption. None of the producing companies attempted to take undue advantage of conditions to create abnormal prices. There were no pyrotechnics, nor sensational features connected with the business in any particular. Lake iron ore prices were $3.75 to $4.25 per ton for Bessemer old range; $3.50 to $4.00 for Bessemer Mesaba; $3.25 to $3.70 for Non-Bessemer old range and $3.00 to $3.45 for Non-Bessemer Mesaba. These prices were fixed and adhered to and the cohesion of values resulted in maintaining harmony all over the region and bringing general prosperity.

PRICES OF PIG IRON, STEEL RAILS, SHEETS, TANK PLATE, STEEL BARS, NAILS, ETC.

The following tabulation is furnished by the Bessemer Pig Iron Association:

Average prices at Pittsburg, 1905.	Pig Iron.			Ferro-Manganese.	Steel	
	Bessemer	No. 2 Foundry.	Gray Forge		Bessemer Billets	Rails.
January	$16.85	$17.35	$16.35	$45.00	23.00	28.00
February	16.35	17.10	16.10	46.00	24.00	28.00
March	16.35	17.00	16.00	47.00	24.00	28.00
April	16.35	16.85	15.85	51.00	24.00	28.00
May	16.10	16.60	15.60	50.00	23.00	28.00
June	15.60	15.60	14.85	50.00	22.00	28.00
July	14.85	15.35	14.50	50.00	23.00	28.00
August	15.35	15.10	14.35	50.00	24.00	28.00
September	16.10	15 60	14.75	54 00	25.00	28 00
October	16.85	16.85	15.85	62.00	26.00	28.00
November	18.10	17.85	16.85	100.00	26.00	28.00
December	18.35	18.35	17.10	125.00	26.00	28.00

Average prices at Pittsburg, 1905.	Steel—Con.			Nails	
	Sheets No. 28	Tank Plate	Steel Bars	Wire Per Keg	Cut per Keg.
January	2.30	1.50	1.40	$1.75	$1.75
February	2.30	1.60	1.50	1.80	1.80
March	2.40	1.60	1.50	1.80	1.80
April	2.40	1.60	1.50	1.80	1.80
May	2.30	1.60	1.50	1.80	1.80
June	2.30	1.60	1.50	1.80	1.80
July	2.30	1.60	1.50	1.75	1.80
August	2.30	1.60	1 50	1.70	1.60
September	2.30	1.60	1.50	1.75	1.60
October	2.25	1.60	1.50	1.80	1.65
November	2.30	1.60	1.50	1.80	1.65
December	2.30	1.60	1.50	1.80	1.70

THE WORLD'S IRON ORE RESERVES.

Charles Kenneth Leith.

The great increase in the world's annual consumption of iron, together with the attempts of large interests to acquire the known iron ore reserves, have led to careful inventories of the world's supply of iron ore, its rate of depletion, and to speculations as to further supplies. Estimates of the time of exhaustion of the present known supply have varied widely, but have shown startling agreement in the short time assigned. During the present year there have appeared several discussions of the subject which merit special attention.

Professor Tornebohm estimates for the Swedish government the iron ore reserves of the world by countries, based on detailed figures for the individual districts, as follows:

	Tons.	Metallic Iron Per Cent.
United States	1,100,000,000	45 to 67
Great Britain	1,000,000,000	25 to 34
Germany	2,200,000,000	30 to 45
Spain	500,000,000	40 to 56
Russia and Finland	1,500,000,000	20 to 65
France	1,500,000,000	
Sweden	1,000,000,000	50 to 70
Austria Hungary and Other Countries	1,200,000,000	
Total	10,000,000,000	

Many will be surprised at the high figures given for the reserves in Great Britain and European countries. So much is heard of our own vast reserves and of the low grades of some of the foreign ores that we have come to think of the supply outside of North America as relatively small. The position of the United States is somewhat better than shown in the table when we take into account the grades of ore. By multiplying the figures by the average percentages of metallic iron given for each of the countries by Professor Tornebohm the result is as follows:

	Tons of Metallic Iron.
United States	603,166,600
Great Britain	295,000,000
Germany	825,000,000
Spain	249,375,000
Russia and Finland	637,500,000
Sweden	611,538,460

It is believed that the reserve for the United States, and hence the total, are higher than indicated in this table, but before taking up this question, we may consider conclusions that may be drawn from the figures as they stand.

President Hadfield of the British Iron and Steel Institute has prepared a diagram showing the world's increase of pig-iron consumption since the fifteenth century and the projection of this rate for the next century on the rate of the last 30 years. If the same rate of increase hold for the next century as has held for the last 30 years, in the year 2000 the world's annual consumption of iron will be three and one-fourth times its present consumption. The total world's supply of iron ore now known, given as 10,000,000,000 tons by Tornebohm, will be exhausted in about 50 years. If the total be correct, about one-quarter of the world's known reserves have been used to the present time.

—From Economic Geology.

THE OLIVER IRON MINING COMPANY,

Is the iron ore producing branch of the United States Steel corporation—the largest and most comprehensive producer of finished and raw materials on the globe. The mines owned, controlled and operated by the corporation are distributed all over the iron region of the Lake Superior district and have an annual capacity of 20,000,000 tons of ore. Ores produced are among the most desirable and valuable varieties for general purposes and are always in demand at the highest market prices. The corporation also operates upwards of 60 coking plants; a lake fleet of more than a hundred vessels; water supply plants; a hard ore crushing and conveying plant at Escanaba; extensive ore docks at different lake points besides various other works. The mines operated employ more men, square a larger monthly payroll and produce a larger output of ore than any other single interest in this or any other country. Mineral, timber and other lands owned by the company are located in different ranges of the district and contain immense bodies of ore of both the hard and soft varieties. The reserve ore bodies opened up in the mines and available for production, at the present rate of mining, are sufficient to last for many years to come. And it is well that this is so. The tremendous business activities of the present time, particularly in structural iron, steel, copper and such other metals such as are used in building locomotives, ships, bridges, steel rails and other similar manufactures are wholly unprecedented and without a parallel in the history of the state or of the nation. To meet existing demands for ore, every mine of the district must be worked to its full capacity and the resources of the region drawn upon more heavily than ever before. And this also is well for it means a continuation of the present era of prosperity for an indefinite period. The vast proportions which the company's operations may reach within the next ten years must be judged by the results accomplished in the past.

Because of its eratic record iron has been aptly termed "a prince or a pauper" but so far as economists are able to penetrate the future, there are no signs of warning on the business horizon indicating that the phenomenal demand for iron products is likely to fall off in the immediate future or that the limit in volume of business transactions has yet been reached. And no business firm or manufacturing establishment in the "Union has done more effectual work or contributed more substantially towards developing and building up this splendid prosperity, than the United States Steel Corporation and its allied interests.

Mr. Thomas F. Cole is president of the Oliver Iron Mining Company and resides at Duluth, Minn., with Mr. John H. McLean for an assistant Mr. Cole is a so-called Lake Superior product and a self made man of the first order. He is a thoroughly earnest man with excellent organizing abilities and the splendid results accomplished at the company's mines speak for themselves and need but little comment. The mines are in the hands of experts who know the mining business thoroughly and do it right. They are opened up and developed on practical, modern methods for general results and equipped with permanent machinery plants designed for the work; are ably and efficiently managed and progress has been substantial and continuous. In many instances, improvements, fundamental and far reaching, have been instituted underground and on surface that resulted in materially increasing the capacity of the mines and

reducing, all things considered, operating costs. The mines form substantial business enterprises, develop the natural resources of the region as well as recover the underground wealth infolded within its underlying rock beds, and are the mainstay of many of the towns and villages scattered over the Iron Range. It is a rare instance indeed where a company is not good to its employes providing them with practically all the essentials necessary for comfortable and pleasant home life.

In every department connected with the company's mines, order and system prevail in a high degree and the affairs of the corporation are transacted with exacting knowledge and marked ability. The policy outlined and followed by the management has been broad and liberal; fair and considerate and the cohesion of prices maintained for the products of the district has worked with distinct success and for the general good of all companies alike and workmen as well. Men are paid good wages and have been given the opportunity to invest their savings profitably through the purchase of the Preferred Stock of the U. S. Steel Corporation at a price materially below the market quotation and pay for it in easy monthly installments. On such stock an annual bonus of 5 per cent in addition to the regular dividend is paid for a period of five years to such employes as remain in the company's service. The men are generally contented and there is employment for all who wish to work.

The following mines located on the Marquette Range, are controlled by the company: The Lake Superior group, comprising the Hard Ore, Hematite, Sec. 16 and Sec. 21; The Winthrop; Regent group, comprising the Queen, Prince of Wales and Blue; Champion; Moore; Richards.

General Superintendent, William H. Johnston; Superintendent, F. E. Keese; Assistant to General Superintendent, D. J. Sliney; Chief Clerk, J. C. W. Chipman; Mining Engineer, Andre Formis; Assistant Mining Engineer, H. T. Hulst.

LAKE SUPERIOR IRON COMPANY.

This is one of the best known corporations in the iron ore region, having been organized on the 13th day of March, 1853—just 53 years before this paper was written. From the beginning of operations, big sums of money have been spent in sinking shafts and in developing the mines underground and on surface. It has been a substantial producer, an excellent business enterprise and one of the chief supports of the town of Ishpeming. It is credited with having produced a total output of 13,144,535 tons ore. About 1,000 men are employed and 550,000 feet of B. M. lumber and heavy timber, besides 1,130 lineal feet lagging and cribbing material are used annually for mine work. The product for 1905 was 755,392 tons ore. Lake Superior Iron Company embrace:—Hard Ore, Section 16 and Section 21. Lake Superior Hard Ore is located in the N. ½ and S. E. ¼ Section 9 and the N. ½ of the S. W. ¼ Section 10, T. 47, R. 27, just south of the town of Ishpeming on a line of the C. & N. W. Railway. Ishpeming is a pretty town with about 12,000 inhabitants. Hard Ore Mine is opened and developed through three working shafts, 720, 840 and 920 feet deep, respectively. Dimensions: 15 ft. 6 in. by 6 ft. 3 in., 8 ft, by 10 ft., and 7 ft. by 9 ft. About 270 men are employed. Shafts generally are sunk in the footwall side of the ore bodies and the product recovered through a series of crosscuts driven from shaft stations or levels. Operated in that manner, shafts are hardly ever disturbed and last as long as the mine. And when any particular place has been exhausted of ore, the walls may come together and fill up the openings or stand up, so far as the management is concerned, as they can in no way interfere with future work. Underground openings are developed on practical lines and operated on modern methods of mining. Shafts are connected at different levels, which ventilate the workings and keep them airy, cool and comparatively comfortable for all doing underground work. Levels in turn are connected by raises or winzes making a complete network of openings. No reasonable amount of labor or expenditures are spared in making every department comparatively safe. Nineteen levels in all are being extended from the three shafts into new ground developing fresh reserves that may be drawn upon, as soon as the word is given to make up the product. Future requirements are anticipated and provided for well in advance. The ore body mined is substantial and continuous and so far as appearances go, good for years ahead at the present rate of production. Ore runs 61.50 per cent iron and less, both Bessemer and non-Bessemer. The stoping method is used for taking out the product. Skips counter-balance in shafts and dump automatically. The work is readily and economically performed. Compressed air for operating machine drills, etc., is supplied from Section 16 mine.

Mechanical equipment is modern, highly efficient and generally adequate for requirements. Machinery buildings are substantial and well located. Equipment includes one 24 in. by 48 in. simple duplex Brown hoisting engine, geared motion, operating 4x12 ft. drums 6 ft. face grooved for 1¼ in. rope, built by Webster, Camp & Lane. Hoists from No. 2 Hematite shaft skip, and Hard Ore No. 6 shaft, and Hard Ore No. 7 shaft. One 22 in. by 36 in. reversible simple slide valve Hoisting Engine geared to 2-8 ft. drums, 4 ft. face grooved for 1¼ in. rope. Engine built by Iron Bay Mfg. Co., Drums by Webster Camp & Lane, Hoists from Hard Ore No. 2 shaft and No. 2 Hematite Cage. One 72 in. by 18 ft. return tubular boiler. Three 72 in. by 15 ft. return tubular boilers. A complete main and auxiliary pumping plant underground. The plant is practically complete, in good running order and economically operated.

LAKE SUPERIOR HEMATITE.

Is located directly south of Ishpeming, in the N. E. ¼ of S. W. ¼ Section 10, T. 47, R. 27 and consists of 80 acres of land. The mine is opened and operated through two working shafts 570 feet deep and no feet deep respectively. Shafts are substantially constructed and capable of taking out a large product of ore. One shaft is 7 ft. by 14 ft. in dimensions and three-compartment. Two compartments are used for hoisting ore, etc., the third for ladder-way and pumping outfit. Second shaft is 6 ft. by 10 ft. in dimensions and two-compartment. Men are lowered in and lifted out the mine workings with cage operated with Hard Ore hoist. About 290 men are employed and compressed air for operating machine drills is supplied from Section 16 compressor. There is considerable development work going ahead on this property and three levels are being extended from shaft to ore body. Work is conducted vigorously and in up-to-date methods. Ore body is substantial and contains some fine blocks of ground opened up in systematic order. Underground openings are connected in various places and air circulates freely through them. This is a comfortable mine and men like to work in it. The product is taken out by means of the "caving system" which answers admirably for the ore deposit mined. Management aims to get out the best there is in the property and progress has been substantial. The ore mined runs about 62.50 per cent iron and less. Bessemer and Non-Bessemer comes out. Mine is in a prosperous condition and looks well. Its future outlook is very promising. For amount of timber consumed annually and product of ore, see Lake Superior Iron Company. The product of this mine is lifted with Hard Ore Hoists. Its equipment includes well equipped workshops, substantial mine buildings, well situated for the best results, besides a complete main and auxiliary pumping outfit and supplementary additions adequate for requirements.

Mining Captain, Joseph Hodgson.

SECTION 16.

Lake Superior Section 16 adjoins Pittsburg and Lake Angeline on the east and lies in the S. E. ¼ of S. E. ¼ Section 9, N. E. ¼ of N. E. ¼ Section 16 in T. 47, R. 27 and consist of 80 acres of land. Mine location is just south of Ishpeming. The amount of timber used and product recovered are included in the Lake Superior Iron Co. statement. 240 men are employed on this property and a 50-drill capacity air compressor is operated. Mine is opened up and developed through one exceptionally fine working shaft, 7 ft. by 16 ft in dimensions, three-compartment and 955 feet deep. Fourteen levels are extended from shaft and development work is underway at the bottom level, 955 feet below surfac. Underground openings are in good shape and the physical condition of the mine is first-rate. Ore body is opened up well ahead and apparently good for years to come. Drifts are going forward and the usual amount of ground is being opened up in accordance with the policy of the management. Ore produced is Hematite and "Hard"—Bessemer and Non-Bessemer. It runs 51.50 per cent iron and less. Openings contain some fine stopes of ore that look well. Underground openings are connected at various points and well ventilated. The "stoping method" is used for taking out the product and it seems just the thing for the ore deposit mined. Men are distributed to the best advantage for general results. No money or effort is spared to make the mine safe and comfortable and every department seems to be running to perfection. Opening work is conducted with a view to getting the best results and progress has been substantial. Compressed air for Hard Ore and Hematite are supplied from Compressor located on this property. The product is trammed by hand labor, skips counter-balance in shafts and dump automatically. The product is readily and economically produced. Mechanical equipment is of the best, powerful, practical, highly efficient and economical. Machinery buildings are substantial and arranged for the best service. Equipment includes one 24 in. by 48 in. single Corliss Hoisting Engine geared to one drum 10 feet in diameter, 8 ft. 9 in. face, grooved for 1⅜ in. rope. Engine built by E. P. Allis Co., Drums built by Webster, Camp & Lane. Hoist in balance. One Duplex compressor, 26 in., and 42 in. by 48 in. cross compound Corliss Engine 25½ in. and 40 in. by 48 in. two stage air cylinders. Engine built by Rand Drill Co., air cylinders by Nordburg Mfg. Co. Furnishes air for Section 16, Hard Ore and Hematite Mines. Average number of drills operated, 80. Four 72 in. by 15 ft. return tubular boilers furnish power for operating the machinery. A complete main and auxiliary pumping plant underground and supplementary additions and fittings adequate for requirements complete the equipment.

Joseph Hodgson, Mining Captain.

SECTION 21.

Is situated about three miles from the town of Ishpeming in the S. ½ of N. W. ¼ and S. W. ¼ of N. E. ¼ Section 21 in T. 47, R. 27. and consists of 120 acres land. This mine produces a soft Hematite and employs about 200 men on an average. Operations are conducted through two working shafts. 760 and 640 feet deep respectively. Each has three compartments. One is 7 ft. by 18 ft. in dimensions, the other 7 ft. by 12 ft. These are fine shafts, in first class running order and capable of taking out a large product without crowding. Underground workings are being developed on broad, practical lines and in the right way for bringing the best results. Five levels, namely: 700, 760, 510, 580 and 640, are going forward from shafts developing fresh reserves ahead so that men may be distributed throughout the workings to the best advantage. Development work is also underway on the bottom levels of both shafts and the underground department of the mine is being materially

strengthened. System and order prevails everywhere and the appearance of the mine is good. The ore body mined is substantial and holds down with no part looking better or promising more for the future of the property than the deepest openings penetrated. It has a bright future outlook. Underground openings are connected in many places and air circulates freely through the mine. The product is recovered through the caving system and it answers admirably, consuming but little timber in conducting the work. Product comes from the different stopes scattered through the workings and each shaft sends out its allotted quota. Surface equipment is modern, efficient, designed for the work and economical. Power houses and workshops are arranged with a view to bring the best results. Shops are fitted with modern tools for doing mine work and the machinery is in first class condition and running smoothly.

Equipment includes: One 22 in., by 42 in. simple Corliss Engine geared to two drums 8 ft. diameter 4 ft face, grooved for 1¼ in. rope, built by Bullock Mfg. Co. One 22 in. by 42 in. reversible Corliss Engine geared to two drums 8 ft. diameter 4 ft. face grooved for 1¼ in. rope, built by Bullock Mfg. Co. One Duplex compressor. 16 in. by 30 in., simple duplex slide valve engine, 16½ in. by 30 in. single stage air cylinder, built by Rand Drill Co. One 60 in. by 15 ft. return tubular boiler. Three 72 in. by 15 ft. return tubular boilers furnish power for running the machinery. Complete main and auxiliary pumping plants underground.

John Trebilcock, Mining Captain.

HARTFORD MINE.

The Hartford is situated about ½-mile Northwest of the town of Negaunee in E. ½ lot 5, lots 6 and 7. Section 36, T. 48, R. 27, making about 65 acres land. Mine location is conveniently situated and contributes material support to Negaunee. Its ore deposits are substantial, consisting of soft Hematite running about 60 per cent iron and less. Both Bessemer and Non Bessemer Ore produced. In 1905 the mine produced 336,853 tons ore. Mine is opened and operated through one permanent shaft, 15 ft. by 5 ft. in dimensions, three-compartment and 950 feet deep. Underground openings are developed on up-to-date methods. Future requirements are anticipated and planned well in advance of actual necessities. Ore bodies are opened up and blocked out in the best way for bringing the best results and form some fine stopes of ground. Levels are connected at various points and producing places well ventilated. The mine is well managed and seems to be in a prosperous condition. Product comes from 470, 650, 750 and 825-foot levels, and all four are being extended in the process of developing fresh reserves. The caving system is used for taking out the product and about 310,000 feet, B. M. lumber and heavy timber as well as 125 M. lineal feet of lagging are used annually in mine work. Every effort is made to keep the mine in a safe condition and comfortable for working in. About 360 men are employed on an average and a 25-drill capacity air compressor operated. Operations are conducted economically and order prevails everywhere. Mechanical equipment is in good running order, well adapted for the work and adequate for requirements. Skips counter-balance in shaft and dump automatically.

Equipment embraces: One pair 24 in. by 48 in. reversible duplex first motion Corliss hoisting engines operating one 9 ft. drum, face 130 inches grooved for 1⅜ in. rope. Built by Bullock Mfg. Co.; one duplex compressor 16 in., and 30 in. by 36 in. cross compound Corliss engine, 17½ in. and 28 in. by 36 in., two stage air cylinders. Built by Rand Drill Co.; four 72 in. by 18 ft. return tubular boilers furnish steam for operating machinery. Complete main and auxiliary pumping plants underground.

James Piper, Mining Captain.

QUEEN GROUP.

The property forming the Queen Group is situated southeast of Negaunee in part of S .W. ¼ Section 5, T. 47, R. 26, and consists of about 64 acres of land. Queen has been a substantial producer for years and still good, so far as indications go, for years to come. About 360 men are employed and in 1905 the mine produced 262,011 tons ore. Ore mined runs about 60 per cent iron, Non Bessemer. Mine is operated through one shaft 6 ft. by 15 ft. in dimensions, three-compartment, and 740 feet deep. Product is recovered by the "caving system" and answers admirably for the ore body mined, which is a soft Hematite. Hand labor is used for tramming, but a complete electric haulage system is now being installed on the 740-foot level for doing this work. When completed, the mine will be in fine physical form and up-to-date in practically every particular. Underground department is opened up and developed on up-to-date methods and well managed. Future requirements are anticipated and provided for. Product conies from the 650 and 740-foot levels. Development work is going ahead on the 740 level, the present bottom. Mine openings contain fine stopes of ore as good as the average of the mine. A 25-drill capacity air compressor is operated. Levels are connected and ventilation is good. Skips counter-balance in shafts. Ore is dumped automatically in cars and added to stock-pile. Property is in a prosperous condition and has a promising outlook. Mechanical equipment and machinery buildings are in first class condition and everything runs smoothly. Machinery is of the best and generally adequate for doing the work of the mine.

Equipment embraces: One E. P. Allis duplex 16 in. by 36 in. engine operating one drum 7 ft. 6 in. diameter, 7 ft. 7 in. face, grooved for 1¼ in. rope. One Duplex compressor, 17 in. by 30 in., simple duplex slide valve engine, 17 in. by 30 in., single stage air cylinder built by Rand Drill Co.; three 72 in. by 18 ft. return tubular boilers provide power for running the machinery. Complete main and auxiliary pumping plants underground.

Richard Roberts, Mining Captain.

The figures given on production previous to 1905 cover only the time that mines have been under lease to the Regent Iron Company and operated by the Oliver Mining Company.

CHAMPION MINE.

This mine is idle and not much of any work has been done on the property since 1903. 64,680 tons of iron ore were shipped from stock piles in 1905. Champion is among the oldest iron mines on the Marquette Range, having been in operation off and on since 1868. It has been a substantial business enterprise, well managed from the start, vigorously operated and since the commencement of operations produced a total output of 4,095,609 tons ore. Champion ores are of the Bessemer grade, magnetic and specular varieties. Mine territory is large and contains considerable bodies of ore blocked out that may be turned to profitable account before long, as a brisk demand for practically all classes of ore seems likely to continue for some time to come. The property is extensively opened up with deep shafts and long levels in good repair and connected at many points making free circulation of air. Champion has fine equipment Buildings are substantial and conveniently located for service required. Machinery is of the best, powerful and adequate for requirements. Machinery has recently been overhauled and put in thorough order and it now stands ready to have the steam turned on at a minute's notice.

THE CLEVELAND-CLIFFS IRON MINING COMPANY.

Is among the oldest, best known and most successful iron ore producing corporations operating in the iron region of the Lake Superior district. Its annual capacity is from 20,000,000 to 22,000,000 tons with ample deposits and scope for further expansion and much heavier production. During 1905, the Company produced 2,014,735 tons ore in Michigan. Under titles somewhat modified, the organization has been in aggressive and successful operation for upwards of fifty years and so far as the physical appearance of its properties is concerned, there is no evidence in view to indicate why the Company may not continue aggressively mining ore for many years to come.

The realty holdings of the corporation are very extensive, consisting of some 1,000,000 acres of mineral, wood and other lands of distinctive value; are located in different ranges of the district and growing in value as the years pass. From time to time and invariably when needed, immense ore deposits have been discovered in its lands which have been systematically developed into fine profitable mines of substantial merit that produced, since the beginning of operations, millions of tons of ore of the different varieties of the district.

The mines form permanent business enterprises that develop the general resources of the region and provide employment, directly and indirectly, for an army of workers, at good wages. They are the mainstay and principal support of the towns, located along the Range; in some cases own the lands on which they stand and accommodate the communities with many privileges and advantages.

The Cleveland-Cliffs Iron Mining Company forms one of the largest and most important iron ore producing organizations in the state, with works scattered and varied and its record for up-to-date progressive mining and business methods stand among the highest in the land.

The Company has spent vast sums of money in the purchase of iron lands; in opening up and developing into mines the ore bodies contained in them and in equipping the properties with powerful machinery plants of modern build for conducting the business of mining on a large scale and on economical lines. The mines are ably and vigorously operated and for the best interest of the Company. Order and system is kept well in the foreground and the business affairs of the mines are transacted with precision and exactness. The ore bodies developed and available for production are sufficient to last for years at the present rate of production and the physical condition of the mines was never better than at the present time, nor did the future outlook for them ever look brighter.

A noteworthy feature and emphatically a praiseworthy one maintained by the managers of the iron and copper mines alike, in the Lake Superior district, is the especial care and attention paid to the general comforts and home life of the Company's employes and their families. In most cases employes are provided with comfortable dwellings having nice patches of ground; the advantages of a mine physician; good water for domestic use; fuel at practically cost to companies, and many other advantages and in some instances, electric light and sewerage system. And it really pays for if good men are to be kept, they must be provided with such conveniences or they will go to other parts where they may be had. In this particular, the Cleveland-Cliffs Company affords a splendid example for the management has gone so far as to pay special premiums for the best cultivated gardens and the most attractive residences. The movement has worked very successfully indeed. The result is that many employes now have cultivated, pretty gardens; raise their own vegetables and small fruits, besides adding quite notably to the attractiveness of their residences and to the general appearance of the location. Other companies might do likewise, for it would be a move in a worthy cause and result in bringing about inestimable good and all would be benefited.

The demand for iron ore during 1905 was continuous and the Cleveland-Cliffs Company, with others, had a very prosperous year while the business for 1906

promises to surpass all former records and to tax the district to its utmost capacity.

Officers of the Company are: President, W. G. Mather; Vice President, J. H. Wade; Auditor, R. C. Mann; Secretary, J. H. Sheadle; Treasurer, W. G. Mather. Main Office, Cleveland, Ohio; Mine Office, Ishpeming, Mich. Mine Agent, M. M. Duncan; Mine Auditor, A. J. Yungbluth. Mining Captain, J. H. Rowe. Engineer, J. E. Jopling.

Cleveland-Cliffs Company operates the following mines, located on the Marquette and Gogebic Ranges: Cleveland Hard Ore, Moro, Cleveland Lake, Cliff-Shaft Mine, Ogden, Maas, Salisbury, Negaunee, Jackson, Lucy, Imperial, Webster, Austin, Stephenson, Princeton and Ashland. Lucy, Imperial and Webster are idle. Ashland is on the Gogebic Range.

CLEVELAND LAKE.

This is a remarkable mine with a fine record and has produced since the beginning of operations millions of tons of ore. Its ores were discovered with the diamond drill years ago and it has formed, and still forms, one of the solid business enterprises of the region. The mine is located within the corporate limits of Ishpeming and lies under the bottom of old Lake Angelina in Sec. 10, T. 47, R. 27.

The ore produced is a soft Hematite inclosed between walls of diorite running nearly due east and west.

Ore Analysis:

	Iron.	Phos.		Iron.	Lake Bessemer Iron.
Lake Bessemer,	63.00	.040	Lake,	60.00	Silica, 48.00
					Phos. .043

The caving system is used for taking out the product and it works admirably.

Mine is opened and operated by means of one of the finest shafts in the district, 470 feet deep, 10 ft. by 16 ft in dimensions and four-compartment. Mine employs 428 men, operates 10 machine drills and in 1905 produced 551,304 tons of ore. It is opened up on broad practical lines and operated on up-to-date methods. Liberal allowances have been made for betterment work from time to time and every department of the mine is in first class form and running satisfactorily.

Ore body is substantial, continuous, looks well and is good for a heavy product for years to come. In 1905, upwards of 800,000 feet of timber, board measure, was used underground for holding up and supporting the works.

Workings are in good condition, and, as the mines go, comfortable and safe. Underground tramming is done by an "electric haulage" system. It works successfully and gives much satisfaction. Surface equipment is powerful, highly efficient and embraces first motion lifting skips counterbalanced in shaft on one, drum and cage in the other; a 40-drill capacity compressor; well equipped machine, blacksmith and carpenter shops and supplementary appliances and additions adequate for requirements.

MORO MINE.

This mine lies in Section 10, T. 47, R. 27, and is situated just east of Ishpeming and is quite a uniform, substantial producer.

It is developed through one large shaft 10 ft. by 15 ft. outside, two compartment, and 814 feet deep.

Its product of ore in 1905 was 76,244 tons. There are 106 men employed and n power drills operated. Ore produced is Red Specular. Analysis: Scotch, 61.70 per cent iron. Ore bodies are large and apparently good for a considerable time ahead. The product is recovered on the "room and pillar" system and works successfully without the use of timber. That means a good deal to a mine today for timber expense rapidly runs into big sums of money. Mine is in good physical condition and economically operated. Surface equipment is in good running order and does the mine work efficiently and well.

CLIFF SHAFT.

This property lies just west of Ishpeming in Sec. 9, T. 47, R. 27, and forms a notable mine. It has a good record and stands well in the estimation of the people. Its growth has been somewhat spasmodic, but upon the whole, substantial. It is now in the best condition and economically operated. Operations are conducted through two shafts 10 by 14 feet inside measurement. Each has two compartments operating cages and skips. Shafts are 661 and 611 feet deep, respectively, substantially constructed and in good working condition. Two hundred and ten men are employed, 32 power drills are operated and in 1905 the output of ore amounted to 230,915 tons. Ore produced is a red Hematite.

Analysis: Crushed Cliff Shaft, 62.60 iron; Lump Cliff Shaft, 63.40 iron.

Underground workings are extensive and contain some fine stopes of ore of average quality. It is in fine physical form, well equipped and capable of maintaining its usual product for many years. The "Room and Pillar" method is used for taking out the product of ore and it works admirably, requiring no timber. That means something for a great mine in this day of high priced lumber. Shafts and levels are connected in many places that ventilate the underground department and make the workings fairly comfortable for working in. Every department of this property is running practically to perfection.

MAAS.

This is a developing proposition with good prospects ahead for making a substantial mine. The mine location is situated north-east of the city of Negaunee, in Sec. 6, T. 47, R. 26. Forty-five men are employed and a fine four-compartment shaft is being sunk in the footwall side of the ore body. When ready to produce the ore body will be reached through cross-cuts driven from shaft. Shaft is 15 by 11 feet in dimensions, substantially constructed and 930 feet deep. Broken rock is lifted out of the shaft and works by a geared hoist good for present requirements and for some time to come. The air compressor in service has capacity to operate 10 machine drills. Four are being operated at the present time. The work of developing the property is conducted on practical, systematic lines. Everything is modern and up-to-date. The property will be developed in the best manner for bringing the best results. Progress has been substantial and of the kind that will count when production begins. The place looks well.

John Ellis is mining captain.

OGDEN MINE.

Ogden lies south of Negaunee in T. 47, R. 27, and is an open pit mine producing a hard Hematite ore running 41.50 per cent iron and 10.40 per cent phos.

About a dozen men are employed in and about the property and in 1905 the product of ore amounted to 6,806 tons. Besides recovering a product of ore the management is conducting considerable exploring work by trenching, sinking and other methods. Some promising disclosures have been made and the future outlook for the property is considered good. The property will be thoroughly explored and all ore bodies discovered put in practical shape for economical extraction. Properly is well managed and economically operated. Results are considered satisfactory.

SALISBURY MINE.

Salisbury is located about a mile and a half south of Ishpeming in Sec. 15, T. 47, R. 27, and forms one of the best known iron properties in the Marquette Range. It has been profitably operated for many years and forms a fine business enterprise. It is worked on up-to-date methods and every department is running satisfactorily.

Mining is conducted through one large shaft 1,107 feet deep, 22 ft. by 11 ft. outside measurement and divided into three compartments. Ores produced are soft Hematite, running from 60.50 per cent to 63 per cent iron.

There are 177 names on the payroll and in 1905, the mine produced 149,664 tons of ore and operated two machine drills. Ore bodies that furnish the product are substantial and continuous; look about as well as the average of the property and appear good for years of successful operation. The product is taken out on the slicing and caving method. No reasonable expense is spared in making the mine safe and comfortable for working in, and in 1905 nearly 300,000 feet of timber, board measure, was used underground in supporting and holding up the workings.

Surface plant is efficient and in good running order and doing good duty. It includes "Geared hoists," lifting skip and cage; a 12-drill capacity compressor, besides supplementary additions and appliances capable of doing the work of the mine. Everything in and about the mine appears to be in first-class condition and running to perfection.

NEGAUNEE MINE.

The Negaunee mine is situated just east of the town of Negaunee in Sec. 5, T. 48, R. 26, and has been an important producer for many years and is credited with having produced since the beginning of operations a total output of upwards of 2,500,000 tons of ore.

The number of men employed is 334 and in 1905 the amount of ore produced was 242,617 tons.

Ore Analysis: Negaunee Bessemer—60.00 per cent Iron; .060 per cent Phos.; Negaunee—.59 per cent Iron.

The mine is operated through two fine shafts; one is 8 ft. by 8 ft. and double compartment, the other 8 ft. by 16 ft. with three compartments. Both are 620 feet deep. Underground developments are extensive and well arranged for economical mining. The growth of the mine has been substantial and continuous and it has sufficient ore bodies to last for many years. The product is taken out in the "Caving and Filling" system and 12 machine drills are operated. No reasonable expense is spared to make the mine safe and comfortable for mining and all working underground. In 1905, nearly 400,000 feet of timber board measure was used for supporting and holding up ground. Underground tramming is done by an "electric haulage" system which renders first class service and is highly appreciated by trammers. It is a big improvement over the old method of pushing cars.

Surface equipments is ample for requirements and embrace "Geared hoists" with two skips in No. 2 shaft, cage in No. 1; 12 drill capacity compressor and the usual mine buildings and appliances that go to complete a well appointed plant.

AUSTIN MINE.

This property is located at Princeton, directly south of Swansea and situated well within the iron belt and adjoins the Princeton Mine.

It is mined through one permanent shaft 10 ft. 8 in. by 11 ft. 4 in. in dimension, 315 feet deep, and three compartment.

Mine employs 97 men, operates five machine drills and in 1905 produced 61,813 tons of ore.

Ore produced is a soft Hematite and runs from 64.70 per cent to 61.70 per cent, iron and about .060 per cent, phosphates.

Ore bodies in mine are continuous and look well. There are large reserves in sight and the underground workings are in fine condition and comparatively safe and comfortable for working in. Mine is in a prosperous condition and good things are predicted for it. Product is recovered by the "drifting and sq. sets" method, which works very successfully. Surface equipment includes "Geared Hoist", air compressor and supplementary additions adequate for requirements.

SOUTH JACKSON.

This is an open pit proposition located just southwest of the City of Negaunee and produces a hard Hematite ore running about 46 per cent, iron and manganese combined. Product of ore for 1905 was 23,143 tons. About 20 men are employed and the product is taken out by benches formed and underhand work. The future outlook for the property is considered good. The property is well managed and the product mined very economically.

PRINCETON MINE.

Princeton is located in Swansea and adoins the Austin mine on the north; employs 210 men and operates four machine drills.

Product of ore was made from August 1st to December 31st and amounted to 59,667 tons.

Ore produced—Soft Hematite and runs 60 per cent. iron. Mine is developed and worked through two shafts, each 8 ft. by 16 ft., inside measurement, and three compartment. One is 324 feet deep, the other 334 feet.

The property is in a prosperous condition and has a good future. It is opened on broad practical lines and being put in shape for bigger and better things. Management aims to get out the best there is in the property.

Product is taken out on the drifting and slicing system and it works very successfully. About 75,000 feet of timber, board measure, are consumed annually in the work. Workings are comparatively safe; are well ventilated and generally comfortable. Ore bodies are large and good for years of successful operation. Equipment includes geared hoists for each shaft. Ten drill capacity compressor and additions adequate for requirements.

STEPHENSON MINE.

Stephenson is a developing proposition located at Princeton in Town 47, Range 27. No shipments of ore have yet been made from there. Property has a very promising outlook and management is developing the mine on broad practical lines, and putting it in condition for substantial results when ready to begin producing. About a dozen men are employed. A fine shaft 17 feet 6 in. by 13 feet 6 in. outside dimensions with four compartments is down 317 feet, "Geared hoist" with bucket developing outfit forms the temporary equipment in service.

THE JACKSON MINE.

This is an old pioneer mine and bears the honor of being the first iron ore property opened and worked in the entire Iron Range of the Lake Superior District. From its ores was manufactured the first iron and steel produced in the State, and on the lands that now forms the company's property the first iron ore deposit, of which there is any record, was discovered. That discovery led to others of vast importance and the good work continued until the Lake Superior District has become the most notable iron ore producing spot on the globe.

The property has been in active operation for upwards of a half a century, and for many years was quite a heavy producer of high grade ores of both the hard and soft varieties. It has contributed in a substantial way to the success and prosperity of the iron industry in its varied forms besides adding to the renown and prestige of the Lake Superior region. The first regular shipments made, which might be called regular, were in 1856 and amounted to 5,000 tons, certainly a very creditable beginning for those times. Aggregate shipments since that date amount to nearly 4,000,000 tons ore. The mine was idle in 1905 and still is so, but shipped last season, 9,987 tons ore from cleaning up old stock piles. Mine location is situated within the corporate limits of Negaunee, a growing town of about 8,500 inhabitants, on the line of the C. & N. W. Ry. Realty holdings include all of Section 1, Town 47, Range 27.

PITTSBURGH AND LAKE ANGELINE IRON CO.

There are but few iron mines on the entire iron ore region of the Lake Superior district that are better or more widely known than the Pittsburgh and Lake Angeline. The Company was organized in 1861, by men of the best and soundest type, who knew a good thing when they saw it and how best to develop its resources for bringing the best results. For many years the property has been a substantial producer, a fine business enterprise, developing the resources of the region and contributing, in no uncertain way, to its

natural growth and prosperity. The property is ably and skillfully managed and for the best interest of the company, and its future wellbeing. From time to time big sums of money have been spent in sinking shafts, driving levels, developing ore bodies and providing powerful mine plants for dispatching work in an efficient and economical manner. The mine is opened on broad practical lines and economically operated. Order and system prevails everywhere and the business affairs of the Company are dispatched with promptness.

General Manager, Thomas Walters. G. R. Persons, Chief Clerk. Mining Captain, W. H. Tregambo. Rudolph Erickson, Engineer.
Postoffice address, Ishpeming, Mich.

Company's property is located within the corporate limits of the City of Ishpeming, in Section 15, Town 47, Range 27, and consist of 399 acres of land. Ores produced are high grade Brown-Specular Hematite. Analysis: Angeline Hematite, 65.10 F. E., .044 phos. South Angeline, 63.29 F. E., .111 phos. No. 1 hard ore, 66.96 F. E., .014 phos. Sheffield, 66.10 F. E., .035 phos.

In 1905 the company produced 269,000 tons ore. Previous to last year it is credited with having produced a total output of 6,858,080 tons of ore and a total output, since the beginning of operations, of 7,127,080 tons. This mine is opened and operated through two main shafts and one sub-shaft Main shafts are 10 by 12 feet inside measurement and three-compartment with double skipways, ladder and pump-ways. East End shaft is 360 feet deep; old mine shaft 420 feet deep, and sub-shaft 290 feet deep. There are 450 men employed for all purposes, and 15 power drills operated. Eleven levels are continued into ore bodies from shafts aggregating in length upwards of 33,000 feet. Ore product comes from different levels and is mined on the "Top-slicing" method which works admirably. Shafts are connected at various levels and underground workings are well ventilated and comparatively safe and comfortable for working in. No reasonable work is omitted nor expense spared that would result in making the mine safe. About 1,000,000 feet, board measure, is used annually in holding up the walls of ground in order that the product may be recovered with safety to all connected with the work. The ore occurs within folds of diorite making north of east about 30 degrees and dipping westward. Ore bodies are strong and continuous with large reserves developed, and in condition for successful and economical extraction. Though no new bodies have been discovered within the past year or two, yet the mine continues in good physical condition and every department is running smoothly. In January of the present year, the "East End" works were connected with the old mine. The haul from the East End to Old Shaft is long, but the electric tram-car haulage system is being installed for doing this work. This change will result in materially increasing the efficiency of the mine. The mine plant is efficient and powerful, in good running order and adequate for requirements. Mine buildings and power houses are substantial and well located for direct service. It includes a 25-drill capacity Rand Compressor, two Corliss and one Westinghouse engine, besides well equipped shops and supplementary appliances that go to fill in and round out a complete plant. I visited the property in January, 1906.

MARIE CHARLOTTE MINE.

This mine is located about three miles southeast of the town of Negaunee and has 80 acres of mineral land situated in Town 47, Range 26. This is practically a new organization, formed by people of the best type, and who do things right. Property is operated with energy, and substantial progress has been made in all its departments. Ore produced is Hematite; analysis not given. In 1905, the company employed 320 men, operated four machine drills and produced 236,703 tons of ore.

Mine is developed through one large substantial shaft, 7 ft. by 18 ft. in dimensions, three-compartment and 175 feet deep. Ore body from which the product conies is large and continuous, is opened up ahead for some time to come with three levels averaging 500 feet in length extended to and in the ore bodies mined. Every department runs smoothly and the mine is in fine physical condition. Its future outlook is good and bigger and better things are predicted for it. Product is taken out by the "caving system," and seems to be admirably adapted for the ore body mined. Ninety-five cars of timber were used during 1905 in development and general work and every precaution is taken to make the workings safe and secure. Diamond drill work in search of new ore deposits and sinking shaft for developing new reserves of ore for future needs continue. Mine looks well and is in a prosperous condition. Surface equipment is efficient, adequate for requirements and economically operated. It embraces a two-boiler Webster, Camp & Lane hoist, a six-drill capacity compressor, besides mine buildings and fittings for doing the work of the company. Mine buildings and power houses are substantial and located for direct work and bring the best results.

General Manager, E. N. Breitung; Mining Captain, T. H. Rodgers; Superintendent, J. F. Foley; Engineer W. St. Clair; Chief Clerk, R. C. Dutton.

REPUBLIC IRON AND STEEL COMPANY.

This Company forms one of the progressive and successful iron ore producing organizations operating on the Marquette Range. It operates at the Cambria and the Lillie Mines. Alexander Maitland, General Manager; John Deacon, Mining Captain; J. H. Connel, Chief Clerk; A. Benson, Engineer.

CAMBRIA.

The Cambria is located about a mile and one-half, northwest of the town of Negaunee, on the line of the C. & N. W. Ry., in Sections 35 and 36, Town 46, Range 27. Company produced previous to 1905, a total output of 1,558,361 tons of ore. During 1905 Cambria employed 92 men and shipped 63,000 tons of ore. Mine operations are carried on through an active shaft 6 by 8 feet, inside measurement; 800 feet deep with lateral openings extending into ore bodies for considerable distances. Face of openings are in ore of good quality and the deposit looks strong and continuous. Large bodies of ore are opened up on different levels that will last for some time to come, and the deepest points penetrated look as well as any place in the mine. From time to time, considerable sums of money have been spent in strengthening the position of the mine, and the success achieved has been, upon the whole, satisfactory. The management aims to get out the best there is in the property and development continues on a vigorous scale. Mine looks good for from 60,000 to 70,000 tons annually. Equipment is good for present requirements and in first class running order. The property is well managed and for the best interests of the Company.

LILLIE.

The Lillie Mine adjoins the Cambria Mine and lies in Section 35, Town 48, Range 27. It has been a substantial producer and looks good for many years to come. Officers of the Cambria are also in charge here. During 1905 the mine employed 95 men and produced 55,000 tons of ore. Ore runs 60 per cent iron and .080 per cent, phosphorus. Ore bodies developed are substantial and look fairly well. Development work continues in a vigorous manner and the outlook for the mine is just as promising at the present time as it has been in the past. Mine is opened upon practical lines and the work of taking out the product is conducted in the best way for getting the best results. Product is trammed by hand labor, dumped in skips and hoisted to surface. Underground operations are carried on through one shaft, 6 ft. by 8 ft. in dimensions and 860 feet deep. Levels are connected at different points, and men may go from place to place whenever they desire or in cases of emergency. Ventilation is good and the workings are comparatively comfortable. Equipment is efficient, in good working condition and capable of doing the work of the mine. Total output of ore, previous to 1905, credited to the Lillie, is 1,554,956 tons.

THE REPUBLIC MINE.

This mine is located in the town of Republic, on the line of the C. M. & St. P. Ry. For many years the mine has been a successful producer, sending out annually a good round product of high grade ore. It has been vigorously operated and formed the mainstay and principal support of the town. Since the beginning of operations, the property is credited with having shipped a total output of 5,603,487 tons of ore. Product for 1905 was 151,065 tons. Realty holdings of the corporation are located in Section 7, Town 46, Range 29. Postoffice address, Republic, Michigan. The property is skillfully managed, and with a view to taking out the best there is in it, and at the same time its future is not overlooked. Though the mine has been a substantial producer for many years and a fine business enterprise, it still contains large ore reserves of excellent quality. Ore bodies, however, are somewhat irregular but persistent and abundant. The future outlook for the property is very promising indeed and about all that could be desired. Mine is opened and developed through four active shafts which are connected at various points and a large force of men is employed at good wages. Openings are well ventilated and comparatively comfortable for working in. Nothing is left undone to make the underground department safe and secure to take out the product. Power houses are substantial, conveniently located for direct results and economical operation. Equipment is powerful, highly efficient, in good working condition and adequate for requirements. Comfortable changing quarters are provided for miners and trammers.

William Kelly, General Manager; D. T. Morgan, Agent; P. W. Pascoe, Mining Captain.

RIVERSIDE IRON COMPANY.

This company is exploring and developing the Riverside mine, located at Republic, Marquette County, Michigan, and has 80 acres of land. Mine lies in Town 46, Range 30, and is well situated. The Company employs about a dozen men and operates five power drills opening ground and developing ore reserves. Ores are high grade, running from 55 per cent to 68 per cent, metallic iron, .06 per cent, phosphorus. Exploration and development work is conducted by means of two shafts 6 ft. by 8 ft. inside measurement. West shaft is 473 feet deep. East shaft, 182 feet deep. Each shaft is in good working order. Levels extend from shafts for varying distances, ranging from 200 to 500 feet, and averaging about 280 feet. The company made no ore shipments in 1905, but previous to last year is credited with having shipped 16,000 tons of ore. The management is making good use of the diamond drill and succeeded in locating a fine body of ore to the west of the 310-foot level. Twelve feet of it runs 68 per cent, iron, and .06 per cent, phosphorus, and is of the specular variety. At the 400-foot level it runs 17½ feet wide and the same quality. In passing through 40 feet of magnetic mixed ore the drill encountered 12 feet high grade ore, two feet soap-rock and again 17½ feet high grade ore—all specular.

The work of exploring and opening up the mine is conducted systematically and on practical methods and the outlook for the property is distinctly encouraging.

John Voghtlin, General Manager; R. H. Sibel, Engineer; Postoffice address, Republic, Michigan.

RICHMOND MINE.

Richmond is located just south of Palmer in Town 47, Range 26 and employs 70 men. The product for 1905 was 86,130 tons of ore. This property is ably managed and opened up with a view of getting out the best there is in it and in the best way. Progress has been substantial and operations are conducted in a practical manner. This mine is an open pit, and low grade ore proposition, there being no shafts. The ore, when mined, is loaded into small cars, and these cars are hauled out of the mine with horses and mules and the ore run through a crusher and loaded into railroad cars. It is necessary to crush all the ore before shipment. The ore is mined at a cheap cost. The work of taking out the product is readily and economically performed. Next year the Richmond is expected to produce about 200,000 tons of ore, and two steam shovels will be used in the work. The Richmond mine operates only during the shipping season. Equipment now includes one Gates Crusher and a Corliss engine.

Postoffice address, Palmer, Marquette County, Michigan.

General Manager, J. R. Thompson; Mining Captain, John Huhtala.

NIAGARA IRON MINING COMPANY.

This Company operates the Beaufort mine. Mine location is Section 22, Town 48, Range 31, Spurr Township, Baraga County, Michigan. It was not operated in 1905, but shipped 38,306 tons of ore from stock pile. Nature of ore mined is a Limonite ore running about 52 per cent, iron and 26 per cent, phosphorus. Mine is opened through two fine shafts, Nos. 3 and 7, each three-compartment and sunk at an angle of 45 degrees from vertical. No. 3 is 300 feet deep with lateral openings as much as 1,200 feet in length, No. 7 is 220 feet deep with levels extending 650 feet from shaft. Mine is quite extensively opened and has a daily capacity when working, of 2,000 tons. It is credited with having produced previous to 1905, 316,355 tons of ore. The property has quite a complete equipment, including one D. D. hoisting plant with three 100-horsepower boilers; a 30-drill capacity compressor; pumping outfit and supplementary additions adequate for recovering and manipulating a substantial product.

Postoffice address, Michigamme, Michigan; Superintendent, G. L. Woodworth.

VOLUNTEER MINE

This property has not been operated for over a year and the Company has relinquished its lease. Nothing new is planned for the mine.

While working, however, a stockpile was accumulated and from it 106,281 tons of iron ore were shipped during 1905.

Thomas Walters, General Manager. Postoffice address, Ishpeming, Michigan.

EMPIRE IRON COMPANY.

This company is opening up and developing a mine near Palmer in Marquette County, and holds, under lease, 80 acres of land.

About 25 men are employed and the development work underway includes sinking a shaft and opening up the mine for shipping ore. The shaft is a fine one, being 6 ft. by 12 ft. in dimensions, three-compartment and 115 feet deep. The work is well in hand and conducted on up-to-date methods and on lines that promise to bring the best results. People behind the proposition know the business and are doing it right. Progress has been substantial and the management expects to have the property in condition for sending out a product of ore by next August. The ore body under development runs about 45 per cent, metallic iron and looks distinctly promising. Possibilities for the property are large and indications are that it will develop substantial values and form a fine business enterprise. Mechanical equipment has not yet been installed, but it will be new, and when completed, efficient and fully adequate for requirements and economically operated. The milling system will be used for taking out the product which is, perhaps, as practical as any in vogue.

A. G. Jones, General Manager; O. H. Symons, Mining Captain; Charles Craney, Clerk.

Postoffice address, Palmer, Michigan.

MENOMINEE RANGE.

On the Menominee Range the Oliver Iron Mining Company controls and operates the following mines: Chapin, Aragon, Cundy, Riverton, Mansfield, Michigan, Cuff and Hill Top.

O. C. Davidson, General Superintendent of Mines.

CHAPIN MINE.

Chapin is the greatest iron ore producer in the State of Michigan, and one of the most remarkable mines in the whole iron region of the Upper Peninsula. It forms a fine business enterprise and is the main stay of the town of

Iron Mountain. Its reserves of ore are very large and will hold out for years to come at the present rate of operation. Few, if any, iron mines have a better record, and its achievements have attracted wide attention. The mine was discovered in 1878 and practically from the start became a heavy producer. Its first shipment was made in 1880, which amounted to 74,000 tons of ore. Since the beginning of operations, it is credited with having produced 13,548,510 tons. 1905 product was 956,968 tons. Analysis: Iron, 59 per cent, phosphorus, .065 per cent; Ajax grade iron, 53.00 per cent, phosphorus, .063 per cent. The ore bodies mined consists of a series of lenses extending easterly and westerly for 6,100 feet in length. The greatest depth reached is in the Hamilton shaft, 1,418 feet. It varies from 50 to 150 feet in width. The mine is opened and developed through three shafts: B. Chapin, 8 ft. by 16 ft, B. Ludington, 7 ft. by 18 ft., No. 2 Hamilton, 7 ft by 21 ft. Two shafts have two compartments each, the third three compartments. Nine hundred and twenty-five men are employed and 50 machine drills are operated. Big sums of money have been spent on this property in its natural course of development, and it is in fine physical condition and economically operated. Order prevails everywhere and practically every department runs to perfection. I have visited the property on different occasions and was always impressed with the way work is done there. Hamilton shaft, I think, holds the record of the district for big hoisting. In January, of the present year, when on a visit to the district, one of the Mining Captains of the mine told me they hoisted and dumped to stockpile 2,530 tons of ore in one night shift of ten hours. "That is certainly going some." The shaft has a fine hoisting plant with a pair of 24 in. by 48 in. hoisting engines operating two reels with over-winding flat wire ropes one-half inch thick and four inches wide. This shaft is 1,418 feet deep, B. Ludington, 1,324, and B. Chapin, 1,028. Underground openings are developed on broad practical lines with shafts and levels connected at numerous places making the workings a veritable network. Air circulates freely through connections and make practically every part of the workings comparatively comfortable for all engaged in underground work. The product is recovered by the "caving system" making the mine secure against accidents and permitting the taking out of practically all the ore as the work proceeds. An electric haulage system is used for tramming the ore, which works to perfection. Twelve cars are considered a load for a motor, but at times as many as fifteen cars are hauled.

Trams dump in pockets formed in the ends of shafts which in turn are emptied into skips. Each pocket holds just a skip load. An apron is adjusted to a pocket operated by a wheel. With a twist of the wheel, the pocket is emptied, the skip is filled and is away towards the surface like the wind. The work is readily and economically performed. Skips counter-balance in shafts, carry five tons to a trip and dump automatically. Future requirements are anticipated in good time and provided for when needed. The usual number of openings are going forward and developing fresh reserves in accordance with the policy of the management. Location and works are lighted by electricity.

A new shaft, known as "C" Ludington, is being sunk at the Chapin Mine, and at this writing, January 1st, 1906, has attained a depth of 1,222 feet. It is located in the slates on the footwall side of the property and about 600 feet southwest of an old incline shaft known as "B" Ludington. The management, in selecting the site for the new shaft, was guided almost entirely by the pitch of the ore body, which is to the west.

The shaft is a vertical one and the inside dimensions are 21 ft 3 in. by 10 ft. 4 in. It has four compartments, as follows:

One Cage, 5 ft. by 10 ft. 4 inches; Two Skips, 5 ft. by 6 ft; One Pump and Ladderway, 9 ft. 3 in. by 10 ft. 4 in.

The shaft is steel-lined throughout, the material consisting of steel rail and "I" Beams with sets four feet apart, and when finished will have reached a depth of 1,500 feet, which will be 300 feet below the present 14th level, and to which point it is proposed to drain the bulk of the water of the Chapin mine from where it will be pumped to surface by a large Cornish pumping plant, reference to which is made below. This new shaft is connected with the level known as the 14th, at a depth of 1,201 feet. This is a new level and the development of the same has been going on for the past eighteen months. As soon as the ore above the present working level, known as the 12th, has been removed, which will probably be in the course of the next few years, it is proposed to make the 14th level the working level.

The Chapin is one of the wettest mines on the whole ranges, making steadily from 2,800 to 3,000 gallons of water per minute. The bulk of this water is now handled through the Hamilton or No. 2 shaft As stated in the foregoing, the management proposes to drain as much of the water flow as possibly to its new C Ludington shaft, where it will be pumped to the surface by a large Cornish pumping engine. This engine which is to be installed, is one formerly in use in D. Chapin shaft and was built by E. P. Allis Company of Milwaukee. At the time D shaft was sunk some eighteen or twenty years ago, the pump was installed there, its, location as to the proximity to the ore body and any necessary mining work was considered perfectly safe. Later developments, however, were such that it was found necessary to abandon D shaft entirely and dismantle the Cornish pumping engine. The engine is a steeple compound of the crank and flywheel type, and has a capacity of 3,000 gallons of water per minute from a depth of 1,500 feet, with a steam pressure of 125 pounds at the throttle. The diameter of the high pressure cylinder is 50 inches and the low pressure 100 inches. The piston and pump rods are 7 inches in diameter. The high pressure cylinder has one piston rod and the low pressure three cylinders. The valves in the engine and pumps are of the double beat Cornish type.

The plungers are 28 inches in diameter. Stroke of engine and pumps, 120 inches. Column, 28 inches in diameter. The pump lifts are 200 feet apart. The flywheel on the engine is 40 feet in diameter, and its weight is 160 tons. Height of engine from top of foundation, 54 feet. Chapin equipment is of the best, highly efficient and in good running order. Buildings are substantial and located for giving the best results. Workshops are equipped with modern tools and fittings for doing mine work and turn out everything needed except new machinery.

Mining Captain, Martin Goldsworthy; Chief Clerk, Jno. A. Ryan; Engineer, S. J. James.

ARAGON MINE.

Aragon is located in the town of Norway and forms a main support of the town. Mine location lies in Section 9, Town 39, Range 29, and consists of 120 acres land. Mining Captain, G. A. Alvar; Engineer, G. A. Hellberg. Five hundred and seventy men are employed on an average, and 45 machine drills are operated. The mine is something of a deep level proposition, developing its most substantial values at moderate depth. For eight or ten years the property has been quite a heavy producer, providing employment for a large force at good wages. Since the beginning of the operations the mine has produced a total output of 4,122,057 tons of ore.

Ore analysis: Granada Grade Iron, 58.50 per cent; Phosphorus, .063 per cent Cadiz Grade Iron, 50.00 per cent.; Phosphorus, .060 per cent. Daily capacity, from 1,600 to 1,800 tons. Product for 1905 was 430,134 tons. Mine is opened and developed through three working shafts: One, 7 ft. 4 in. by 15 feet and three-compartment; a second, 6 ft. by 13 feet, and two-compartment; the third, 10 ft. by 14 ft. 2 in., and four-compartment. Depths run 850 feet, 955 and 1,052 feet. All three shafts are substantially constructed and in good running order. Connections are made underground at different levels. Air circulates freely through stopes and drifts and ventilate workings. Developments are conducted on practical methods and the product is taken out in the best way for the ore body mined. The "caving system" is used and answers well. It protects the mine from accidents and permits taking out practically all the ore body as the work proceeds. Levels are going forward in the three shafts developing ore reserves with openings averaging 1,370 feet in length. Underground openings are extensive, forming quite a network and contain some fine stopes. I visited this district in November, 1905, and the mine seemed to be in a prosperous condition. Every department, both underground and on surface, was running vigorously and order prevailed everywhere. Every effort is made to make the mine safe and up-to-date. About 1,000,000 feet of timber, board measure, is consumed annually in this mine. Ore body mined is continuous and good for many years' work at the present rate of production. Mine is well managed and economically operated. Mechanical equipment is of the best, powerful, highly efficient and adequate for requirements.

CUNDY MINE.

The Cundy mine has been idle since October 1st, 1903. The mine is in good shape and the equipment at the property in good condition.

Management is not at this time able to say just when operations at the property will be resumed. The mine is opened and developed through two shafts, 8 ft. by 14 ft., and 8 ft. by 12 ft. in dimensions, 615 and 435 feet deep, respectively. Each has three compartments. Ten levels are extended from the shaft. Average distance of openings in ore body, 450 feet. Daily capacity when operated, 400 to 600 tons of ore. Ore produced is a hematite, running about 43 per cent, iron and .038 per cent, phosphorus. Mine has a complete equipment including a 24-drill capacity air compressor.

J. J. Cundy, Mining Captain.

RIVERTON MINE.

Riverton combines the Dober and Iron River mines, located at Stambaugh in Town 42 and 43, Range 35, consisting of 60 acres of land.

Mining Captain, H. E. Duff; Engineer, William Crago.

The property is developed and worked through three main shafts—Nos. 1, 2 and 3. No. 1 is 9 ft. by 6 ft. in dimensions, three-compartment and 390 feet deep. No. 2 is 14 ft. by 6 ft., three-compartment, and also 390 feet deep. No. 3 is 15 ft. by 9 ft. 6 in., three-compartment, and 611 feet deep. All three shafts are in thorough repair and capable of taking out a heavy product. Underground developments are conducted on practical lines and up-to-date methods. About 145 men are employed and on an average 15 power drills are operated. The mines are well ventilated and as mines go, comfortable for working in. Ore bodies are substantial and opened up well ahead. Property is practically young and credited with having produced since the beginning of operations 767,593 tons of ore. The 1905 product was 111,749 tons. Ore produced, Hematite. Analysis: Brunswick Iron, 56.00 per cent.; Phosphorus, .650 per cent; Barton Iron, 58.00 per cent, Phosphorus, .585 per cent. Management aims to get out the best there is in the mines, and progress, with a view to getting bigger and better results, has been substantial, and of the kind that counts. Ore bodies contained in the mines look well, and ten levels in all are being extended, developing fresh reserves for future needs. No effort or expense is spared to make the mine safe and comfortable and about 600,000 feet of timber, board measure, is consumed annually in mine work. Openings are extensive and contain some fine stopes that will turn out well. A number of improvements have

practically been made all over the mines and their position strengthened in many ways. In the Iron River mine the "square sets system" is used for taking out the product and in the Dober, the "milling system" is used. These systems are practical and bring satisfactory results. Ore is trammed by hand power and skips counter-balance in shafts. Mines are in good physical condition and economically operated. I visited this district in November, 1905. The mines appeared to be in a prosperous condition and were working vigorously and successfully. Mechanical equipment is of the best—practical, modern, located and arranged for direct work and the best results. Mine buildings are substantial and well equipped. The plant is in good running order and capable of doing practically any work required.

MANSFIELD MINE.

This mine is located in the village of Mansfield, Section 17, Town 43, Range 31, with about 31 acres of land. Village is named after the mine, and n machine drills are operated. Mine has been operated off and on for about a dozen years or more, but has never been a heavy producer. Is credited with having produced since the commencement of operations, 869,530 tons of ore. Ore Analysis: 58.50 per cent iron, .144 per cent, phosphorus. The 1905 product was 39,875 tons of ore. Mine is developed by means of one working shaft, three-compartment, 16 ft. by 7 ft in dimensions, and 1,058 feet deep. Daily capacity is from 400 to 600 tons. Product is taken out on the "slicing system" and no timber is used only for shaft repairs. Operations are conducted with marked ability, and the mine is opened up on up-to-date methods. Underground openings are connected in various places and the workings are well ventilated. Development work, opening up reserves of ground for future needs goes forward steadily and eight levels averaging 1,240 feet in length are extended from the shaft into the ore body mined. Openings are extensive and contain some good stopes of ore, but the mine has its limitations. Development work is continued in the most practical way for bringing the best results. Mine is ably managed and in a prosperous condition. Future outlook is fairly promising and bigger and better things are anticipated. Mechanical equipment is actuated by steam power. Ore underground is trammed by hand labor. Skips counterbalance in shaft and dump automatically. Mine plant is in good running order and equal to requirements. Mine buildings and location are lighted by electricity.

MICHIGAN MINE.

The Michigan is situated on a loop of the C. M. & St. Paul Railway, and lies in Section 9, Town 44, Range 33 and consists of about 40 acres of land. Postoffice address, Amasa, Michigan. J. P. Edwards, Mining Captain. Seventy-five men are employed, and six machine drills operated on an average. Mine is developed through one shaft, 16 ft. by 6 ft., and three-compartment. It is 518 feet deep with five levels extending into ore body for an average length of 250 feet. Daily capacity of mine, from 200 to 250 tons of ore. Ore produced, Hematite, running 55.00 per cent iron and .285 per cent, phosphorus. Mine openings are developed on practical lines and worked the best way for bringing the most satisfactory results. Levels are connected at different points and the underground openings are well ventilated. Management aims to get out the best there is in the property and a number of improvements have been made here and there that resulted in strengthening the position of the mine. Levels are going ahead developing additional ore reserves in accordance with the policy of the management. Future needs and requirements are anticipated and planned well in advance of actual necessities. Physical condition of the mine shows a steady improvement and there are better things ahead for it. The product is recovered on the "slicing method" which answers first-rate, and requires but a moderate quantity of timber in conducting the work. No system succeeds better, I think, for taking out practically all the ore contained in a deposit in the cleanest way than the "slicing." Mine is well managed and looks promising. Mechanical equipment is powerful, efficient, in good condition and adequate for requirements. Mine buildings and location are lighted by electricity. Ore produced in 1905, 43,609 tons.

CUFF MINE.

The Cuff mine has been idle since the year 1900. It is not known at this time just when operations will again be resumed at this property. Mine location lies in Town 40, Range 30, Dickerson County, near Iron Mountain, and consists of 160 acres of land. Mine is credited with having produced 68,860 tons of ore previous to 1905.

HILL TOP MINE.

This mine has been idle since 1901. It is located in Town 43, Range 32, Iron County, and consists of 80 acres of land. Mine is credited with having produced 22,178 tons of ore previous to 1905.

THE PEWABIC COMPANY.

This Company forms one of the progressive, successful organizations producing iron ore on the Menominee range and operates, among other mines the Pewabic which includes the property formerly known as the Walpole mine. The Pewabic is located just to the north-east of the town of Iron Mountain, in Sections 29, 30, 31, 32 and 33, Town 40, Range 30, and embraces 840 acres of land. Ore produced is a red hematite, ranging from a high grade Bessemer, low in phosphorus and high in iron, to a high silicious ore which is low in iron

and also low in phosphorus. The analysis of the various ores produced as to iron and phosphorus are given below:

Pewabic, 66 per cent, iron; .009 per cent, phosphorus.

Toledo, 48 per cent, iron, .010 per cent, phosphorus.

Genoa, 40 per cent, iron, .010 per cent, phosphorus, 38 per cent, silica.

Walpole, 59 per cent, iron, .120 per cent, phosphorus.

The product of this mine for 1905 was 493,655 tons of ore.

Since the beginning of operations in 1890, the property is credited with producing a total output of 5,182,772 tons of ore. There are 650 names on the company's pay-roll, and from time to time the company has spent large sums of money in developing the property and equipping it with an up-to-date plant. The mine is opened up and developed on broad, practical lines, ably and skilfully managed, and progress towards bigger and better things has been continuous and the results accomplished fairly satisfactory. The average number of drills operated is 30. Developed ore bodies from which the mine product is obtained, are large and persistent and never looked better nor promised better things in the history of the mine than at the present time. There is plenty of ore blocked out, and available for production to last for some years to come at the present rate of extraction. The end of each year finds the ore reserves rather increased than diminished. Underground operations are carried on through three fine shafts substantially constructed and divided in from three to five compartments, ranging from 500 to 850 feet deep. Shafts generally are sunk in the foot-wall and connected with the ore bodies by cross-cuts driven from different stations. Seven levels have been extended from the shafts, and which are connected, makes air circulation good and the openings comfortable for working in. No effort has been left undone or expense spared to make the mine safe. About 850,000 feet of timber is consumed annually for supporting and holding up the ground in order that the ore may be stoped out or caved, as the case may be, with safety to all connected with the work. The block caving method is most largely used in producing ore. Where the ores are very soft, however, sub-level caving is used. Wire rope trams are operated underground and on surface for hauling the ores to and from the shafts. At the Walpole, where the distance is greater than 1,000 feet for moving ores, it has been decided to install an electric haulage to do the work.

The Pewabic mine is in fine physical condition and order and system prevails everywhere. I visited the property in November, 1905, and again in January of the present year, and found everything in good order and running smoothly. Machinery and power houses are substantially constructed and conveniently located for direct, economical work. Power plants are highly efficient and adequate for requirements. The various workshops are well appointed and fitted with the necessary tools and appliances for doing the work of the mine. The equipment is actuated by steam power. It includes two ten-foot first motion drum, plants with Corliss engines capable of hoisting from a depth of 1,500 feet; one first-motion drum plant, seven-foot drum with Corliss engines capable of hoisting from a depth of 1,200 feet. Triple expansions pumping engines capable of pumping 4,000 gallons of water per minute from a depth of 1,000 feet, using a steam pressure of 150 pounds to the square inch at the pumps; compound Corliss duplex air compressor with capacity to operate 42 drills. These, with other supplementary appliances, round out and complete the mine equipment.

A noteworthy feature connected with the Pewabic mine is a new shaft sinking in the south half of Section 32 for the purpose of developing an ore body which was located there last year with the diamond drill. The shaft is now down 300 feet and when sunk 100 feet deeper cross-cutting will be started towards the ore body. When thoroughly explored the deposit will be developed on modern methods, and if conditions warrant, it will be worked on a liberal scale. Any important developments made there will mean much for the future of the property. And indications are certainly promising.

Like all other producing iron companies, Pewabic people had a very prosperous year in 1905, and the future outlook for the company never looked brighter nor promise more than at the present time.

The Pewabic company is a Wisconsin corporation with its general financial offices located in Milwaukee. President, Mr. George VanDyke.

The general mining office is at Iron Mountain, Michigan.

General Manager, E. F. Brown; Mining Captain, Ed. J. Lord; Chief Clerk, W. G. Monroe; Engineer, Charles E. Bohman.

THE MINERAL MINING COMPANY.

This is a Wisconsin corporation with headquarters at Milwaukee. In addition to carrying on various explorations at different points, the company is operating the Naniamo mine at Iron River, containing in its lease-hold 240 acres of land and embraces what was formerly called the Beta Mine.

The main office of the company is located at Milwaukee, Wisconsin.

Mr. George D. VanDyke is President.

General mining office is at Iron Mountain, Michigan.

General Manager, E. F. Brown; Chief Clerk, W. G. Monroe; Mining Captain, Ben Martin; Engineer, Charles Swanson.

The number of men employed is about 150. Ores produced are red hematite. Analysis: Beta ore, 58 per cent, iron, .350 per cent, phosphorus. Gamma ore, 50

per cent, iron, .325 per cent, phosphorus. Amount of ores produced during 1905 was 90,722 tons. The Naniamo was one of the first mines opened in the Iron River district of the Menominee Range, and was in operation up to 1901, from which time it remained closed until acquired by the company in 1903. The property looks well, is ably managed and economically operated. Ore bodies developed are substantial and continuous and apparently good for many years to come. Deepest points penetrated look about as well as any workings in the mine, and there is an abundance of ore in sight available for production. The mine is opened and developed through one shaft down to the third level and sinking toward the fourth. Shaft is now 370 feet deep with three levels extended laterally for various distances. Preparations are underway for sinking another shaft. The preliminary work has been started. A modification of the sub-level caving method is used for taking out the ores and it works admirably without the use of timber. The annual consumption of timber is nominal which is a remarkable feature and means a great deal to the company. Timber costs run into money fast to say nothing of the time consumed and waste of energy in lowering the supply and putting it in place. There are 18 power drills operated on an average for opening up new ground and doing the stoping work of the mine.

The mine equipment is actuated by steam power and embraces hoisting engines capable of lifting a three-ton load from a depth of 500 feet Pumping machinery capable of raising 2,000 gallons of water per minute from a depth of 500 feet, an Ingersoll-Sargent air compressor, piston inlet, with capacity to run 18 drills; a well-equipped machine shop, besides smithy, carpenter shop and other supplementary works and additions that go to fill in and round out a well-appointed mine plant.

The Mineral Mining Company also operates the Breen mine which is located at Waucedah, Dickinson County, Michigan. This mine was discovered in 1872 and holds the distinction of being the first property opened in the Menominee Iron Range. Except some work that was carried on there in 1875 and 1877, the mine had been idle since its first opening up to last year,—1905. The same general officers are in charge of the work except the mining captain, who is Thomas Rowell. During 1905 the company employed 40 men and produced 16,625 tons of ore. The ore rims about 40 per cent, iron, .018 per cent, phosphorus, .39 per cent, silica. Mine is good for a product of from 50,000 to 100,000 tons per annum for many years to come without crowding. Amount produced will depend largely on market conditions and the demand for ores.

Nothing has yet been mined below a depth of 100 feet Ores are taken out on the open pit and milling method and is operated cheaply and economically. Equipment embraces hoisting engine, air compressor and auxiliary machinery installed in buildings conveniently located for direct service and is quite adequate for general requirements.

THE DESSAU MINING COMPANY.

This company is opening up and putting in condition for active operations the Millie mine, which has been idle since 1903. The realty holdings of the organization consists of 70 acres located in Section 31, Town 40, Range 30, Dickinson County, Michigan. Mine office address, Iron Mountain, Michigan. There was no product made in 1905 but previous to that year, the company is credited with having produced a total output of 298,550 tons of ore. Ore produced runs about 41.07 per cent. iron and .027 phosphorus. When producing, the product is taken out through the open pit system. At the present time five power drills are in operation. About a dozen men are employed and preparations are underway for making the property a shipper during 1906.

S. Dessau, Secretary-Treasurer; S. J. McGregor, Superintendent.

HIAWATHA MINE.

This mine, located near Sheridan, has been out of business since May, 1904. The Roger Brown Company, of Buffalo, N. Y., are starting to unwater the property with a view to operating it afresh.

Ore shipments from stockpile in 1905 from this property amounted to 9,704 tons.

THE ANTOINE ORE COMPANY.

This company operates the Traders mine located in Section 17, Town 40, and Range 30. Postoffice address, Iron Mountain, Michigan. Two hundred men are employed, fifteen machine drills operated and the mine is worked with considerable vigor. The product for 1905 was 138,395 tons of ore. Ore produced is rather low grade running about 41.00 per cent. iron and 38.00 per cent. silica. Property contains large ore bodies extensively opened up and developed on practical lines with openings extending laterally as much as 400 feet or more in length. I visited this property last November. Everything was then running smoothly and successfully. Operating costs were low. Daily capacity about 1,200 tons. The product is recovered through the milling system, which seems excellently adapted for such a proposition as the deposit mined. Scarcely any timber is consumed in the work. The mine is in good physical form with big possibilities ahead. Mechanical equipment is not elaborate but adequate for requirements and economically operated. Property is in capable hands and operated the best way for bringing the best results. General progress has been substantial and the mine seems to be in a prosperous condition. E. W. Hopkins, General Manager; Frank Carbis, Mining Captain; W. K. Carter, Clerk.

PICKANDS, MATHER & COMPANY.

This company controls the Verona Mining Company operating at Quinnesec, Michigan, and the Hemlock Mining Company operating at Amasa, Michigan.

C. A. Munger is General Manager for the company, with office at Duluth. Charles E. Lawrence is General Superintendent for Michigan, with office at Iron Mountain, Michigan.

Samuel Mather, President; Walter Scranton, Vice President; H. S. Hasselton, Secretary; H. G. Hamilton, Treasurer. Main Office, Cleveland, Ohio; Mine Office, Iron Mountain, Michigan.

The company occupies a prominent position among the progressive and successful iron ore organizations operating in the Lake Superior district, and it has a good record. It is composed of people who know the business thoroughly and do it right. Every move made counts and general progress has been continuous and of the nature that means improvement and a stretching out for bigger and better results. The present capacity of the company is about 500,000 tons of ore with ample scope for material expansion and a heavier output. Its real estate holdings and acquirements are broad and extensive and possesses great possibilities. 1905 was the banner year of the organization. The total amount of ores shipped for the season being 378,000 tons as against 282,000 tons for the previous season. And prices realized for the output were satisfactory. They were high enough to enable all companies to pay workmen good wages and then make fair dividends for stockholders.

The mines operated by Pickands, Mather & Company are, as a whole in better physical condition now than at any previous period, and in trim to turn out a heavier product, and barring accidents, shipment during 1906 promise a total considerable more than the tonnage sent out in 1905 which broke all former records. In the natural course of mining progress big sums of money have been spent in opening up and developing the mines of this company and in putting them in shape for economical and efficient service. Besides a considerable portion of the revenues realized from the sale of ores has been put back into the mines, whenever it happened to be for the best interest of the organization, and it has proved a fine investment. The management aims to carry on operations on a scale somewhat commensurate with the possibilities of the properties, and to get out of them the best there may be in them, besides making provision for future requirements. The success achieved has been substantial and gives general satisfaction. The machinery plants are highly efficient as liberal allowances have been spent in putting them in first-class operating condition. The mines are ably and skillfully managed and for the best interests of all connected with the enterprise. The ore bodies opened up and available for production and from which the product of the company comes are large and continuous and amply sufficient to last for some time to come at the present rate of production. The mines are opened on broad, practical lines and worked on up-to-date methods. Order and system is kept well in the foreground and maintained in every department. The affairs of the company are discharged with promptness and precision and in a very capable manner. I visited the mines of the company last November and found everything running smoothly and successfully.

C. H. Munger is general manager for the company.

The producing mines operated by the Verona Company are: The Vivian, the Baltic and the Caspian on the Menominee Range, and the Mikado on the Gogebic Range.

THE VIVIAN MINE

The Vivian mine is located at Quinnesec, Michigan, and has the west half of Section 34, Town 40, Range, 30, and was organized in 1901. James Brew, Mining Captain, G. D. Crippen, Engineer.

The mine produces rather low grade ore, running 40 per cent, iron, and has a daily capacity of 300 tons. It is opened and operated through one large shaft, 5 by 14 feet in dimensions. Twelve power drills are operated and one hundred men employed. Shaft is 210 feet deep with lateral openings extending in ore body averaging in length 1,000 feet. Skips counterbalance in shaft and work very smoothly. The back stoping method is used for recovering the ore, and during 1905 the mine's output amounted to 110,000 tons of ore. Total amount of ore shipped since the beginning of operations, 243,860 tons. The general equipment is efficient and adequate for present requirements. It is in good condition and operates economically. I visited the property last November. A better grade of ore is predicted for the Vivian when greater depth has been attained.

THE BALTIC MINE.

The Baltic mine is located at Stambaugh, Iron County, Michigan, in the west half of west half of Section 7, Town 42, Range 34, and owns 160 acres of land. W. H. Jobe, Local Superintendent; W. H. Bengry, Mining Captain.

Ore produced yields 57 per cent, metallic iron. One hundred and fifty men are employed and the mine has a daily capacity of 400 tons of ore. Mine is opened and operated by means of one shaft, 7 by 9 feet in dimensions; 15 power drills are operated. Shaft is 400 feet deep. Average length of openings in ore body reach 600 feet. Ore body is large and continuous and looks as well in deepest point penetrated as anywhere in the mine. The back stoping method is used in taking out the product and it works admirably. Mine is in good physical condition and economically worked. Equipment is highly efficient and includes hoisting engine, air compressor, with three boilers for furnishing power, besides

supplementary appliances and shops for doing the work of the mine. Amount of ore produced during 1905 was 133,000 tons.

THE CASPIAN MINE.

The Caspian is a young producer, having made its first shipment of ore in 1903. It is situated at Stambaugh, Iron county, Michigan, and located in the northeast quarter of Section 1, Town 42, Range 35. W. H. Jobe, Local Superintendent, W. Gulgrew, Mining Captain.

Ore produced runs 57 per cent. iron. The mine employs one hundred men and has a daily capacity of 200 tons of ore. It is opened and worked through one shaft. Twelve power drills are operated. Product for 1905 was 10,000 tons of ore. The working shaft is 375 feet deep with openings in the ore body mined 400 feet in length. Total amount of ore produced by the Caspian since the beginning of operations is 16,330 tons. I visited the property last November and found everything running smoothly and successfully. "Pillar and room" is the method used for taking out the ore.

Mine equipment is good for present requirements and in firstclass order. This mine has an encouraging outlook and good things are predicted for it with greater depth and further expansion.

EXPLORATION.

Besides operating these producing mines, Pickands, Mather & Co. are doing considerable exploring work in promising localities on the Menominee and Gogebic Ranges. New shafts are going down and the chances for finding new ore bodies of merit are considered good.

The work involves all kinds of risk and deserves its reward. The company is reopening the old Calumet mine, located in the Naranta branch of the C & N. W. Ry. It is handled on a basis of an exploration, but it is a lean ore, namely, 40 per cent, iron, similar to what the company is mining at the Vivian mine at Quinnesec, Michigan. This property is being operated with the hope of finding a better grade of ore in the immediate vicinity, or as the shaft reaches the ore strata.

HEMLOCK RIVER MINING COMPANY.

This company operates the Hemlock mine, located at Amasa, Iron River county, on the Menominee Range, and owns 400 acres of land in Section 4, Town 44, Range 33. The ore mined is a non-Bessemer, running about 53 per cent. iron. The mine became a producer in 1891 and since the beginning of operations has produced a total of 1,170,435 tons of ore. Amount produced during 1905, was 125,000 tons. The mine is opened and developed by means of one fine shaft 7 by 15 feet in dimensions, 850 feet deep, with a capacity for lifting 300 tons of ore daily. The ore bodies furnishing the product look well; are large and continuous and are reached by various levels, which being connected, make free circulation of air and the underground openings are fairly comfortable for the miners working there. Average length of openings in ore bodies is about 1,800 feet, and there is an abundance of ore reserves in the mine to draw upon in the regular order of production. One hundred and fifty men are employed and 20 power drills operated. The back stoping method is practiced for taking out the mine product. The mine equipment is powerful, efficient and includes hoisting plant, two air compressors, five boilers for furnishing steam power, besides supplementary additions, fitted with the necessary tools and appliances for doing the mine work sucessfully. Property is in fine physical condition and good for many years.

Charles E. Lawrence, Superintendent; C. W. Hughes, Mining Captain; G. D. Crippen, Engineer.

MUNRO MINE.

This mine is located near Norway, Dickinson County, in Town 39, Range 29, and consists of 80 acres leased land.

G. L. Woodworth, General Manager. H. McDermott, Mining Captain.

The Munro is a substantial mine with fair future prospects. It produces a hard hematite ore and in 1905 shipped 92,182 tons of ore from stockpile accumulated. At the present writing the mine is not operated. It is opened through one shaft, 6 by 14 feet in dimensions with three compartments, and 86 feet deep. Average length of openings in ore body is 525 feet. Munro is an open pit proposition with product recovered through the "milling method." Equipment embraces a hoisting plant, 25-drill capacity air compressor, and supplementary additions sufficient for requirements.

SAGINAW MINING COMPANY.

This company is doing exploratory and development work, and has a lease on the southwest quarter of the southwest quarter of Section 4, Town 39, Range 29, Dickinson County, Michigan.

Development and exploratory work is conducted through one shaft 5 by 9 feet in dimensions and divided into skip and ladderway. Shaft is 230 feet deep and has three levels going. The work is conducted on systematic, practical lines and indications are favorable for developing a substantial property. During 1905 the company produced 3031 tons of ore. It runs about 52 per cent, iron and .020 per cent phosphorus. Ore is recovered on the caving system and it works well. About thirty men are employed, and four power drills are

operated. Good progress is being made. The company is enterprising and deserves to be rewarded. A promising ore body of the Bessemer grade has been located in the property with a diamond drill and it has been planned to run the hole down to a depth of 1,000 feet.

George A. Baird, of Chicago, is president and treasurer. E. W. Jones, of Norway, Michigan, is secretary and general manager. Postoffice address, Norway, Michigan.

THE PENN IRON ORE MINING COMPANY.

This Company ranks among the prominent and well known iron ore producing organizations operating in the iron ore region of the Lake Superior district. The properties owned and operated by the corporation are located at Vulcan and Norway in the Menominee Range and have an annual capacity of from 350,000 to 450,000 tons of ore. For many years the mines have been vigorously and successfully worked, employing a large force of men and contribute to the output of the district since the beginning of operations, 3,356,848 tons of ore. I visited the properties of this company last fall and so far as the physical appearance of them is concerned, there was nothing in sight to indicate why they might not be kept going vigorously for many years to come and keep on adding to the output of the district and developing its natural resources. The organization has large possessions of mineral and timber lands of decided value and before the ore bodies now furnishing the mines' product are exhausted there is not the least doubt but that others will be discovered to take their places.

The Penn Mining Company is constructing a complete hydro-electric plant at the Sturgeon Falls. The electric equipment to be furnished by the General Electric Company, and the electric power used for operating the hoists, compressors and pumps at the East Vulcan, West Vulcan, and Curry mine properties. The plant is located between three and four miles from the mines and the transmission lines will be erected for the total capacity of 3,000 Kilowatts at 6,600 volts, 3-phyase alternating current.

The plant will be in operation some time during 1906. This change from steam to electricity will give the Penn Company one of the most complete and up-to-date electrical plants in the Upper Peninsula of Michigan. The Penn Company mines include the properties known as East Vulcan, West Vulcan, Curry, Brier Hill, Norway and Cyclops. The workings on the West Vulcan, Curry and Brier Hill are connected in one mine and Norway and Cyclops are contiguous. These properties are located on the Menominee Range. The output of the properties during 1905 was 424,669 tons of ore. The ores produced make six grades from special Bessemer to low grade silicious. Mines are developed and operated through six fine shafts, well located, substantially constructed and in fine running order. Shafts are connected on different levels, that makes ventilation good and producing places comparatively safe and comfortable for working in. Skips carry heavy loads, counterbalance in shafts, dump automatically and are lowered and lifted with great speed. Machinery is of the best; is highly efficient, practical in mechanical construction, in first-class trim and economical in operation. Many conveniences and privileges are provided for the employes that contributed largely in making home life at the mines comfortable and pleasant. The plant is very complete, adequate for present requirements and good for some time to come. General office for the mines is at Vulcan, Michigan.

Officers of the company: President, Powell Stackhouse; Secretary and Treasurer, A. P. Robinson; General Manager, William Kelly; Chief Clerk, Anton Johnson; Mining Engineer, F. A. Janson; Mechanical Engineer, F. H. Armstrong. General Office, Philadelphia, Pennsylvania.

Mining Captain of East Vulcan, Wm. Harris.

Mining Captain of West Vulcan, Wm. Bond.

LORETTO IRON COMPANY.

This mine is located in the town of Loretto, on Section 7, in Town 39, Range 28, near the Sturgeon River, and became a producer in 1893. The ore deposit reaches up to the overlying sand and wash of the region which, in places is heavy and difficult to carry shafts through. The mine is developed and operated through one hoisting and one timber shaft and sinking is underway to the 8th level. Shaft dimensions are 16 feet by 6 feet, divided into three compartments; is substantially constructed, with a daily capacity of about 335 tons of ore. The "square sets method" is followed for taking out the ore and it works satisfactorily. About 600 pieces of timber are consumed annually in the work, which serves to secure and hold up the ground and make mining comparatively safe and comfortable. The mine is not deep and air circulation is good. There are 175 names on the payroll, and nineteen power drills are worked on an average. Air compressor has capacity to run 35 drills, and as developments are extended, additional drills will be placed in commission. Progress has been substantial and continuous. The mine is opened up and developed on practical, systematical lines and economically operated. The ore bodies that furnish the mine product are quite large, continuous and persistent with no place looking better or promising more for the future of the property than the deepest openings penetrated. Average length of openings in ore bodies is about 600 feet. Stoping or ore extraction is continued on different levels and the amount of ore developed in sight and available for production is sufficient for a long successful run at the present rate of producing. The property has a good outlook for the future and better things than it has yet enjoyed are predicted for it. Mechanical equipment is powerful, fairly complete, in

good running order and capable of doing the work of the mine. Last season the Loretto produced about 100,162 tons of ore, and since the beginning of operations, a total of 826,308 tons. The ore is sold on a guarantee of 50 per cent natural—equal to about 54.50 per cent, iron and .065 per cent phosphorus.

J. Ward, General Manager; Harry Truscott, Mining Captain; W. J. McLaughlin, Clerk and Engineer.

CORRIGAN, McKINNEY & COMPANY.

This company stands among the prominent, progressive mining organizations, producing iron ore in the Iron Region of the Upper Peninsula of Michigan. For many years the company has been a heavy producer and successively turning out such varieties of ore as there generally happens to be a ready market for at profitable prices, and its stockpiles are pretty well sold up and shipped out. The company makes a point of keeping abreast of the times and providing up-to-date facilities and appliances for meeting the enormous demands of the present energetic age or for any emergency that may arise. It is an enterprising concern with large possessions of mineral and timber lands located in different sections; is well known within mining and business circles and has a fine record with practically unlimited credit. Stockholders are men of the best and soundest type who know the business thoroughly and conduct it for the best interests of all connected with the enterprise. Lands contain immense bodies of soft ore characteristic of the district, some of which have been opened up and developed into profitable mines that form solid, substantial industries, with ample room for further expansion and employing a large number of men at good wages. The trade coming from the employes of the mines is the mainstay and principal support of the towns located all over the iron region. Wherever mines are started and develop distinctive values, locations and towns spring into being and become populated in a wonderfully short time. Mines are often described as the "great commissary of the present industrial warfare," the advance guards of colonization and of civilization.

The ore reserves developed in the property of the Corrigan, McKinney & Company are small, but sufficient to keep the mines running at full capacity for a long time ahead by crowding the opening works. Mines are opened on broad, practical lines, and vigorously operated. The management aims to work them on a scale somewhat commensurate with their possibilities and to get out the best there is in them, and the success achieved has been quite satisfactory. The machinery plant is about as good as there is going for requirements. It has no frills nor tinsel, but is powerful and efficient and economically operated. Mines are ably and skillfully managed and progress towards bigger and better things has been substantial and continuous. To what extent the operations of the company may reach within the next ten years may be judged by the results accomplished in the past. A large portion of the profits have been put back into the property, which has strengthened its position in all branches and added to its capacity. The physical condition of the property was never better than at the present time nor did the outlook for it ever appear more promising. And it is well that this is so for it means good times and prosperity for one and all. Order and system prevails everywhere and the business affairs of the company seem to be performed promptly and with excellent efficiency. I visited the mines of the Company last fall and found everything running smoothly and on up-to-date methods. The prices of groceries and all provisions and household necessities are high, but men are earning good wages and are generally satisfied with their lot in life. Miners, as a rule, are a happy dispositioned people, who mind their own business, live well and constitute good law abiding citizens, maintain comfortable homes and provide liberally for their support. Like practically all other mining companies located in the Upper Peninsula of Michigan, the Corrigan, McKinney & Company pay especial attention to the needs and requirements of its employes and their families, and provide them with many privileges and conveniences that help much toward making social conditions in and about the mine locations enjoyable and pleasant.

The company controls and operates the following mines: On the Gogebic Range, the Ironton, Winona and Colby. In the Crystal Falls district, Menominee Range, the Tobin, Armenia, Been, Lament, Fairbanks, Kimbal, also the Lincoln mine, Crystal Falls mine, Great Western mine, Quinnesec mine, besides different properties under exploration.

Main business office, Cleveland, Ohio; mine office, Crystal Falls, Michigan; President, James Corrigan; General Superintendent, W. J. Richards; Secretary-Treasurer, J. E. Ferris; Chief Clerk, E. J. Oswald; Engineer, Fred C. Roberts.

TOBIN IRON MINING COMPANY.

The Tobin is a substantial mine and a fine business enterprise with a good future. Recent developments have been quite satisfactory, as they resulted in opening some good stopes of ore. Mine is opened on modern methods and progress has been continuous, and of the sort that counts. It was the first mine in the Iron Country started on the caving system, and has proven an entire success. By using this method, practically all the ore can be taken out, as the work proceeds with comparative safety to all doing underground duty. Company employs 225 men and operates 25 power drills. Ore produced is a red hematite running about 58 per cent, iron and high in phosphorus. The 1905 product was 243,000 tons of ore. This includes, however, the Genesee output. Mine is opened and developed through two main shafts, 6 feet by 18 feet in dimensions, and three-compartment. Shafts are in first-class

condition, 500 feet deep, with seven levels developing fresh reserves for future requirements. About 50,000 feet of timber, board measure, are consumed per annum in mine work. Future needs are anticipated and provided for in good time. Average length of openings in ore body is about 400 feet. I visited this property last November and found everything running smoothly and in first-class condition. Shafts are connected on different levels, and levels in turn are connected at various points that ventilate the workings and make the place comparatively safe and comfortable for miners and all doing underground work. Equipment is good, embracing powerful hoists, a 30-drill capacity compressor, well equipped machinery houses and supplementary fittings, buildings and other necessities for doing mine work.

GREAT WESTERN.

Great Western is situated northwest of the town of Crystal Falls on a line of the C., M. & St. P. Ry., in Town 43, Range 32, and controls 80 acres of land. The mine has been a substantial producer for many years and is credited with producing from the beginning of operations 1,109,260 tons of ore. This mine is a very wet proposition and the pumping charge is heavy. Manganese being in some of the ore makes the separation hard, and therefore, expensive. Ore is a red Hematite. Analysis: 57 per cent. iron, and high in phosphorus. Mine is operated through two fine shafts, 6 feet by 18 feet in dimensions, and three-compartment. Shafts are 850 feet deep, with 12 levels extended for distances averaging 400 feet to and in ore bodies. 250 men are employed and the product of ore shipped in 1905 was 211,000 tons. These figures, however, include the Lincoln mine output for last year. Mine is opened up and worked on broad, practical methods, and management aims to take out practically all its values in the best way for bringing satisfactory results. Fifteen power drills are operated. I visited this property in November last and everything was running smoothly and successfully. Property appeared to be well managed and in a prosperous condition. Order prevailed everywhere. Men are well served, earn good wages and receive their money every 30 days. The back stoping system is used for taking out the product and about 60,000 feet of lumber, board measure, are consumed annually in mine work. Skips counterbalance in shafts, dump automatically and do first class duty. Shafts and levels are connected on various points and ventilate the underground departments satisfactorily. Mechanical equipment is excellent, embracing powerful hoists, a 15-drill capacity compressor, well equipped shops, substantial mine buildings, besides other appliances and fittings capable of doing all mine work in a satisfactory manner. Location and buildings are lighted by electricity. Employes of the mine contribute substantially to the support of the town of Crystal Falls.

CRYSTAL FALLS.

This mine has been a substantial producer and is credited with having produced 1,385,685 tons of ore previous to 1905. But the mine is pinching out very rapidly with depth and unless there is a change in the formation soon for the better, the life of the mine will be short. The 1905 product was 152,000 tons of ore. Ore produced is a red Hematite. Analysis: 58 per cent, iron and high in phosphorus. There are 150 men on the payroll with 12 machine drills in operation. The mine is opened up on pactical methods of operation and the management aims to get out the best there is in the property in the most economical way. Results obtained have been fairly satisfactory and the mine may hold fresh surprises. Property is well located and new ore bodies may be found in the regular order of opening and doing mine work. Mine is in capable hands who know the mining business thoroughly and do it in the right way for bringing satisfactory results. One three-compartment shaft is operated. It is 5 feet by 18 feet, and 800 feet deep, with 12 levels extended for an average distance of about 128 feet. Development work continues on the 12th level and the underground department is in good condition. 20,000 lineal feet of timber are consumed annually in mine work. Equipment is in good running order, efficient and adequate for requirements. Underground openings are connected at different points and the workings are well ventilated.

LAMONT.

Lament mine is situated near the town of Crystal Falls in Town 40, Range 32 and leased 40 acres of land. Its product of ore for 1905 was 75,000 tons, which includes the product of the Paint River also. This mine is now producing only ore left in pillars and forms a back stope proposition. Considerable development work is underway and unless something is found, the mine will be worked out very shortly. Underground operations are conducted through one substantial shaft, 6 feet by 18 feet in dimensions, and three-compartment. It is 800 feet deep with eleven levels in all extending doing development work or producing the mine product Operations are conducted skillfully and in a practical way. Whatever values may lie imbedded, will likely be found in the thorough way the work is being conducted. Ore produced runs 54 per cent iron and high in phosphorus. One hundred men are employed and 12 machine drills operated on an average. The "caving system" is used for taking out the ore and it answers admirably requiring only a moderate quantity of timber and practically all the ore body is recovered. Annual consumption of timber runs about 25,000 lineal feet. Mechanical equipment is efficient, in good running order and adequate for present requirements. It embraces a 12-drill capacity compressor, powerful hoists, besides other fittings and additions required for doing mine work.

DUNN.

The work done at this property is that of trying to reclaim an old mine and also exploring and opening upon other ore bodies if any can be found. A new shaft was sunk for this purpose. It produces a red Hematite ore. Analysis: 57 per cent, iron and high in phosphorus. The shaft, through which the property is operated and developed, is 760 feet deep, 6 feet by 18 feet in dimensions, and three-compartment. Two levels are going ahead with fair chances of developing substantial values. Product for 1905 was 21,000 tons of ore. There are no men on the payroll and ten machine drills are operated. Progress has been continuous and mine workings approaching a good physical condition. Property is well managed. Product is recovered on the back-stoping method, and about 30,000 lineal feet of lumber is consumed annually in mine work. Underground openings are well ventilated and comparatively safe for working in. Equipment is efficient, in good running order and adequate for some time to come.

ARMENIA.

Armenia is quite an old mine, having made its first shipments in 1889. During a number of years, however, it was idle and produced no ore in 1905. The ore produced is low grade, about 52 per cent, iron, and high in silica. The mine has just been unwatered and is now getting in shape to take out the ore. It is credited with having produced previous to 1905, 247,061 tons ore. Twenty men are now employed and four machine drills are operated. Operations are conducted through two shafts, 5 feet by 18 feet in dimensions and three-compartment. Shafts are 365 feet deep, with developing work continuing in four levels extended about 150 feet in length. The work of unwatering was conducted with much energy and substantial progress made from start to finish. Work underway is practical and planned for bringing the best results. Product is recovered through the "caving system" which is just the thing for such a proposition. Equipment is portable, embracing a 12-drill capacity air compressor, hoists and supplementary fittings. Armenia is in capable hands and well managed.

KIMBALL.

Kimball is an exploring proposition. Work is conducted with a portable plant at the present time, which will likely be replaced with a permanent one as soon as requirements demand the change. Property will be thoroughly explored and developed on methods for bringing the best results.

STAR WEST.

Some test pitting and exploratory work in general was done at this property during 1905, but nothing of value being found, work has been suspended.

BRISTOL.

This property is located just north of the town of Chrystal Falls with 80 acres in Town 43, Range 32. It has been operated for some years and credited with producing previous to 1905, an output of 744,147 tons of ore. It is well managed and good progress has been made in its development. The mine has no uniform iron ore course with organized form, but small irregular bodies of hard brown Hematite running about 53 per cent. iron. The property is thought to contain important values and at greater depth, these ore bodies may unite and form one substantial deposit. There are 180 men employed and 14 machine drills operated on an average. Daily capacity, about 600 tons. In 1905, the mine produced 214,000 tons of ore. The mine is developed through one substantial shaft, 8 feet by 16 feet, three-compartment, and 650 feet deep. Product is taking out with the "milling" system, and it seems to be the best for the property. About 12,000 feet of timber, board measure, was consumed last year in connection with the work.

Surface equipment is in good running order and adequate for present requirements. It includes a three-boiler hoist, 14-drill capacity air compressor, besides the usual number of workshops and supplementary additions and fittings for doing mine work.

Improvements are underway that will increase, quite materially, the capacity of the mine. A double drum, first motion hoist and a Norwalk compressor will be installed in a new power house, which is under construction. Engine will have capacity to lift 6-ton net loads from a depth of 700 feet at a speed of from 1,500 to 2,000 feet per minute. Compressor capacity, 20 drills. The shaft has been sunk an additional 80 feet and considerable new ground has been opened up.

General Manager, E. W. Hopkins; Mining Captain, Emil Carlson; Assistant Superintendent, Arvid Bjork; Mining Clerk, F. H. Miller. Postoffice address, Crystal Falls, Michigan.

GOGEBIC RANGE.

On the Gogebic Range, the Oliver Mining Company controls and operates the following mines: Aurora, Norrie, Tilden, Davies, Chicago, Geneva and Puritan.

O. C. Davidson, General Superintendent of Mines: D. E. Sutherland, Superintendent; Chief Clerk, F. J. Sullivan.

AURORA MINE.

This is a substantial mine with solid merit, a fine business enterprise and forms one of the chief supports to the town of Ironwood. It is located just east of the town in Section 23, Town 47, and consists of 160 acres of land excellently located. Mine has been in successful operation for about 15 years and is credited with having produced previous to 1905, 1,820,035 tons of ore. The ore bodies developed are large and continuous and looks good for years ahead at present rate of production. The product in 1905 was 482,551 tons of ore. Ore runs 61.50 per cent, iron, .038 per cent, phosphorus, 5.50 per cent silica. The mine is developed and operates through two fine working shafts, "A" and No. 1. Shaft "A" is 987 feet deep and No. 1 is 1,115 feet deep. Underground workings are developed in the best up-to-date methods and well managed. Shafts are going down and the usual number of drifts are going ahead developing additional new ground in accordance with the policy of the management. Future requirements are anticipated and provided for. This matter is kept well in the foreground. No reasonable amount of cost or labor is spared in making the mine safe and comparatively comfortable for working in and men appreciate its physical condition. Levels are connected by various openings, well secured and air circulates freely through practically every part of the underground department. Different methods are used for taking out the products of ore. Conditions are not always the same and the method best adapted for each situation is used. Something over 1,000,000 feet of timber, board measure, are used annually in mine work and every department is in fine running order. Skips counterbalance in shafts, dump automatically and carry four tons to a trip. I visited the property in January of the present year. Everything seemed to be running practically to perfection. Order prevails everywhere and affairs of the mine appeared to be dispatched with care and precision. Mechanical equipments are of the best for requirements, highly efficient, in good running order and economically operated. Workshops are conveniently located, equipped with the best tools and fittings and can turn out nearly any kind of work required in a modern mine. Mine is in a prosperous condition, with officers and men alike well satisfied with the existing conditions. Wm. Thomas, Mining Captain.

NORRIE MINES.

This is one of the best known and most successful iron ore producers of the State and is credited with having shipped more ore in a single season than any mine in the whole iron region of Michigan. Its banner year was 1902 when the output amounted to 1,080,032 tons. The property has an excellent record, and produced since the beginning of operations millions of tons of high grade ore, and is good for millions more. It forms a splendid business enterprise and one of the chief supports of the town of Ironwood. Norrie mines embrace: Norrie, East Norrie and Pabst, and lie in Section 22 and 23, Town 47, Range 46, with mine buildings forming a part of the town of Ironwood. Mine employs a large force and operates 15 machine drills. Product in 1905 was 802,136 tons of ore.

Ore analysis: Iron, 62.75 per cent.; phosphorus, .040 per cent; silica, 4.00 per cent.

Mines are opened and operated through eight shafts: Norrie, 2,749 feet deep; A shaft, 1,373 feet deep; Shaft B, 1,409 feet deep; E. Norrie, C shaft, 808 feet deep; No. 3, 1,128 feet deep; D, 1,049 feet deep; Pabst, C shaft, 781 feet deep; No. 4, (New) 531 feet deep.

Air for operating machine drills, etc., for these mines is furnished by the Aurora mine compressor. These shafts are substantially constructed, in good running order and capable of caring for an enormous output Shafts generally are sunk in the footwall side and ore bodies reached by a series of crosscuts. Underground openings are developed on up-to-date, practical methods, and the product is taken out in the best way for the best results, no matter whether the method be caving, stoping, slicing or any other. Shafts are connected on different levels, and the levels in turn are connected in various places that ventilate the workings and keep them airy, cool and comparatively comfortable for all doing underground work. Underground workings form a regular network with drifts going forward, opening up new ground that may be drawn upon whenever-needed. Future requirements are anticipated and provided for well in advance. No expense is spared to make every quarter safe and nearly 3,000,000 feet of timber, board measure, is consumed annually for mining purposes. The mines are in first-class condition, order and system prevailing in every department. An electric haulage system is used in this mine for tramming. Skips counterbalance in shafts, carry five tons to a trip and dump automatically in cars. Management aims to get out the best there is in the property and substantial success has been achieved. Mechanical equipment is of the best. It is powerful, highly efficient and arranged for handling a large product with dispatch and economically. The mine buildings are substantial; hoisting engines, air compressor plant are permanent, practically complete, in good running order and adequate for requirements.

TILDEN MINE.

Tilden is a fine mine, a profitable business enterprise, and has been a substantial producer for a dozen years. It is credited by "The Iron Trade Review" with having produced since the commencement of operations previous to 1905, 4,152,648 tons of ore. Its product in 1905 was 207,252 tons of ore. Analysis of ore: Iron, 62.00 per cent; phosphorus, .048 per cent.; silica, 5.00 per cent.; manganese, 5.00 per cent. Mine employs a large force of men and operates 12 machine drills on an average. Operations are carried on through three shafts: No. 6, 980 feet deep; No. 9, 650 feet deep, and No. 10, 610 feet deep. Shafts are connected in different levels and underground openings are developed in modern lines of mining. Openings are connected

practically all through the workings and air circulates freely through them and they are comfortable for working in. No effort is spared to render the mine safe everywhere and something over 900,000 feet of timber, board measure, are consumed annually in mine work. Developments are conducted vigorously and in the best manner for bringing the best results. Shafts are going down and the usual number of drifts are going ahead in different directions from shafts, developing fresh reserves in accordance with the policy of the management. Product is recovered from various openings, located practically all over the mine, and taken out in the most modern way. Mine is opened up well ahead and in good physical condition. Mine equipments are adequate for requirements and in good running order. People in charge of the property know the mining business and do it right and conduct operations with a view to taking out its values to the best advantage. Ore bodies are substantial and good for some time to come at the present rate of production. Skips dump automatically, in cars, counter-balance in shafts and carry from two to four tons to a trip. Mine buildings are substantial and well located for direct service. Machinery is modern, in first-class running order and generally adequate for requirements. Mine appears to be in a satisfactory condition and looks thrifty. W. H. Knight, Mining Captain.

DAVIES EXPLORATION.

This property is located in Town 47, Range 46, and consists of 80 acres of land. It is as the title indicates, an exploring proposition with one shaft sinking. About 25 men are employed. Prospects for striking a deposit of ore at an approximate depth of 1,000 feet are considered distinctly favorable. Work is conducted in the most practical manner and progress continues at a satisfactory rate. James Stanlake, Mining Captain.

CHICAGO MINE.

No work has been done at this mine for about three years. The ore contained in this property is rather low grade. It is not known just when operations may be resumed. Mining Captain, W. J. Truscott.

GENEVA EXPLORATION.

Is a development exploration property, located in Town 47, Range 46, with 160 acres leased land. The organization was formed in September, 1902. Mine has produced previous to 1905, 2,904 tons of ore, but made no product in 1905. The property is being developed through one shaft, 1,510 feet deep. About thirty men are employed and three power drills are operated. Its future outlook is considered decidedly encouraging. Equipment is adequate for requirements. Mine will be put in the best condition for bringing satisfactory results. James Stanlake, Mining Captain.

PURITAN EXPLORATION.

Is located about one and three-fourths miles southwest of the town of Bessemer in Section 17, Town 47, Range 46, and consists of 160 acres leased land. Property is being developed on modern lines and employs about 35 men. Four machine drills are operated and the mine is opened by the means of one shaft, 713 feet deep. Outlook for the property is considered first-rate and some people think it holds important values. Mine made no product in 1905. Surface equipment is good for present requirements and embraces a hoisting plant, 10-drill capacity air compressor and supplementary additions. James Stanlake, Mining Captain.

ASHLAND MINE.

This mine is owned and operated by the Cleveland-Cliffs Company and located within the corporate limits of the town of Ironwood, Gogebic County, and has no acres of land in Section 27, Town 47, Range 47.

Post-office address, Ironwood, Michigan. H. F. Ellard, Superintendent; W. H. Moore, Clerk.

The Ashland is one of the best known mines in the Gogebic Range and has a good record. It produces a high grade ore, running 60 per cent. iron, and .045 per cent, phosphorus. Its product for 1905 was 346,694 tons of ore. Property was opened up in 1884 and since the beginning of operations is credited with producing a total output, including 1905 product, of 4,165,599 tons ore. There are 315 names on the pay roll Mine is opened up and developed on broad, practical lines, and economically operated. From time to time, big sums of money have been spent on the property that resulted in strengthening its position and adding to its producing capacity. I visited the mine in 1904 and again in 1905 and found everything running smoothly and nicely. Mining operations are conducted through three shafts: Two are 6 by 6 feet in dimensions with two compartments each; the third is 10 by 16 feet inside measurement and divided in six compartments. This is a fine shaft, vertical and 1,050 feet deep. It has a large incline cage with two floors for men and timber. It is the first shaft of the kind seen in the Lake Superior district and it works admirably. Fifteen levels in all are extended. The longest one being one-half mile in length. Shafts and levels are connected, and the ventilation is good. Horses are used for underground tramming. Twelve power drills are operated for opening ground and breaking the ore. "Slice caving, drifting and room and pillar systems" are used in taking out the ore. About 400,000 feet; board measure, is consumed annually in holding up and supporting the ground, and no reasonable expense is spared to make the workings

safe and comfortable for miners and all connected with the work. Sinking shafts and driving levels are continued and large blocks of ground are being systematically developed and put in condition for economical extraction. Mechanical equipment is actuated by steam. It is powerful and efficient, embracing hoisting, air compressor and boiler plants, all in good running order. It is adequate for present requirements. A large solid brick and cement "Dryhouse" was built in 1905 to furnish comfortable quarters for underground employees. It is provided with a system of shower baths and expanded metal lockers, which are very much appreciated by the men. Underground and on surface, the property is in first class physical condition and good for a long successful run.

NEWPORT MINING COMPANY.

The Newport Mining Company operates the Newport and Anvil mines in Gogebic County. Postoffice address, Ironwood, Michigan. J. R. Thompson, General Manager. Newport is located about a mile northeast of Ironwood, in Section 24, Town 47, Range 47. The mine has been a substantial producer and is credited with having produced since the beginning of operations 3,077,253 tons of ore. Mine is opened upon broad practical lines and progress has been substantial and continuous. In 1905 the product of ore was 359,222 tons.

		Mng.
62.00-040	57.00-040	50.00-6.00-040
Ore Analysis, 62.00 Non. Bess.	57.00 Non. Bess.	55.00-7.00-040

Seven hundred and sixty men are employed and the mine is vigorously operated and on the best economical methods. Management aims to get out practically all the values in the property and in the most practical business-like way. I visited the mine in January of the present year and was very much impressed with the appearance of the property and the forceful, substantial way in which operations are conducted.

The Newport Mine was originally opened on ore lying on what is known as the Aurora-Pabst-Newport dyke. The ore contained a considerable amount of manganese, and the end of the deposit on the Newport property furnished perhaps the largest amount of manganiferous Iron ore mined from a single deposit in the United States. This original deposit furnished the large part of the product of the mine, while the “A” shaft was being sunk as rapidly as possible to develop new ore bodies. The original deposit extended only about 500 feet deep. At a depth of 1,000 feet at the 9th level, a small deposit furnished the large part of the product of the mine, while the “A” shaft was being sunk as rapidly as possible to develop new ore bodies. The original deposit extended only about 500 feet deep. At a depth of 1,000 feet at the 9th level, a small deposit containing approximately 175,000 tons was found upon another dyke. The shaft, however, was continued in spite of considerable discouragement to a depth of 1,950 feet where ore was found. This ore body has proved to be of considerable size and is thought by some to be the extension of the Norrie ore bodies farther to the west. So much for the west end of the property.

At the east end of the property, known as the Bonnie, a small chimney of ore was followed down from surface to the 14th level. The size of this ore body was small, turning out some 35,000 or 40,000 tons of ore per 100 feet in depth, but the ore was followed with the hope that at some poiut the chimney would encounter a dyke and spread out into a body of considerable size along the dyke. This occurred at the 14th and 15th levels, the shaft cutting the dyke at the 15th level. The ore lying upon the dyke, in the usual manner of Gogebic ore bodies, is of no great cross section, but has been followed for about 2,000 feet. At the present time they are mining on both the 14th and 15th levels and the shaft has been extended to the 17th level, and the work of opening the 16th and 17th levels has been commenced.

The Bonnie or "K" shaft was originally a single compartment shaft, but below the 9th level, it was sunk as a two-compartment shaft. During the period the mine was idle in 1904, the portion of the shaft above the 9th level was stripped out to make a double compartment shaft, for its whole length, so that the shaft is now being operated with two skip roads hoisting in balance. The hoisting plant at this point is somewhat unusual. Two 20x42 Corliss engines are direct connected to two parallel drums six feet in diameter and eleven feet long. Both drums are loose on the shaft and are operated by friction clutches and brake bands, so that the two drums can be clamped together at any point and operated in balance. The unusual feature of the plant is that the two drum shafts are parallel and are connected together by side rods similar to the operation of driving wheels of a locomotive. The capacity of the plant is a five-ton net load hoisted in balance from a depth of 2,500 feet at a speed of 2,200 feet per minute.

At the west end of the property a new hoisting plant was found necessary and a drum eight feet by twelve feet wide was installed, driven by two simple 24x48 Corliss engines. This engine was designed to hoist an unbalanced load of five tons at a speed of 3,000 feet per minute in a single compartment shaft. It was so designed, however, that another parallel drum can be added, making the plant similar to the one at "K" shaft. The plant was ordered April 1st from the Thompson-Greer Company, of Chicago, and on the 10th day of July commenced to hoist ore, and is now hoisting from 1,200 to 1,300 tons per day from a depth of 2,000 feet, besides handling all the men and supplies, as well as the ore, over a single skip road.

A new shaft with four hoisting compartments has been started back in the foot wall and it is proposed to build a new power house which will contain the necessary hoisting plants for this shaft and also a larger air compressor and electric haulage plant, which have already been ordered.

The mines are in a prosperous condition, skilfully managed and economically operated.

ANVIL MINE.

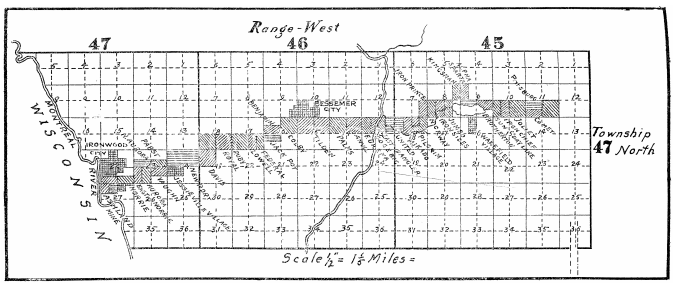
The Anvil mine is located in the northeast corner of Section 4, Town 47, Range 45, and about one mile southeast of Bessemer, Gogebic County.

Postoffice address, Ironwood, Michigan. J. R. Thompson, General Manager.

One hundred men are employed on an average and the mine is developed on up-to-date methods. Order and system prevails all over and the property is economically operated. Product is taken out in the best way adapted for the ore body mined and underground openings are in good physical condition. The product of ore in 1905 was 38,875 tons.

Analysis, 62.50-048 -57.00-045.

Shafts are substantial, in good running order and connected at various points enabling men to pass from place to place when desired or in cases of emergency. Air circulates freely through the workings and they are cool and comparatively comfortable, as mining goes, for working in. The management is progressive and has planned certain improvements that will result in strengthening the position of the mine. Mine buildings and power houses are well located and everything in and about the property appears to be running along smoothly and successfully. I visited this property in January last.



IRONTON AND COLBY MINES.

Are operated by Corrigan, McKinney & Co.

Ironton is a comparatively young mine with a promising future and is owned and operated by people who know the mining business and do it right. The property consists of 160 acres of land located in Section 17, Town 47, Range 46, and about a mile southwest of the town of Bessemer. Ore produced is a high grade red Hematite, of the Bessemer and non-Bessemer varieties, 62 per cent, iron, .065 per cent, phosphorus. The amount of ore produced in 1905 by the Ironton was 39,107 tons, and since the beginning of operations, the total output has been 179,126 tons. There are 179 men employed in the mine and twelve power drills are operated for all purposes. The mine is developed and operated through two active shafts 5 feet by 14 feet within timbers and divided into two compartments. Shafts have an average depth of 960 feet, with levels 500 feet long and extended into the ore body for a distance of 300 feet. Connections are made in shafts on different levels and other avenues that make ventilation good and the workings comparatively safe and comfortable for the men engaged in developing the mine and making the product of ore. Management is capable and aims to get out of the property the best there may be in it and in the most practical and successful way. The mine is opened on up -to-date methods and operations are conducted economically. The “subbing” method is used for taking out the ore, and in doing the work of the mine, about 500 pieces of 10-inch timber are consumed annually. Underground developments and mechanical construction have been continuous for some time and the property is surely broadening out for an increased output and improved results. The mine plant is actuated by steam power and the equipment includes a five-foot two-drum hoist, a twelve-drill capacity air compressor and the usual auxiliary machinery and well equipped shops for doing the work of a well appointed mine. In the way of betterment work, the management is having installed a battery of five boilers and a foundation for a Sullivan 20x48 direct acting two-drum hoist has been finished. The engine and boiler houses are completed. There is being built for the mine one 75-Kilowatt generator and a 14x14 McEwen engine and a four-ton electric locomotive to be used in an underground electric haulage system. No. 4 shaft is being stripped down and enlarged for two skipways to admit two skips working in balance. It is now a single skipway shaft. A new change house has also been recently built and a contract has been given for forty new dwelling houses to be erected early next spring. With these improvements completed the property will be in fine physical form and in condition for a long, continuous and successful run.

Mine officers: G. S. Barber, Superintendent; George Buzzo, Mining Captain; Alfred Kohlmetz, Chief Clerk; Frank Blackwell, Engineer.

THE COLBY MINE.

This is a remarkable mine with a fine record and produces high grade ores of the Bessemer and non-Bessemer varieties. From the start, it jumped into prominence and attracted wide attention. It forms a fine business enterprise and contributes material support to the town of Bessemer, the capital of Gogebic County. The mine is situated in Section 16, Town 47, Range 46, and consists of 160 acres of land. Last year, 1905, the mine produced 75,913 tons of ore and since the beginning of operations, 2,006,643 tons. Ore analysis: Bessemer, 62 per cent iron, .045 per cent phosphorus. Non-Bessemer, 62 per cent, iron, .045 per cent, phosphorus. Company employs 250 men and operates 15 power drills. Mine is developed and operated through

one vertical shaft 5 feet by 14 feet within timbers and three-compartment. It is 1,130 feet deep with levels extended into the ore bodies 1,200 feet in length. The ore bodies are large and to all appearances, good for a substantial product for a considerable time. The product is recovered on the "back stoping and subbing" method. The ground is supported by timber 10x10 in dimensions, and about 900 pieces are consumed annually. Everything within reason is done to make the mine safe. The ventilation through the workings are splendid. The property is ably and skilfully managed. Order rules in every department and its business affairs are discharged promptly and efficiently. In the way of betterment work, the company is sinking a new four-compartment steel-lined shaft 800 feet east of the old one. In the last year, the present working shaft was sunk 200 feet and a crosscut from the 9th level disclosed a small new ore body 400 feet east of the footwall. It is a north deposit of ore not previously known to exist at this point and it was on account of this new discovery that the second shaft is being sunk. During the same period, twenty-five new dwellings were completed for the use of the employees. The employees are provided with many privileges and advantages by the management that help to make their home life comfortable and pleasant. The mine equipment is highly efficient, in good working condition and adequate for present requirements. It includes a 14-foot two-drum geared hoist, a twenty-five-drill capacity Rand compound compressor, besides auxiliary machinery and well equipped shops for doing the repair work and also a large part of the construction work of the mine. The property is in fine physical condition and looks good for many more years of successful operation.

Mine officers: G. S. Barber, Superintendent; William Crowgey, Mining Captain; Alfred Kohlmetz, Clerk; Frank Blackwell, Engineer.

ASHLAND IRON AND STEEL COMPANY—YALE MINE.

The Yale mine is practicaly a new mine. It made its first product in 1901. The mine is located just southwest of Bessemer in Section 16, Town 47, Range 46, and consists of 80 acres of land. Postoffice address, Bessemer, Michigan. General Manager, William Wilkins; Mining Captain, Jno. D. Shea.

The mine is opened and developed through one shaft 7 ft. 2 in. by 10 ft. 2 in, double-compartment, and is 1,296 feet deep. Mine is opened on practical, up-to-date methods and efficiently managed. Ore body mined is substantial with average length of openings 700 feet. Thirteen levels are being extended and the underground workings show continuous improvements in physical condition. One hundred and fifteen men are employed, and five machine drills are operated. Product in 1905 was 60,913 tons of ore. Mine output previous to 1905, was 139,954 tons. Mine product is recovered through the stoping system and 70,000 feet of timber, board measure, was consumed last year in mine work. Underground workings are comparatively safe and comfortable for working in. Sinking and drifting are underway and the mine seems to be in for a prosperous period. Equipment includes hoisting plant, six-drill capacity air compressor, pumping outfit, and supplementary fittings adequate for requirements. The mechanical equipment is run by steam power and underground tramming by hand labor. Machinery is working smoothly and doing good duty. Power houses and mine buildings are practically new, in good repair and placed for efficient service. Property seems to be in capable hands and operated right for bringing the best results.

CASTILE MINING COMPANY.

This Company operates the Eureka and Castile mines. The Eureka is located between the Mikado and the Anvil mines at Ramsey, about two miles southeast of the town of Bessemer in Sections 12 and 13 in Town 47, Range 46, and owns 240 acres of land.

George Abeel, General Manager; Charles J. Jones, Superintendent; J S. Rumsage, Chief Clerk; John Danielson, Mining Captain; J. W. Weldon, Engineer.

The mine became a producer in 1890 and continued to send out ore in a moderate way until 1896, when all shipments ceased. Total amount produced was 128,719 tons. No output has been reported since that year. The mine is now being opened up and developed on systematic and practical plans for energetic operations and the indications for making a successful mine are considered first rate. The shaft has been sunk deeper, levels extended further and good progress has been made in putting the property in a condition for sending out a regular product and its position has been materially strengthened. Some good stopes of ore have been developed and put in shape for economical mining and that which promises to turn out very well. Underground developments are conducted through one shaft 6 by 10 feet in dimensions, divided into two compartments and 750 feet deep. There are 50 men on the company's payroll, and three power drills are operated. Mine equipment embraces a two-boiler hoisting plant, a twelve-drill capacity air compressor, and buildings adequate for present requirements.

CASTILE.

The Castile mine is located between the Eureka and Mikado mines with 400 acres of land on the strike line of the iron ore formation on the Gogebic range in Sections 12 and 13, Town 47, Range 46. Mine location is just northeast of Ramsey. Ore produced is a red Hematite.

Analysis: 55 per cent. iron, .045 per cent. phosphorus.

The organization is practically a new one, having been formed in 1903. It made its initial product last year, which amounted to 823 tons of ore. Mine is developed by means of one shaft substantially constructed and divided into two compartments. It is 8 by 16 feet in dimensions and 800 feet deep with five levels extended laterally for various distances. Levels are connected and air circulates freely through the underground workings. The proposition has an encouraging outlook and the general feeling seems to be that it will develop into a substantial mine, and a good business enterprise. The same officers manage both mines, except the mining captains. John Martin is captain of the Castile. Development work continues on up-to-date methods and the physical condition of the property shows a healthy, wholesome growth. The people behind the enterprise are of the best type and mean business. They have put considerable money into the property and deserve to be rewarded. Developments indicate that they will be in a substantial way. Mine equipment includes a two-boiler hoisting plant, an air compressor, besides miscellaneous buildings, which are ample for present requirements. Machinery is running smoothly and everything in and about the mine seems to be in good order. Location has a good appearance and the business affairs of the company are dispatched promptly and efficiently.

MIKADO MINE.

The Verona Mining Company operates the Mikado mine.

This mine is located on the Gogebic Range, about three miles east of the town of Bessemer, in Section 18, Town 47, Range 46, and owns five forties of land. The Company employed during 1905 a force of 160 men and produced 150,000 tons of ore. Mine became a producer in 1895 and up to the close of last season, 1905, has shipped a total output of 502,-299 tons of ore. Ore produced is a high grade Bessemer. Analysis: 58 per cent. iron, 157 per cent. phosphorus, 12.40 per cent. silica. In any kind of a market there is always a demand for these ores.

The mine is opened and developed through two shafts, No. 1 and No. 2, divided into two compartments, and 6 feet by 12 feet in dimensions. Average depth of shafts is 775 feet, with levels 600 feet in length. Four power drills are operated, and the average length of the openings in ore bodies is 1,800 feet. Mine looks well and is in fine physical condition and good for a substantial annual output for years to come. It is opened and developed on modern methods of mining and economically operated. Ore bodies developed are large and robust in character and there is an abundance of reserves underground that is fully up to the standard of the property. The circulation of air in the underground departments is good, and the producing points are comfortable for working in. Method used for recovering the ore is "subbing."

Development work underway includes sinking No. 2 shaft to the 12th level and driving a cross-cut south from No. 1 shaft. The cross-cut is now in about 400 feet. The company contemplates installing a new 20x42-inch, first motion plant, and in the future hoist the bulk of the product through that shaft. With this plant installed and operating the general equipment will be adequate for requirements for a considerable time.

Everything in and about the property is in good order and running smoothly.

Mine officers are: C. H. Munger, General Manager; G. S. Barber, Superintendent; J. M. Davis, Chief Clerk; James Coole, Mining Captain.

BROTHERTON IRON MINING COMPANY.

This mine is located northeast of the town of Wakefield in Section 9, Town 47, Range 45, and adjoins the Sunday Lake mine on the north-east. Property consists of 120 acres well located within the iron belt. Property has a good record and is credited with having produced previous to 1905, a total output of 1,163,776 tons of ore. Company employs 120 men and produces a Hematite ore running about 60 per cent. iron. In 1905, the company produced 136,023 tons of ore. The mine is opened up and developed through two working shafts each 6 feet by 12 feet in dimensions, double-compartment, and 900 feet deep. One air compressor is operated and progress has been substantial and continuous. Shafts are substantially constructed, in good running order and doing satisfactory service. The ore is trammed by hand labor, dumped directly into skips and hoisted to surface. Shafts and levels are connected underground and air circulates freely through the workings. No effort is left undone to make the mine safe and secure for taking out the product and a considerable quantity of timber is consumed annually in the work. Ventilation is good and the mine is comfortable for working in. The underground department is opened up and developed on practical lines and the different levels contain substantial ore bodies of distinct values. Product is recovered through the best method for bringing the most satisfactory results. Physically, the mine is in good condition. The mechanical equipment needs strengthening and by doing this, the position of the mine would be improved and bigger and better results may be obtained. Property is well managed and economically operated.

General Manager, C. H. Munger; Superintendent, C. E. Walton; Postoffice address, Wakefield, Michigan.

SUNDAY LAKE MINE.

This mine is located just northeast of the town of Wakefield, in Section 10, Town 47, Range 45, and owns 160 acres of mineral land, adjoining the Brotherton on the northwest. Company mines a Hematite ore running about 60 per cent. iron. The mine has been operated for many years and is credited with having produced since the beginning of operations, 913,154 tons of ore. 1905

product was 79,208 tons. The mine is opened and developed through two working shafts, each 6 feet by 12 feet in dimensions, and two-compartment. Two hundred men are employed and a number of machine drills are operated in opening up the mine and blocking out ore reserves. Shaft connections are effected on different levels and levels in turn are connected by raises or winzes and form quite a network of underground openings that efficiently ventilate the workings and make them cool and airy. In a cool, airy mine, men can always do a good day's work. No reasonable expense is spared in making the mine safe and solid and considerable quantities of timber are consumed annually in this work. And this work must constantly be kept up, or the product will soon stop coming to the surface. The best method is used in taking out the product for bringing the most satisfactory results. All tramming is done by hand labor. Trams dump directly into skips which are hoisted to surface and in turn dumped in ore cars and the load transferred to stockpile. The work is readily and economically done. Operations are conducted on practical lines and the management aims to get out the best there is in the property and in the most business-like way. Results accomplished have been fairly substantial and should be, in the main, satisfactory. Mechanical equipment is in good running order, and includes hoisting plants, an air compressor plant, pumping outfit, workshops conveniently located and supplementary appliances adequate for requirements.

General Manager, C. H. Mungor; Superintendent, C. E. Walton; Postoffice address, Wakefield, Michigan; Mining Captain, B. Trebilcock.

PIKE MINE.

This mine is located in Section 9, Town 47, Range 45, adjoins Chicago property on the east and borders on the Sunday Lake. Company employs 50 men and operates six machine drills. Mine is being developed through one shaft 10 feet by 6 feet in dimensions, two-compartment, and 960 feet deep. Property contains a considerable deposit of ore and has a bright future. The management is conducting development work on practical lines and for better and bigger results. The 1905 product was 11,000 tons. A much larger output will be mined in 1906. Property is well managed and economically operated. Equipment includes hoists, pumps, a six-drill capacity compressor and workshops conveniently located for economical and efficient service.

General Manager, R. D. Pike; Mining Captain, A. S. Johns. Post-office address, Wakefield, Michigan.

MICHIGAN BLAST FURNACES.

Nine large charcoal blast furnaces were operated in Michigan, during the year 1905, making pig iron, and one was under construction. All are well equipped for the work and in first class condition. The largest percentage of iron ore is now shipped east to points along Lake Erie, near the coal fields and where cheap fuel may be had the year round.

Following are the charcoal furnaces operated:

ANTRIM IRON COMPANY.

T. J. O'Brien, President; J. C. Holt, Secretary-Treasurer; N. M. Langdon, Manager.

This Company's furnace is located at Mancelona. Average number men employed during 1905, 200. Tons pig iron produced, 34,597.

BOYNE CITY CHARCOAL IRON COMPANY.

Chas. H. Schaffer, President; Frank B. Baird, Vice President; Noah W. Gray, Secretary-Treasurer; Fred Smith, Manager.

This company employs 50 men the year round and produced in 1905 23,578 tons of pig iron. Postoffice address, Boyne City, Michigan.

ELK RAPIDS IRON COMPANY.

Lincoln Brown, President; E. G. Rust, Vice-President and General Manager; C. D. Towne, Treasurer.

This company employs an average number of about 100 men, and during 1905 produced 27,495 tons pig iron. Postoffice address, Elk Rapids, Michigan.

MANISTIQUE IRON COMPANY.

General Office, Detroit, Michigan; Furnace, Manistique, Michigan; W. H. Nelson, Manager at Furnace.

This furnace was in operation only ten months in 1905. Average number of men employed, 100. Loading kilns, 30. Average number of men in wood camps, 175. Product of pig iron, 25,342 tons.

MICHIGAN IRON COMPANY.

General Office, Detroit. Michigan; Furnace, Newberry, Michigan; E. E. Johnston, Manager.

This company produced 22,815 tons of Lake Superior charcoal pig iron during 1905.

PIONEER IRON COMPANY.

Geo. A. Garretson, President; Wm. G. Mather, Vice-President; Fred A. Morse, Treasurer; E. V. Hale, Secretary; Austin Farrell, Superintendent.

This company operated three furnaces: Marquette Furnace, located at Marquette; Gladstone Furnace, located at Gladstone; Carp Furnace, located at Marquette.

The Marquette Furnace was in operation during 1905, 340 days, and employed on an average 65 men and made 39,710 tons of pig iron.

The Gladstone Furnace was in operation 49 days, employed on an average 62 men, and made 4,779 tons of pig iron.

The Carp Furnace was in operation 191 days, employed on an average 50 men, and made 9,981 tons pig iron.

THE SPRING LAKE IRON COMPANY.

J. C. Ford, President and Treasurer. Postoffice address, Fruitport, Michigan.

The average number of men employed by this company during the year 1905 was 85, and the total production of charcoal pig iron amounted to 26,004 tons.

MITCHELL-DIGGINS IRON COMPANY.

Joseph C. Ford, President; W. W. Mitchell, Vice-President; Ed. Fitzgerald, Secretary; Delos F. Diggins, Treasurer; Postoffice address, Cadillac, Michigan.

This furnace was not completed until March 5, 1906.

RECAPITULATION.

	Tons.
Antrim Iron Co.	34,597
Boyne City Charcoal Iron Co.	23,578
Elk Rapids Iron Company	27,495
Manistique Iron Company	25,342
Michigan Iron Company	22,815
Marquette Furnace	39,710
Gladstone Furnace	4,779
Carp Furnace	9,981
Spring Lake Iron Company	26,004
Total	214,301

COPPER AND THE COPPER INDUSTRY.

Copper ranks next to iron in values among the metals of the United States. In 1905 the value of the copper produced exceeded the combined value of the gold and silver produced in this country. Phenomenal progress has been made in copper mining in the United States during the past few years, and the industry attracts wider attention from day to day. The expansion of the industry has been substantial and continuous and the product of the metal for 1905 was the largest in its history. In many ways, the position of copper and of the copper market has been quite unique during the year. New conditions seems to be springing up with wonderful rapidity. General progress is eclipsing all past records. Though the product of copper last year was the largest ever made, yet the supplies in first hands, both foreign and domestic, at the beginning of 1906 were not, it is believed, more than enough for about six weeks or two months' consumption. The foreign visible supply was reduced to about 12,000 tons and it looks as if this factor would soon disappear from the market. The statistical position of the metal is excellent and about all that could be desired. Foreign consumers have been calling for the prompt shipments of their purchases and a further increase in consumption in European countries is expected. Domestic consumers are doing a tremendous business and using enormous quantities of copper. The consumption going on for electrical purposes by telephones, electric lighting and other companies, is enormous and unprecedented. And there are plans on hand for the electrification of a considerable mileage of steam railroads. These will require large quantities of copper. Then there are no copper combinations or trusts in the world. The metal stands on the legitimate basis of supply and demand. Producers act independently and sell to the firms that pay the best prices, whether they be European, Oriental or American. European requirements continue to be an important factor of the copper industry and consumption across the Atlantic appears to be more than keeping pace with production. Singular as it may seem, China came into our market early in the year and bought up large quantities of copper. This move resulted in materially improving the statistical position of the metal at home. Exports of copper in 1905 were 150,000 tons over and above imports. And since the closing of the Japan-Russian war, the world appears to be consuming more copper at 17 or 18 cents per pound than the mines can supply. This would indicate that industries consuming copper are expanding faster than the producing mines. This condition, however, may not last forever—it is hardly to be expected. In a year or two, this industrial activity may fall off and production again overtake consumption. This seems to be the logic of events and history usually repeats itself. The average price of copper for 1905 was about 15.70 cents per pound. The year was an exceptionally prosperous one for copper

mining and the outlook for the industry was never brighter than at the present time. While official figures have not yet been secured, the estimated product of copper in the United States during 1905 is 871,000,000, as against 817,715,035 for 1904, an increase of approximately 53,284,965 pounds.

Following are the revised figures of the Engineering & Mining Journal on the production and consumption of copper for 1905 in the United States, (in pounds):

State.	1905.	1904.
Alaska	4,703,600	2,043,586
Arizona	222,866,024	191,602,958
California	a13,089,993	29,974,154
Colorado	9,854,176	9,401,943
Idaho	6,500,000	5,422,007
Michigan	218,999,753	208,329,248
Montana	319,179,885	298,314,804
New Mexico	5,638,842	5,368,666
Southern states	14,907,982	15,211,086
Utah	51,950,789	47,062,889
Wyoming	2,393,201	3,565,629
Other states*	1,550,000	1,418,065
Total	871,634,245	817,715,035

**Including Oregon,, Washington, Nevada and South Dakota, (a) Partially estimated, especially mines outside of Shasta county.*

It appears from the above table that the actual increase in copper production in 1905 was only about 6% per cent, over the production in 1904. The domestic consumption of copper, on the other hand, showed a very large increase, the total representing an average of about 51,000,000 pounds per month. The details of the consumption are given in the following table, (in pounds):

Consumption:

	1905.	1904.
Stock, January 1	208,376,672	230,111,792
Production	871,634,245	817,715,035
Imports	210,724,685	182,292,205
Total supply	1,290,735,602	1,230,119,032
Exports	548,772,403	555,638,552
Stock, Dec. 31	128,980,000	208,376,672
Consumption	612,983,199	466,103,808

The stock on hand at the end of 1905 represented chiefly crude copper in transit and in the process of refining. It is estimated on the basis of 6 per cent. of the Lake production and 17 per cent. of the other production (these figures corresponding to the average time required in each case), plus 5,000,000 pounds of refined copper in first hands.

We have collected statistics of the consumption of spelter, by direct reports from the consumers, which indicate that out of a total consumption of about 200,000 tons, about 26 per cent., or 52,000 tons, were used for the manufacture of brass. Incidentally, this gives a rough idea of the consumption of copper for brass-making. If 52,000 tons of spelter were used for that purpose, there must have been at least 104,000 tons of copper for the same purpose. This figure corresponds to about 34 per cent. of the domestic consumption of new copper in 1905.

Estimates of the world's production of copper in 1905 prepared by Aaron Hirsch & Son, of Holburstadt, Germany, are as follows. English Ton.

	1904.	1905.
United States	366,522	397,909
Spain and Portugal	50,000	48,000
Mexico	52,500	60,000
Chile	33,000	33,000
Japan	32,000	28,000
Germany	24,500	25,500
Canada	21,500	24,000
Australia	30,000	35,000
Peru	7,000	8,000
Russia	10,700	11,000
Cape Colony	7,250	9,000
Norway and Sweden	6,000	6,000
Italy	3,250	3,300
Newfoundland	2,000	2,200
Bolivia	2,000	2,000
Austria Hungary, Servia and Bosnia	1,500	1,300
Turkey	1,500	1,300
England, Argentina and others	1,300	1,000
Total	652,522	696,609

From the same source is obtained the following analysis of the United States' output, the figures being in pounds:

	1905.	1904.
Lake Superior	218,000,000	210,000,000
Arizona	231,000,000	191,000,000
Montana	325,000,000	312,000,000
New Mexico	5,000,000	7,000,000
California	21,000,000	27,000,000
Utah	59,000,000	47,000,000

	1905.	1904.
Colorado	10,000,000	5,000,000
Alaska	5,000,000	2,000,000
Wyoming	2,500,000	4,000,000
Idaho and Nevada	1,000,000	2,000,000
Tennessee and South	12,000,000	12,000,000
Other States	2,000,000	2,000,000

LAKE SUPERIOR COPPER PRODUCTION.

Mines.	1901.	1902.	1903.	1904.	1905.
			1901-1905.		
Calumet & Hecla	82,519,676	81,248,739	76,490,869	80,341,019	82,500,000
Osceola	13,723,487	13,416,396	16,059,636	20,472,429	18,938,965
Quincy	20,540,720	18,988,491	18,498,288	18,343,160	18,827,557
Tamarack	18,000,852	15,961,528	15,286,093	14,961,885	15,824,008
Champion		4,165,784	10,564,147	12,212,954	15,707,426
Baltic	2,641,432	6,285,819	10,580,997	12,177,729	14,384,684
Trimountain		5,732,160	9,237,051	10,211,230	10,476,462
Wolverine	4,946,126	6,473,181	9,024,034	9,764,455	9,464,418
Mohawk	160,897	226,824	6,284,327	8,149,515	9,387,614
Atlantic	4,666,880	4,949,366	5,505,598	5,321,859	4,049,731
Franklin	3,757,419	5,237,460	5,309,030	4,771,050	4,206,085
Michigan		166,898	275,708	2,746,127	2,891,796
Isle Royale	2,171,955	3,569,748	3,134,601	2,442,905	2,973,761
Mass	837,297	2,345,805	2,576,447	2,182,931	2,007,950
Adventure	29,361	606,211	2,182,608	1,380,480	1,606,208
Phoenix	93,643		202,823	1,162,201	273,219
Winona		101,188	1,036,944	646,025	
Centennial	806,409			641,294	1,446,584
Ahmeek				376,687	1,552,957
Allouez					1,167,957
Arcadian	714,000	445,000			
Arnold	108,000				
Miscellaneous	50,000	250,000	50,000	50,000	75,000
	155,818,145	170,480,598	192,299,191	208,329,248	217,762,382

DIVIDENDS PAID BY LAKE SUPERIOR COPPER MINES IN OPERATION.

	1905.	1904.	Total amt. paid
Calumet & Hecla	$5,000,000	$4,000,000	$92,350,000
Quincy	550,000	500,000	15,520,000
Tamarack	120,000	90,000	8,870,000
Osceola	384,000	192,300	4,824,200

	1905.	1904.	Total amt. paid
Wolverine	660,000	450,000	2,700,000
Champion	1,000,000	200,000	1,500,000
Baltic	1,250,000	.....	1,250,000
Atlantic	50,000	.....	990,000

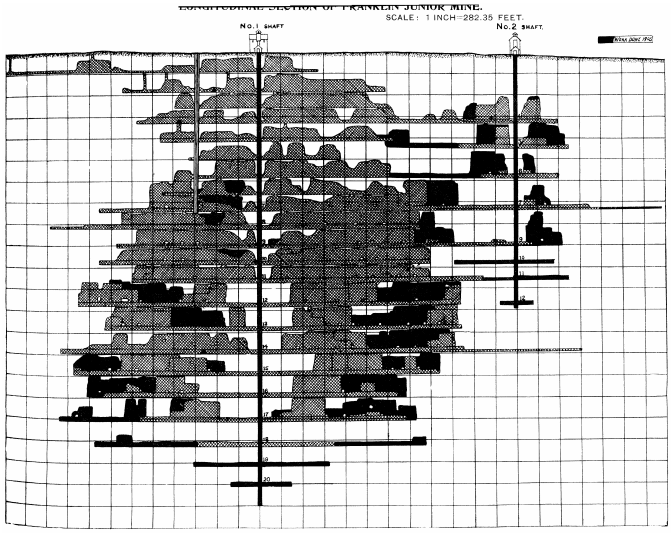
Following are highest, lowest and average prices of copper for a period of twenty years:

Years.	Low.	High.	Average.
1886	10.00	12.⅛	10.95
1887	9.⅞	17.90	11.22
1888	15.90	17.65	16.78
1889	11.00	17.50	13.49
1890	14.00	17.50	15.60
1891	10.25	14.50	12.76
1892	10.50	12.⅜	11.56
1893	9.50	12.50	10.75
1894	9.00	10.25	9.52
1895	9.35	12.25	10.73
1896	9.75	12.00	10.98
1897	10.75	12.00	11.36
1898	11.00	13.25	12.05
1899	13.25	19.⅜	17.76
1900	16.00	17.25	16.65
1901	13.00	17.00	16.72
1902	11.00	13.50	12.16
1903	12.00	15.50	13.70
1904	12.25	15.50	13.27
1905	14.75	20.00	15.70

In 1905 the total number of men employed in and about the mines of Houghton County was 15,255.

LAKE COPPER MINES.

In 1905 the copper mines of Michigan were worked with great vigor and the substantial producers had a prosperous year. There was work for all at good wages and a larger force was employed in and about the mines than ever before. The companies in general have been stretching out for bigger and better results, and progress has been continuous in practically all departments of mining. Additional equipments have been installed; underground reserves enlarged; the methods practiced for taking out the products in some instances modified; the efficiency of stampmills increased by compounding heads and through other changes made in washing copper. Although big wages are paid on the Lakes and supplies bring high prices, yet all the mines are operated with rigid economy and splendid ability. Future requirements are anticipated and provided for well in advance of actual necessities. These are matters that must never be lost sight of, but kept well in the foreground for upon them depend largely the success of Lake Copper Mines. Compared with copper beds worked in any other part of the world, those mined in the Lake Superior district are low grade and poor. Even Calumet & Hecla with its unequaled record for dividends paid, is mining a hard belt that yields but 2¼ per cent. copper of 45 pounds to the ton of rock treated. What other district in the world has a mine earning handsome profits, working a hard lode that yields but 2¼ per cent. copper. As age goes, the mine is old, its shafts deep averaging over 6,000 feet below the surface. The lode runs only about 16 feet wide, which necessitates the opening up of new ground continually, and this the most expensive part of mining. The splendid success achieved only becomes possible by taking out an enormous product with the aid of the best machinery the genius of man can invent and money can buy, combined with a thorough knowledge of the work by the management and working it the best way for bringing the best results. What is true of Calumet & Hecla is practically true of other Lake mines. Franklin and Atlantic rock—The former yields but about three-fourths of one per cent. while that of the latter yields but 0.70 of one per cent. Yet these mines manage to pay their way and make a little money, most of which, however, is put back in the properties for betterments.



WHAT IT MEANS TO PRODUCE AND TREAT A TON OF ROCK.

If the reader would realize, in a faint way, what it means to produce and treat a ton of rock, let him imagine two men standing at the mouth of a great hole sinking away down into the interior of the earth at an angle of 38 degrees for a distance of from a half to a mile and more in depth. A man car that carries about thirty men is being lifted and lowered down this immense hole. They, with others, board it and descend to the level, perhaps 4,000 feet down, to the level or floor leading to their place of work. There, the men get off and proceed to the workings. They begin the work by rigging up machine drills, perhaps 60 or 70 feet up in the backs above the main floor, and bore holes in the solid rock. When finished, drills and tools are removed to places of safety, the holes charged, exploded and the burden of the rock is broken away. Often the burden conies down in rocks too large to be handled and must be broken smaller. The broken rock is then loaded into tram cars which are pushed to the shaft, emptied into skips, hoisted to surface and dumped in the rockhouse. Rock here is manipulated, the poor picked out and discarded, the profitable run into bins and in turn run into rock cars and hauled to stampmills, six or seven miles distant. In the mill, the rock is pulverized by a powerful stamp-head striking over a hundred blows a minute and crushing every twenty-four hours, 600 or 700 tons of hard rock as fine as sand. The pulverized stuff is put through many processes and in the work of separating the copper from the waste, about thirty tons of water is used for each ton treated. The result of all this work is about twenty-three or twenty-four pounds of concentrates or mineral. This mineral is then hauled to the smelting works, refined and made into ingots, cakes and bars. The product is now ready for the market and is shipped to New York and sold. All this is done for about $1.50 per ton of rock treated, and here no allowance has been made for timber men, timber used, engineers employed, foremen, machinists, fuel consumed and many other factories that contribute to the production and manipulation of a ton of copper rock. As before remarked, the results obtained in Michigan copper mines become possible only by mining big products with the aid of the best machinery and excellent management.

Although Lake mines had a prosperous year in 1905, aside from Calumet & Hecla, profits, in view of the capital invested and the risk run, were only moderate after all. With some, it is nothing but a struggle for existence and the hope of encountering a profitable lode by continuing the work and never a penny returned to the stockholders, while millions of money has been sunk never to be recovered.

HOUGHTON COUNTY MINES.

QUINCY MINE.

This mine is picturesquely situated, just over the brow of the Quincy Hill, about a mile from the shore of Portage Lake. Portage Lake is connected with Lake Superior, and forms the main waterway of the North and South Range mines of the Copper district. Quincy Hill is named after the mine, and rises to an elevation of 550 feet. Dwelling houses on the south end of the Quincy location form a part of the City of Hancock, one of the prettiest places in the Upper Peninsula of this State. Quincy Mine forms one of the principal supports of the city, and stands in high esteem with the people.

Realty holdings of the Company comprises some 29,000 acres of mineral, timber and other lands of distinctive values. The mine has been in continual and successful operation for upwards of half a century, and contributed to the world's wealth more than $50,000,000 worth of copper. In point of production and amount of dividends paid, the mine ranks next to Calumet & Hecla, having produced, since the beginning of operations 356,283,149 pounds of copper, and paid seventy-four dividends aggregating $15,220,000. No amygdaloid mine has a better record. In the natural course of developments, between $30,000,000 and $40,000,000 has been spent in operating, developing and mechanical construction. For forty years, I have lived not more than a dozen miles from the mine location, and witnessed its growth, which has been continuous and substantial. I have seen the shares sell for less than $2.00 each on the present capitalization and over $140.00. I well remember the time when it was a much harder task to produce 100 tons of copper a month than it is now to produce 1,200 tons.

Ten years ago, the amount of rock stamped was 495,402 tons. In 1905, the amount stamped was 1,135,162 tons or more than twice the quantity and this in spite of the fact that the workings are much deeper and the lode narrower. The mine is in fine physical form and run in the interest of the stockholders. Every department of the plant is running to perfection. Management aims to get out the best there is in the property and the results accomplished should be

considered satisfactory. From time to time, big sums of money have been spent in the purchase of additional lands, developing fresh ground reserves and adding to the equipment. Expenditures were well placed and resulted in materially strengthening its position as a producer of copper and in reducing operating costs. When the limit may be reached, the capacity of the mine and the efficiency of the plant brought up to the point aimed for by the management, must be judged by the results of the past. But the mine is old, the workings getting deeper and operating costs increase as depth is attained. Shafts are over a mile deep, the lode much leaner in copper contents than formerly and the quantity of mass copper is not so large as in previous years. Product of mineral in 1905 was 29,422,000 pounds, which yielded 18,827,557 pounds refined copper.

The company is mining the Pewabic lode and a parallel belt known as the West Branch. Pewabic lode forms the main source of production and runs from three to eighteen feet in width. West branch is a narrow, pockety belt with product running to mass and barrel copper. The yield of refined copper per ton of rock treated in 1904 was eighteen pounds, as against an average of about twenty-nine pounds in 1895. Quincy mine is opened and operated through five working shafts ranged along on the strike like of the outcrop for over a mile in length and numbered 2, 4, 6, 7, and 8. All five shafts are connected at different levels underground. Ventilation is very good and especially so for such a deep mine. It is comparatively comfortable for working in. Developments are conducted on an enormous scale. Underground workings from one end of the mine to the other are over two miles in length. Large reserves are opened up ahead on different levels, so that men breaking down the lode can be distributed to the best advantage. In the deepest and most extended openings, the lode looks vigorous and contains the usual grades of copper belonging to the formation. The lode is extracted on the regular stoping system typical to the district, with modifications proved by experiments to be admirably adapted for the work. Both walls are good and the hanging stands up without being supported by heavy timber. Dry walls built of waste rock take the place of stull timbers, and but little of it is consumed in taking out the product. There are 2,000 names on the payroll and no reasonable expense is spared in making every department of the mine safe for working in. One hundred and fifty power drills are operated and the daily output of rock is now about 3,700 tons, and capacity of air compressor plants is about 225 drills. Underground tramming is done by an electric haulage system installed in 1901. The Quincy was the first mine to introduce this power for underground use in the copper district. It works admirably and is a decided improvement over hard labor and much more economical. Trams dump into pockets formed in the hanging wall at shafts. Skips are filled from pockets by lowering aprons operated by levers. No time is lost by trammers in waiting with loaded cars. The work is done easily and quickly. Skips scarcely touch the gates before they are hoisted again. That means something to a deep mine where a large product must be sent up. The work of loading, conveying, dumping cars and sending up skips is skillfully performed. All five shafts of the Quincy are large, in good condition and capable of conveying an enormous rock output. Numbers 2, 4 and 7 range from north to south and lift the rock from the old Quincy workings. Number 6, north of No. 2, is but 200 feet from the Franklin boundary line and sunk in what was formerly the Pewabic mine. Number 8 is the northernmost shaft, sunk in the Mesnard territory and designed to raise the output from that quarter. Mesnard is practically a new mine and has a fine plant. Underground working openings are extensive, and show up a strong lode containing profitable values. Each shaft has a separate plant of great power and high efficiency. Hoists are of direct action with large winding drums that raise with great speed skips counterbalancing in shafts carrying from six to eight tons to a trip. Sips dump automatically on to grizzles. Fine stuff passes directly through grizzles to rock bins; the coarse rock moves by gravity down shutes through crushers into bins. The product of rock is then ready for the stampmill. Manipulation of rock is dispatched rapidly and economically. Rockhouses are substantially constructed and equipped with powerful crushers and trip hammers especially designed for the work. The machinery equipment is actuated with steam power. Power houses and workshops are constructed with stone, trimmed with sandstone and look well. Workshops are equipped with modern tools and fittings and can turn out practically any kind of work. The whole plant is very complete and of the best that is going. Mine location has a very neat appearance, is provided with a large number of comfortable dwellings for employees and lighted by means of electricity. Stampmills are located at Torch Lake, about four miles distant, where the Company has a large lake frontage with sand room for practically all time and water the year round. The Company also has a smelting plant and does its own smelting and refining and a moderate amount of custom work. The stampmills are connected with the mine, by the Quincy & Torch Lake Railway, which was built and equipped by the company and does all the hauling for the various works of the mine. Quincy stampmills are spacious, airy structures, well lighted and equipped with eight powerful heads, that in turn are fitted with the best machinery known for washing and saving copper. Works are about as automatic as they very well can be and all appliances are modern. Water for concentrating purposes is pumped from the lake by huge pumps of enormous capacity. The plant is very complete.

James W. Shields is mill superintendent.

The Quincy company's equipment is very complete and in every particular is running to perfection, and the mine is in fine physical condition and good for many more years of successful operation.

President, Wm. R. Todd; Vice-President, Walter P. Bliss; Secretary-Treasurer, W. A. O. Paull; Superintendent,

Chas. L. Lawton; Chief Clerk, F. J. McLain; Head Mining Captain, Thos. Whittle; Chas. Kendall, Assistant Mining Captain, North Quincy; Geo. Jacobs, Assistant Mining Captain, South Quincy.

FRANKLIN MINING COMPANY.

The property of this company includes two separate and distinct mines, Old Franklin and Franklin Jr. Old Franklin is among the oldest producing mines in the district and has perhaps, been in active operation for more years than any other mine in the entire copper region. The mine was opened in 1857, and barring a short period around 1868, has been in continuous operation ever since. It has been a wonderful property and a surprise to everybody. Its tract of land is relatively small, being but 160 acres, yet a considerable rock output has been coming out of the workings daily—Sundays excepted—for nearly half a century. And the end is not yet. The end of each month finds about 100 tons high grade mineral to its credit. Where it comes from month after month is a mystery, but it comes. Product now comes from the old workings on the upper levels passed up years ago supposed to have been exhausted. Mine is operated through two shafts, Numbers 3 and 5.

Franklin mine is situated about a mile north of the City of Hancock, adjoins the Quincy mine on the north, and mines the northern continuation of the Pewabic amygdaloid, which is the same formation the Quincy works. Lands lie in Section 24, Town 55, Range 34.

Company is capitalized at $2,500,000 in 100,000 shares, par value $25 each. Total assessments levied, $220,000, and dividends paid, $1,240,000. All told, there are 551 men employed and 45 machine drills operated. Rock stamped in 1905 was 374,130 tons, producing 8,375,290 pounds mineral and 4,206,085 pounds refined copper.

Franklin Jr. is now looked upon as the mainstay of the Company. It was purchased with the hope that it would result in stretching out the life of the corporation, and if the change for the better in the conglomerate which set in a short time ago holds out in depth and for a few thousand feet in extent laterally, then ultimate results should show that the management made no mistake in making the purchase. The property is located about 2% miles north of Franklin and looks like an ideal spot for a mine. It is large and carries the Pewabic and Kearsarge amygdaloid beds besides the Allouez conglomerate, which the company mines. Mineral lands consists of 1,199 acres and lies in Town 55, Range 33, adjoining Rhode Island on the south and the Arcadian on the north. Company also owns an extensive acreage of timber and other lands. The mine is developed through two shafts numbered from north to south, sunk in the lode. Number 1 is down to the 21st level and sinking to the 22nd, Number 2 to the 12th and underway to the 13th. Shafts have double skipways and are connected underground. Air circulates freely through the workings, making them fairly comfortable for all doing under ground work. The lode is wide and big breaking, but hard and low grade, yielding in the past only about 14 pounds of copper to the ton of rock treated. Rigid economy must be and is practiced to make both ends meet. Big sums of money have been spent in exploring and developing the property, but thus far, never a dollar paid back in dividends. It must be a long lane, however, that has no turning, and better things now seem to be ahead for the company. Mr. R. M. Edwards, its new superintendent, has introduced changes and innovations that have resulted in reducing operating costs, and strengthening the position of the property. A little seems to be saved almost everywhere and "many a mickle makes a muckle," and decided improvement took place in the character and copper bearing qualities of the lode in the last couple hundred feet sunk.

I was at the mine a short time ago and saw excellent rock that had just come out of the mine, and Superintendent Edwards told me it was not the best they had—but it was good enough, and it bore the characteristics of stability. The improvement came in at the 19th level and continued to the 21st, the deepest point penetrated at the present writing. The vein rock was charged with heavy copper and had a healthy look. The improvement was reflected in the January product, 445 tons mineral, the largest monthly product made in the history of the company. I rather think the improvement will hold and continue. At any rate, they now have it 200 feet deep, over 200 feet long and eight feet wide.

Surface equipment is adequate for present requirements, but will need strengthening from time to time in the natural course of developments. The product is taken out in the best methods adapted for the mine, and conies from various stopes scattered through the underground workings. Where practical, drifts are extended to the boundary and stoped hack to shaft. Drift stopes are driven about 12 feet high carrying the full width of pay ground. From end to end mine openings are fully 3,000 feet long or more in length, and contain large reserves of ground carrying average values.

The underground department is in good physical condition and shows a steady improvement. Mine is ably managed, and promises to do better in the future than it has in the past. The management succeeded in locating the Kearsarge amygdaloid bed with diamond drill. Rock cores showed some copper. A cross-cut is now being driven from the conglomerate workings to test its values.

The company's stamp mill is located about six miles from the mine at Grosse Pointe on the shore of Lake Superior. Site is an excellent one with an abundant supply of water the year round. Mill is modern and equipped with four powerful heads and supplementary fittings of the best for washing and dressing copper. The mill is in good condition, practically new, and runs very satisfactory. Rock is hauled by the Mineral Range

Railroad Company. The mine locations are well provided with comfortable dwellings for the employees.

ASSETS AND LIABILITIES—December 31, 1905.

ASSETS.

Cash on hand in bank	$77,128.45	
Accounts receivable and copper on hand	40,080.38	
Supplies at mine	93,327.23	$210,536.06

LIABILITIES.

Liabilities at mine	$80,940.98	
Drafts outstanding	16,012.09	
Accounts and bills payable	5,183.86	$102,136.93
Balance assets December 31, 1905		$108,399.13

President, Francis H. Raymond; Secretary-Treasurer, Daniel L. Demmon; Superintendent, R. M. Edwards; Clerk, Arno Jaehnig.

OSCEOLA CONSOLIDATED.

Osceola is a great property with a memorable record and not many mines in the entire copper district are better known or stand in higher esteem with people living in Houghton County. For years, the management has been bending its energies toward strengthening the position of the property and increasing its producing capacity. The success achieved has been substantial and may be readily appreciated by comparing the following statement showing the annual rock outputs, copper produced and profits made during the past four years:

	1902.	1903.	1904.	1905.
Tons rock treated	836,400	924,400	1,095,520	1,007,200
Pounds copper produced	13,416,396	16,059,636	20,472,459	18,938,965
Net profit	$15,172.80	$453,735.45	$662,819.77	$938,746.07
Balance	*$226,025.82	$131,599.63	$505,929.40	$867,775.47

* Deficit.

The comparison presents upon the whole a healthy growth and a satisfactory state of affairs. The 1905 output of rock and product of copper would have exceeded that of 1904 only for an explosion that occurred in the Kearsarge mine and a strike among the trammers. Though the expansion and stretching out for bigger and better results have been substantial, there are still better things ahead for the property, as the coming years will abundantly testify. In the course of developments, big sums of money have been spent in sinking shafts, extending levels, developing fresh reserves of ground and in strengthening the equipment. The management aims to get out of the property the very best there is in it. Changes in methods of operation, fundamental and far reaching are underway and planned that will result in increasing the capacity of the property and in reducing the operating costs. The management plans to extend drifts to the boundary wherever practicable and stope back to shaft and leave the waste underground for filling-in purposes, besides instituting other innovations.

Osceola Consolidated embraces three active mines and a defunct one: Old Osceola, South Kearsarge, North Kearsarge and Tamarack Jr. Tamarack Jr. is idle.

Average yield of copper when selected per ton of rock treated is about eighteen pounds. Old Osceola adjoins the Calumet & Hecla mine in the south with 720 acres mineral land carrying the Calumet conglomerate and the Osceola amygdaloid in which the mine is sunk. The Old Osceola employs an average of 643 men; operates 42 machine drills and hoists about 28,000 tons of rock per month. The lode is about fourteen feet wide and irregular in trend and characteristics. Mineral makes in bunches and the mine is deep and old. Operating expenses increase with depth, but improved methods for taking out the product have recently been introduced and put in force that will soon begin to reflect in the cost sheet, if it does not already show them. The mine is operated through two shafts, Numbers 5 and 6, located about 1,300 feet apart. Both are three-compartment and opened up ahead with substantial ground reserves carrying the average values of the lode. Shafts are connected and also with the old workings and ventilation is first-rate. Deepest openings look as well as any part of the mine. Hangings hold up quite well without supporting timbers and the workings are comfortable for working in. The old mine looks as well now as it has in many years and promises just as much for the future. It is in quite a prosperous condition and good physical form. Surface equipment is powerful, in good running order and efficient, but may need some strengthening in spots and changing about. Each shaft has a separate hoisting plant good for 6,000 feet, operating counter-balancing skips carrying four tons to a trip. Machinery and power buildings are of stone trimmed with brick and make a good appearance. Pervious to the reorganization of the company in 1897, Old Osceola paid $2,172,500 in dividends. Hugh James, Mining Captain.

South Kearsarge is located about two miles northeast of the Old Osceola and joins Wolverine on the south with 160 acres of land. Three hundred and ninety-eight men are employed, and 42 machine drills are operated. Mine is working the Kearsarge lode through two shafts, Numbers 1 and 2, about 1,100 feet apart, sunk at an angle of 39 degrees from vertical. Both shafts are three-compartment operating four-ton skips counter-balancing in shafts and lift about 1,300 tons rock daily. Average depth of shafts is 1,800 feet. The lode averages 14 feet wide, and produces a good grade of rock yielding over twenty pounds to the ton stamped. Though the lode is bunchy in this branch it is more uniform than in the North Kearsarge and yields higher values. Shafts are going down and levels extending in new ground in accordance with the policy of the management and the usual reserves maintained throughout the mine. Deepest openings in the lode look as well as any part of the mine and carry the usual grades of copper. Shafts are connected in different levels and the underground workings well ventilated. Each shaft is equipped with a separate hoisting plant capable of doing the work of the mine satisfactorily. Surface equipment is adequate for requirements. Frank Landers, Mining Captain.

KEARSARGE.

Kearsarge is separated from South Kearsarge by the Wolverine mine which it adjoins on the north and the Allouez and Ahmeek on the south. Lands consist of 1,120 acres, admirably located and carries the Kearsarge lode in which the mine is opened for over a mile in length. The lode developed on this property is very bunchy and irregular with the best values occurring in patches. The late Captain John Daniel! used to liken it to a "knotted thread," with the copper making in pockets. The tendency of the lode is to improve with depth. Operations are carried on through two main shafts, three-compartment, sunk in the lode on its plane, of 1,800 feet apart. Number 1 is about 3,000 feet deep and Number 3 2,718 feet deep and connected by various levels. Levels in turn are connected by winzes and raises that make free circulation of air and a comfortable mine for working in. Workings are developed on broad practical lines and contain an immense amount of opened ground carrying values about the average of the mine. The lode averages about fourteen feet. From end to end, the openings are over 3,000 feet in length. Extreme points penetrated look as well as any workings in the mine. The mine employs about 570 men, operates 62 machine drills and produces nearly 2,000 tons of rock daily. There is ample territory north of Number 3 for another shaft, and plans have been considered for sinking one there. This branch of the company's property has an encouraging outlook and better things are predicted for it. The surface equipment is very complete, practically new, up-to-date, highly efficient and adequate for requirements. The mine buildings are substantial, conveniently located and equipped with the best tools and machinery for doing mine work. The property is ably managed and economically operated. Each branch of the property is well provided with comfortable dwellings for employes.

Joseph Biscombe, Mining Captain.

The company's stampmills are located on the shores of Torch Lake, about six miles from the mine. The site is a good one with an abundance of water the year round. Mine and mills are connected by the Hancock and Calumet Railroad, in which the company holds an interest. It hauls all of the rock produced by the Bigelow Syndicate of Mines. The mills are of the best and excellently appointed; are practically automatic and have a capacity for treating about 4,000 tons of rock daily. They are equipped with seven heads of the Nordberg type, which in turn are fitted with the best machinery known for washing and dressing copper. One head is used for crushing and treating Ahmeek rock. The machinery is actuated by steam power furnished by a boiler plant located in the adjoining building. The mills are very complete and in good running order.

From earnings of 1905, the Company paid two dividends, $2 and $4 per share, respectively. Total dividends paid to date, $5,208,800.00.

President, Albert S. Bigelow; Secretary-Treasurer, W. J. Ladd; General Manager, Norman W. Haire; Superintendent, Will J. Uren; Assistant Superintendent, Frank H. Haller; Clerk, William Veale; Mining Captain, Probis Richards.

CALUMET AND HECLA MINE.

The Calumet and Hecla is the greatest copper producer in the Lake Superior District, and one of the most remarkable and best known mines in the world. Its copper ground reserves are very large and will hold out for many years at the present rate of production. No mine has a better record and its fame has extended to all quarters of the globe. In the last fiscal year the company paid $4,500,000 in dividends and has distributed to stockholders from the beginning of operations to the close of last year, 92,250,000, or 37 times its capitalization. Moreover, the company spent vast sums of money in opening up, developing and equipping the property. Its splendid equipment includes what was considered, when provided, to be the best for the company's requirements that money could buy, and no reasonable expense was spared in making it powerful, efficient and economical. Parts of it may need some modernizing as the bulk of it was installed many years ago and work to that end is going forward constantly. The management is considered as good as there is in the land and the company enjoys a high credit. About four and one-half years ago, Mr. James MacNaughton was appointed superintendent of the property, and later, General Manager. The success achieved during his administration amply proves that the appointment was a good one. So fundamental and reaching have been the improvements instituted in practically every department of the mine workings that the cost of mining, it is believed, has been reduced as much as a dollar per ton of rock treated. And there are still better things ahead. All the improvements underway and planned have not yet been completed. When it is borne in mind that the company mines about 2,000,000 tons of rock a year, some idea may be formed regarding the effectiveness of the changes made. Order and system prevails in every department, kept well in the foreground, and the general business of the company is discharged with dispatch and practically exacting knowledge. The mine has been vigorously and continuously operated since 1866 and during its natural period produced upwards of 1,800,000,000 pounds of as good a brand of copper as there is made. Besides, the company has reclaimed a goodly portion of the wilderness and built thereon, one of the finest mine locations of which there is any record. In producing this enormous amount of copper something like 35,000,000 or 40,000,000 of tons of rock must have been mined and treated. When it is remembered that every ton represents twelve cubic feet, a faint idea may be realized regarding the vast inroads that must have been wrought in the company's mineralized conglomerate belt. Still in spite of such gigantic results, the management has

succeeded in maintaining the usual amount of ground reserves and even adding a little to them from year to year. Moreover, the earning power of the company, applicable for dividends, were never greater than at the present time.

A three-years comparison follows:

ASSETS.

	1905.	1904.	1903.
Cash and copper	$6,444,180	$6,070,918	$6,118,435
Notes and Bills Receivable	590,212	451,521	509,584
Ins. Fund	938,025	763,899	606,859
Totals	$8,172,417	$7,286,338	$7,234,878

LIABILITIES.

	1905.	1904.	1903.
Drafts and Bills Payable	$ 425,228	$ 373,299	$ 373,681
Mach. contracts	603,000	330,000	304,175
Surplus	7,144,189	6,583,039	6,557,023
Totals	$8,172,417	$7,286,338	$7,234,878

The product of fine copper for the fiscal year was 82,500,000 pounds.

The Calumet and Hecla Mining Company formerly consisted of two properties—the Calumet mine and the Hecla mine. Before the mines began to pay dividends, assessments aggregating $800,000.00 were levied on the stock. Hecla paid its first dividend of $5 per share in December, 1869, and Calumet in August, 1870. The companies were consolidated in May, 1871, with a capital of $1,000,000 in 40,000 shares, par value, $25. In 1879, the capital stock was increased to $2,500,000 and the number of shares to 100,000, par value $25 each.

B The company's main tract of mineral land, and in which the great SJLjue is opened, consists of about 2,700 acres, situated in Town 56 North, Sfemge 33 West, and about twelve miles north of Houghton, the county

The company’s main tract of mineral land, in which the great mine is opened, consists of about 2,700 cares, situated in Town 56 North, Range 33 West, and about twelve miles north of Houghton, the county seat of Houghton County. Name of mine location is Calumet and has a population of about 30,000, and includes people from nearly every quarter of the globe. Location is laid out with wide streets and avenues and many of the substantial mine buildings and neat residences, with well-kept lawns and cultivated gardens, would be features of attraction almost anywhere. The company owns about eight hundred comfortable dwellings rented to employees on very moderate terms. Employees own about 1,000 homes built on company ground for which a nominal ground rent is charged. They are worth of a place in almost any town.

The company has ever been liberal to its employees and provided practically every convenience and privilege essential to their happiness and comfort, physically, intellectually and morally. There are nineteen school buildings on the company's lands with about 6,000 children enrolled and 159 teachers. The company has one of the best equipped hospitals in the state for the use of its employees, also a handsome public library, and a fine building for the use of the military company and entertainments. Thirty churches, of different denominations, to say nothing of other massive structures, are on the company's lands. The library is provided with over 23,000 volumes, a variety of the leading magazines of the day, besides daily newspapers. The number of works circulated during the year ending September, 1905, was 114,156, and the attendance in the reading room 47,569. The attendance and circulation show that the institution is highly appreciated.

GREATER CALUMET AND HECLA.

For many years the Calumet and Hecla confined its mining operations exclusively to the famous conglomerate belt; and from this wonderful deposit came all the dividends distributed to stockholders and the revenues for developing the property, or very nearly all. Some time ago, however, the management started development work on the Osceola and Kearsarge amygdaloid belts on its main tract at Calumet. More recently, the company succeeded in purchasing the Delaware, the Central and other mining properties located in Keweenaw County. The lands are well situated in the mineral belt and covered quite extensively with heavy growth of timber. For many years these properties had been known to carry copper bearing lodes, as considerable work had been done on them but previous to the advent of modern mining. Last summer the company put a force of men to work opening up a lode there known as the Montreal River lode and developments proved so satisfactory and promising that the Calumet and Hecla people organized two separate companies—the Manitou and the Frontenac—for systematically developing that formation and perhaps the Kearsarge, which underlies the property, but outcropping some distance further south. A shaft has been sunk in the belt 100 feet deep and it shows good values and characteristics that denote stability. The entrance of the Calumet & Hecla interests in “Old Keweenaw” will mean a great deal for that once famous camp. Each company is capitalized at $500,000 divided into 20,000 shares, par value $25 each. Furthermore, in October last the company purchased a controlling interest in the superior Mining Company located south of Portage Lake on the South Range and adjoining the Atlantic and Isle Royale mining properties. This property is large and carries a long stretch of the Baltic lode. A shaft has been sunk into the lode 170 feet, and two drafts driven in the formation for some 200 feet ore more each side of the shaft. The lode is from fifteen to forty-five feet wide and shows good values distributed from foot to hanging. The results have been quite satisfactory and afford substantial reasons for believing that a large valuable mine will be developed. I was underground there a month or two ago. These newly acquired properties will be under the direct supervision of Mr. James MacNaughton, the general manager, which

means that they will be opened to the best advantage. These additions are substantial, very valuable and materially strengthens the position of the company in the district besides adding to its prestige.

MAIN WORKINGS.

The main workings of the company are at Calumet and there are 5,000 names on the pay-roll. There, the Calumet conglomerate is vigorously worked, the Osceola amygdaloid moderately so, and the Kearsarge amygdaloid undergoing development. The Calumet conglomerate is a unique deposit and richer in copper contents than any other belt mined in the Lake district. It is made up of sand, pebbles, boulders and copper cemented together. In some primeval age, it was a sea beach or the bed of a vast body of water. In the deepest openings of the Calumet and Hecla or Tamarack, from one to two miles below the earth's surface, pebbles and boulders, worn as smooth and rounded as those on the shores of Lake Superior, are found and apparently identical with them. Copper fills the interstices that once existed between the boulders and pebbles and comes out in every conceivable form and shape. In some instances where the pebbles forming the lode are fine and small, the copper is formed infinitely more beautiful and delicate than the richest and finest piece of lace work. Occasionally, copper boulders are found, generally on the footwall side, varying from the size of a man's head to that of a goose egg. Many are formed almost solidly of pure copper while others are simply copper shells enclosing decomposed porphyry. The conglomerate dips to the northwest at an angle of 37½ degrees from horizontal. It averages about 14 feet wide and yields from 45 to 50 pounds of copper to the ton treated. It is mined through nine active shafts—eight incline, sunk the lode, and one vertical—the Red Jacket shaft. For convenience, the workings are divided into four branches: Calumet branch, Hecla Branch, South Hecla branch, and Red Jacket shaft branch. Each branch is quite a complete mine in itself. Mr. J. B. Risque is head mining captain. South Hecla embraces shafts Nos. 11, 10 and 9—a double one—and 8, and takes in the complete south end of the conglomerate carrying copper in paying quantities. No. 11 is the southernmost one in commission. Reserves of ground tributary to it are limited, but No. 10 and No. 8 are fine deep shafts with large reserves yielding the usual values belonging to that quarter. Hecla branch includes shafts numbered 7, 6, 3 and 2 Hecla. This branch is in the heart of the rich deposit and has always been an important producer. From these shafts, millions of dollars' worth of copper have been mined and they still continue to yield the usual quota of the mine product.

Calumet branch joins Hecla on the north. The extreme north end of the conglomerate carrying profitable values, includes shafts Nos. 2, 4, 5 and 6—5 and 6 are double shafts, and are, perhaps, in importance and in value next to Red Jacket shaft. Reserves of ground tributary to these shafts are very extensive and contain copper values fully as good as the average of the mine. Number 4 is the deepest incline shaft in the world, being bottomed 8,100 feet deep on the dip of the lode below the earth's surface. Number 5, with two compartments, is the northernmost shaft on the conglomerate workings. Red Jacket shaft has six compartments. It is vertical and located directly west of the Calumet branch. All the lode mined in this quarter below the 56th level is hoisted through Red Jacket shaft; all mined above the 56th level is hoisted through the incline shafts. The average depth of the shafts is about 6,000 feet on the plane of the lode. All are connected underground and the openings from end to end are dry and comfortable for working in. Air circulation is as good as it is possible to make it in a great deep mine, and every means Is taken advantage of to make the place safe and secure. Total length of the conglomerate on its strike, contained in the company's property, is 13,000 feet, and the total length of openings underground approximates 10,000 feet. The underground openings form a vast net-work of subterranean passages reaching out in practically all directions, and if footed together would aggregate as much as 300 miles. The hanging wall is jointy, heavy and treacherous and unless strong sticks of timber are placed against it at spaces of but a few feet apart great slabs of rock fall down and bury everything underneath. To hold the hanging up and keep the workings safe while the lode is being extracted, about 20,000,000 feet of timber is consumed annually. Gangs of men are continuously at work all over the mine taking out old timber and putting new in its place and doing repair work. And if the copper is to be taken out, this work must be ever kept up. There is no other way out of it.

The lode is extracted on the back stoping system typical of the region, with modifications. By actual experiments it has been proved to give better results than any other method that has been given a trial and it seems well adapted for the conglomerate. Shafts are sunk in the lode and timbered with exceptionally strong dividings and end pieces with stations fixed every 100 feet apart in depth. Levels 8x8 are driven from shaft to shaft and connected or to the end of copper courses to be worked away. Arches of ground, 75 feet long and reaching to levels above are left standing at both ends of each shaft to prevent the walls from closing in. After the vein has been mined away by cutting-out stopes, raise stopes are started about midway between shafts or some advantageous point and run up to the level above or as high as desired. Backs are then broken down by swing and wing stopes. Walls are kept up and lode commanded by either stull timbers covered with cedar poles and spiked or with square sets known as the Western System of timbering. Both systems are in vogue. The broken vein rock is trammed to shaft and dumped in skips by hand labor. Tramming rock in the Calumet and Hecla, however, will soon be done with electric motors. Wm. Weir is Mining Captain at South Hecla, Wm. Daniels, Hecla; Jno. Opie, Calumet.

SURFACE EQUIPMENT.

Each shaft has a separate rock-house built on practically the same plans except that for Red Jacket shaft. Skips carry from five to 7½ tons and dump automatically on grizzles; the fine stuff passes through to the rock bins while the coarse rolls by gravity into the jaws of powerful rock-crushers, which reduces it to proper size for stampmill. The Company has its own rolling stock consisting of fifteen locomotives varying in weight from 27 to 90 tons. Also a large number of rock cars, and does its own hauling. The rolling stock is powerful, designed by the management especially for doing the work of the mine, which consists of heavy hauling. All the working parts of the property are connected by the Hecla and Torch Lake Railroad, also owned by the company. Mr. Will A. Childs, who has been with the company for many years, has charge of the work. Machinery plant is not only powerful and efficient and complete in practically every particular, but handsome to look upon, and proves a great attraction to visitors from other mining fields. Powerhouses and machinery buildings are massive and spacious and built of mine rock or brick and look well. Rock is lifted out of the mine workings by eleven powerful hoisting engines varying in capacity from 1,000 to 3,000 horsepower located at convenient points for high duty. Men and supplies are lowered into and lifted out of the mine workings by nine hoisting engines especially designed for that kind of work. Air compressors operating power drills, underground hoist, pumps, etc., have an aggregate capacity of 10,000 horsepower. All told, the company operates on an average about 260 power drills and have an air compressing capacity to operate as many more. Two Westinghouse engines—sizes 23 and 40x20, run the electric plant, which lights the location and mine buildings.

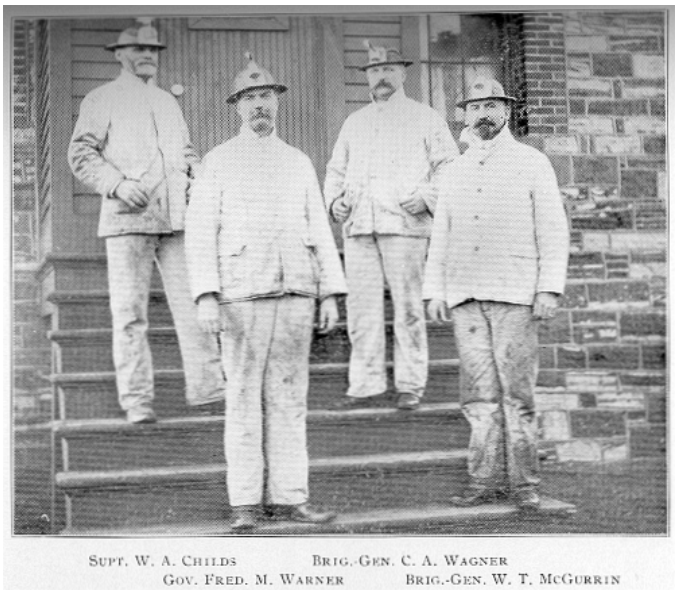
RED JACKET SHAFT.

In mining and engineering, this shaft is one of the wonders of the world, and, including plant and equipment, represents more money, perhaps, than any other similar works in existence. It is vertical, one of the largest and deepest shafts in the world, being 24½ by 14½ feet within timbers; six-compartment, and 4,900 feet deep. It is an admirable piece of work, built solidly with brick and cement from collar well down into the settled rock and below that point, substantially timbered with only the best Georgia pine. Practically everything science and skill could provide was worked in to make it safe and perfect in every particular. Two compartments are used for hoisting rock with Kimberly skips in service carrying from seven to eight tons of rock to a trip; two compartments for hoisting water, and two for lowering and raising men and supplies in and out the workings. Kimberly skips are a new innovation in this district. They were introduced by the present management, and are in use only in the Red Jacket shaft. They run smoothly, dump automatically and are a decided improvement over the car and cage system formerly in use there, and much more economically operated. The vein in this shaft was intersected at a depth of 3,260 feet below surface. Above and below the point of intersection, the vein is reached by crosscuts driven from the shaft. First crosscut is 2,106 feet below the surface; second, 2,296 feet; third is 2,486 feet, etc. In all, there are 28 crosscuts or levels connecting the workings in the vein with the shaft. In the bottom of the shaft the thermometer registers 87.6 degrees Fahrenheit. The Red Jacket shaft and No. 4 shaft Calumet, connect on the 56th level. Reserves of ground tributary to these shafts are very extensive and contain the usual values of the Calumet conglomerate. Daily output of rock is about 1,200 tons. Output, however, may be materially increased when desired.

A notable feature connected with the Red Jacket shaft is a new slope shaft, started on the 57th level 3,400 feet vertically and is sinking for the purpose of taking out the vein in the five forties of land located between North Tamarack, Tamarack Junior and also east of the Tamarack Junior. Its collar is 2,800 feet north of No. 4 shaft. It was started in the footwall about twenty-five feet from the vein and running parallel with the vein, and sinking northward at an angle of twenty-two degrees. It may possibly reach an enclosed depth, from collar, of 5,000 feet. Cross-cuts are driven to the vein at every 60 feet vertical, which makes the levels 100 feet apart in the vein. Four cross-cuts are driven to the vein at every 60 feet vertical, which makes the levels 100 feet apart in the vein. Four crosscuts are driven; 58th, 59th, 60th and 61st. Broken vein is loaded in sort of tramcars, constructed for the work and hauled, without unloading on the way, to Red Jacket shaft and dumped directly into bins. From the bins, it is run into Kimberly skips and hoisted to surface. Thus the rock is handled but once underground, although it is hauled through an incline shaft, conveyed over a long cross-cut and hoisted to surface through one of the deepest vertical shafts in the world. It is a remarkable undertaking, but that it will prove decidedly successful, there is no doubt, whatever. The lode here is strong and healthy and shows the usual enrichment of the formation. Red Jacket shaft is equipped with a sinking engine house of stone, 69x36 feet, containing a pair of horizontal tandem Corliss engines with cylinders 16x32 inches in diameter with a 48-inch stroke, with tail rope house, and has the Whiting drum system. The main hoisting engine house, built of stone, 220x70 feet, contains two pairs of triple expansion engines of 3,000 horsepower per pair, having cylinders 20⅛, 31¾ and 50 inches in diameter, with a 72-inch stroke, to run 60 revolutions per minute, and fitted with the Whiting drum system, arranged to hoist 10 tons per load at a speed of 60 feet per second. To give the reader some idea of the size of the engines, the weights of some of the parts is here given: Engine bed, 76,106 pounds; main pedestal plate, 120,722 pounds; end pieces for bed plate, 19,464 pounds; two cylinders, 25,550 pounds; details of brake, 51,171 pounds; one foundation bed plate, 38,547 pounds; wheels carrying

rope, 143,577 pounds; engine beam forged of steel, 64,920 pounds; crank shaft, 26,000 pounds; air pump, 13,540 pounds; the total weight of the pieces enumerated, and they are few compared with the complete engine, is about 520,000 pounds, or 260 tons.

The shaft house for Red Jacket shaft is build almost entirely of iron, fitted with powerful rock crushers, and other modern appliances for economical manipulation of rock. In this branch, as in others, a number of improvements have been incorporated into the equipment during the past year or two that have resulted in bringing about a big saving in expense to the company.



Returning from a trip underground in the Red Jacket Shaft, Calumet and Hecla Mine.

Calumet & Hecla Office, Library opposite
Photo by O. F. Tyler

OSCEOLA AMYGDALOID BED.

This lode is situated about 750 feet east of the conglomerate, and parallels it clear across the company's territory at Calumet. It dips to the westward at an angle of thirty-eight degrees from horizontal, averages from fifteen to thirty feet wide and yields in the neighborhood of twenty pounds of copper to the ton of rock when selected. The Calumet and Hecla Company has five shafts sunk in this amygdaloid on its strike and numbered from north to south. All five shafts are large, three-compartment and average in depth about 1,100 feet. No. 13 is the southernmost, and No. 17 the northernmost. Shafts 13, 14, 15 and 16 are equipped with permanent combination shaft and rockhouses with ample bins and powerful rock crushers for reducing and handling the rock. No. 17, however, has but temporary equipment, but adequate for developing purposes and good for some time to come. Levels 8x8 and 100 feet apart in depth are driven from shaft to shaft and connected, which makes air circulation good and afford means for passing from one part of the mine openings to another. In the different levels there is opened up considerable ground carrying the average values of the bed. The lode is more or less irregular and bunchy, but portions of the opened ground will make good stopes and turn out fair values. Some years ago, this amygdaloid was worked by a former management and quite vigorously, but results then were decidedly unsatisfactory and all work there was discontinued. In July, 1904, the works were reopened and the lode values tested under the improved methods now in force at the mine. 75,000 tons of rock was hauled yielding 22 pounds to the ton. Results obtained under the new, practical way of doing things are fairly satisfactory, and it has now been planned to open up and develop this formation on a much larger scale, which means that the company will have a valuable mine on the Osceola amygdaloid bed. Air power for operating the machine drills, underground pumps, etc., is conveyed from the air compressors located in the main workings on the conglomerate.

THE KEARSARGE AMYGDALOID LODE.

This is one of the great master lodes of the mineral belt and stretched along through the district for miles in length. Like the Calumet conglomerate and the Osceola amygdaloid, it extends clear across the Calumet and Hecla main tract at Calumet, paralleling these belts about 2,000 feet east of them. The Calumet and Hecla company is developing this lode through three shafts located along its strike and numbered from north to south. All three, 19, 20 and 21, are fine shafts built solidly with concrete and brick from collars well down into settled rock. This precaution was considered necessary on account of deep wash and heavy overburden through which they passed before reaching the ledge. No. 21 is not so deep as the others, but built in the same manner with concrete and brick. The three shafts are large, 9x22 feet, and sunk on practically the same plan. Each has three compartments, two for hoisting rock, the third for ladder-way, pipes, etc. No. 19 is 500 feet deep and sinking to the 5th level. No. 20 is about 500 feet deep and sinking to the 5th level. No. 21 is about 100 feet deep.

The underground development work in the lode goes forward with the usual energy characteristic of the management and substantial progress is being made. Drift extensions are carried forward both sides of the shafts in different levels and large blocks of ground systematically developed for future requirements or whenever needed for milling purposes. Thus far, no attempt has been made toward stoping in this formation and all rock going to mill is fair and the character of the lode is to improve with depth. The outlook for another valuable mine within the company's main tract at Calumet is good on the Kearsarge amygdaloid. Shaft equipments, though not considered permanent, are powerful and adequate for developing purposes, and good for some time to come, besides they are economically operated.

Water for condensing purposes is obtained from a pond—practically a lake—on the company's property and lifted to the works by two pumps with a combined capacity of 17,000,000 gallons per twenty-four hours. For domestic purposes, water is pumped from Lake Superior by two 3,000,000-gallon capacity pumps. The principal workshops of the mine, including machine shop, carpenter shop, blacksmith shop, roundhouse and warehouse are centrally located in the Hecla branch. Shops have a most complete equipment and can turn out a locomotive, a power drill or the most delicate piece of fitting, as well as do the general work of the mine. Mr. James D. Ramsey, who has been connected with the machinery department for thirty-seven years in some official capacity, is Superintendent of motive power. Main office is located in Calumet branch. It is a fine attractive structure, trimmed with brick and granite and surrounded with a well kept lawn.

The Calumet and Hecla stamp-mills, smelting and refining plant, landing docks for coal and supplies, main electric power generating plant and supplementary buildings are located at Torch Lake, Lake Linden, from four to five miles from the mine, where there is an abundant supply of water for all purposes the year round and open waterway, for freighters six months in the year and connecting with the great lakes. Works and mines are connected by the Hecla and Torch Lake Railroad. The works are necessarily large and extensive, covering many acres of ground, very complete and in keeping with the mine plant. There are two stampmills constructed of steel, with seventeen stampheads of improved pattern in commission, six undergoing remodelling and five of the old style yet to be remodelled. Heads are fitted with the best and most economical machinery for milling and washing and for saving copper from running into the lake. During the past three or four years, many improvements and innovations have been added to the plant that strengthened its efficiency and resulted, not only in reducing operating costs, but in recovering a much larger percentage of fine copper than formerly from passing out with the slimes. Water is pumped from the lake for the two mills by a "Levett triple expansion pumping engine" of enormous power and capacity. Mr. W. A. Cake is Superintendent of the stampmills.

During the past three years, electricity has been utilized for operating the mills. The company has already in service two 1,000-Kilowatt generators, and at the present time two 2,000-Kilowatt generators are being installed. When the addition to this plant is completed, electric current will be taken to Calumet over lines now being constructed, and used for tramming and pumping underground, and operating all rockhouses and shops, and indeed, supplanting the direct use of steam everywhere except in the main hoists and compressor engines.

The Calumet and Hecla Company has two smelting and refining plants for the treatment of its product of mineral: one at Hubbell, near the mils, the other at Buffalo, N. Y. The one at Hubbell was established about eighteen years ago, and that at Buffalo some years since. Both were successful from the start. They have been in competent hands and run in the interest of the company. Here, as well as in most other parts of the property, during the past year or two, certain alterations have been made and extensions added to the plants, which increased their efficiency and capacity. The changes were made partly, however, for the purpose of treating mineral for other mining companies, for in this line, the Calumet and Hecla has achieved much success. Mr. J. B. Cooper is Superintendent at Hubbell works; Hon. Charles Smith, Chief Clerk; Mr. M. B. Patch, Superintendent of Buffalo plant. The plants include buildings to store the mineral, docks, blister and refining furnaces, assay office, laboratory and all other adjustments that go to round out a well appointed smelting and refining plant. The copper of the Calumet and Hecla is recognized the world over as an excellent brand and sells in the market at the highest prices. A considerable amount of the company's product is exported and sold directly to consumers.

Officers: President, Alexander Agassiz; Vice-President, T. L. Livermore; Secretary and Treasurer, Geo. A. Flagg; Superintendent, James MacNaughton; Chief Clerk, J. H. Lathrop; Engineer, E. S. Grierson.

TAMARACK MINING COMPANY.

The Tamarack is a deep level mine and one of the most remarkable mining enterprises on the globe. It was organized in 1882 for the purpose of mining the western continuation of the Calumet conglomerate as it passed from the lands of the Calumet and Hecla into those of the Tamarack. The company has large tracts of land in Houghton and Keweenaw counties, but its main tract and that in which the mine is opened is located at Calumet, adjoining the Calumet and Hecla mine on the west and consists of 1,280 acres. The Tamarack mines the Calumet conglomerate bed—the mineral bed that has made Calumet and Hecla famous, and the admiration of the mining world. It also mines the

Osceola amygdaloid in a moderate way, but the conglomerate forms the chief source of supply. Tamarack has no outcrop of either bed, but reaches them and secures the product through five large, deep vertical shafts. The conglomerate outcrops in the lands of the Calumet and Hecla from 4,000 to 9,000 feet east of Tamarack workings and dips northwesterly at an angle of 37½ degrees from, horizontal. It sinks away down through the Calumet and Hecla territory into that of the Tamarack, getting deeper and deeper, in its onward course, to unknown depth and distance. The Calumet and Hecla people take out the conglomerate up to their boundary and there drop the work. Tamarack people then take hold of the formation, about 100 feet beyond where the Calumet and Hecla leaves off, and develop their mine. The shortest vertical distance from surface to the conglomerate is about 2,200 feet. The Tamarack is a substantial mine and a fine business enterprise. The company has paid $8,880,000 in dividends, nearly six times its capitalization, developed the property and equipped it with one of the most complete and costly mine plants on the continent. The company is capitalized at $1,500,000, divided into 60,000 shares, par value $25 each. In 1905, the company paid $180,000 in dividends and the previous year, $90,000.

Balance assets, December 31, 1905, $848,589.37. These annual disbursements were not so heavy as formerly, but during the past few years, the company has put big sums of money back into the property for betterments, that resulted in materially strengthening the position of the mine. The great shafts have been sunk deeper, reserves of ground increased and additional equipment installed. Number 2 shaft, for instance, has been retimbered, and No. 5 has been completed and put in a position send out a monthly output of 30,000 tons of rock to say nothing of other improvements. There are 1,800 names on the pay roll and 95 machine drills operated. In 1905, the company stamped 750,220 tons of rocks which yielded 15,824,008 pounds of refined copper—a trifle over 21 pounds per ton treated. As before remarked, Tamarack is mined through five large deep vertical shafts, but the bulk of the product is lifted through Nos. 2, 3, and 5. Mine is divided in three branches: Tamarack, North Tamarack and No. 5 Shaft. No. 1 is used only for hoisting rock from the Osceola amygdaloid, as the conglomerate tributary to it is exhausted. A description of depth and dimensions of the five great shafts might be interesting. No. 1 is 3,409 feet deep and a three-compartment. No. 2 is 5,200 feet north of No. 1, 16 feet by 8 feet inside measurement, down to the 30th level, three-compartment and 4,355 feet deep. Nos. 1 and 2 constitute Old Tamarack. Nos. 3 and 4 are known as North Tamarack. No. 3 is 5,200 feet north of No. 2 and is down to the 17th level, 20 ft. 2 in. long inside measurements, four-compartment and 5,139 feet deep. This is the deepest vertical shaft in the copper district, and perhaps, in the world. It is the mine's best shaft. No. 4, located 618 feet north of No. 3 is 4,450 feet deep and a duplicate of No. 3 in dimensions. No. 5 is one of the greatest shafts in the world. It is 27 feet long by 7 feet wide within timbers, divided into five compartments and 5,000 feet deep, and is secured and divided from top to bottom with the best and soundest kind of timber, and equipped with one of the most powerful plants on the Upper Peninsula. No. 5 and Old Tamarack are connected on the 29th level. This opening helps to ventilate the works and offers a way for escape in case of accident at either quarter. No. 1 was the first started and created more excitement and speculation than any other shaft ever sunk in the region. It was a new innovation and regarded by many as a bold, hazardous venture. All kinds of disasters were predicted for the work by the wise ones and some went so far as to say the shaft would never reach the lode. But the work went steadily on and the shaft continued downward without a hitch worth mentioning and in three and one-half years from the time of starting, Calumet conglomerate rock, containing the usual values belonging to the formation, was dumped on the Tamarack land. The work was planned by the late Captain John Daniel and executed under his direction. Time is a mighty leveler and results accomplished a forcible teacher. The starting of such an enterprise today would hardly cause a ripple of excitement. This shaft was started in the southeast corner of Section 14, and at a depth of 2,270 feet below surface, where the conglomerate was struck. Two compartments of each shaft are used for hoisting rock, the others for lowering men, timber, supplies, etc. The conglomerate is reached by a series of crosscuts driven from shafts and as depth is attained the conglomerate gradually creeps further and further away from shafts and crosscuts grow longer and become more expensive to drive. The costs of mining the product are naturally increased with remoteness of lode from surface. Crosscuts are 120 feet apart vertically, which gives 200 feet of conglomerate backs or makes the levels 200 feet apart in the conglomerate. The back stoping system typical of the district with modifications is used for taking out the lode. The best method for the work is practiced The people connected with the work know the business. When conditions are right, levels are continued to the end of the territory or the point considered the most advantageous for recovering the lode and stoped back towards the shaft. Levels are connected by winzes and raises, which ventilate the workings and make breasts for starting fresh stopes. When the last of the backs have been broken down, the walls may stand up or fall in so far as the management is concerned. They can in no way interfere with the future work. To support the walls, however, and make the workings safe while the lode is being taken out, a large amount of timber is consumed annually. The hanging is always heavy and treacherous and requires strong timbering. Gangs of men are constantly at work doing nothing but putting in timber and if the copper is to be taken out, this work must be constantly kept up. From end to end, workings in the Tamarack are fully 6,000 feet long. The openings form a vast network of passages extending practically in all directions with immense quantities of ground opened up and developed. No reasonable expense is spared to

make the mine safe and comfortable for workmen. The lode is taken out mostly in contract work.

The rock is trammed underground by an endless rope system operated by mechanical power that works first-rate. Crosscuts are long and the system is highly appreciated by trammers. Filled trams are loaded on cages counter-balancing in shafts, hoisted to the surface and dumped on grizzles in the rock houses. Safety clutches are fastened on each side of the cages. Rock is carefully and economically assorted and manipulated in rockhouse. The whole work is efficiently and economically performed. The mine, however, is naturally an expensive one to operate on account of its depth and great length of cross-cuts that must be driven through barren rock to reach the lode. The early developments in No. 5 were disappointing, though expectations for it ran high. Copper values contained in the conglomerate are not up to the average of the mine, nor have the average of the mine for some years, been as good as formerly. For some time, the conglomerate has been yielding much lower values than the average of the lode in the levels above the present workings. The yield of ingot has been only about 1⅓ per cent. against as much as 3 per cent. or 4 per cent. in former years. While the belt has been wide and strong and robust, it has been irregular in organization, the copper occurring mostly in streaks separated by bars of barren, unprofitable rock or in patches of limited extent instead of being mineralized throughout such as is characteristic of the great belt in its normal condition. Upon the whole, however, there seems to be quite an improvement in the lode exposed and unless indications miscarry, there are better things ahead. Some changes and modifications of operations are planned—some are underway that will result in reducing operating costs and strengthen the position of the property in practically every department. The management is aiming to get out of the property the very best there is in it. Future requirements must be anticipated and provided for in a great mine, and they are in the Tamarack. Tamarack has a very complete equipment in first-class running order and efficiently operated. Much of it is of modern design and manufacture and good for years to come. Machinery buildings are substantial and well located. Shops are equipped with the best tools and fittings and each shaft has a separate hoisting plant of enormous power that lift cages with loaded cars at the rate of 3,000 feet a minute. The plant is operated by steam power and the location is lighted by means of electricity. Mine location forms a part of the town of Calumet and has a large number of comfortable dwellings for employes, besides a well equipped hospital, Methodist church, a fine public school and other necessary buildings.

The company's stamp mills are located at Torch Lake, about six miles from the mine. The Hancock and Calumet Railway hauls the rock from the mine to the mill. The company holds an interest in the road. The mill site is an exceptionally fine one with an abundance of water for concentrating and domestic purposes the year round. Mills are equipped with seven powerful heads and the best machinery known for washing and saving copper. Supplementary machinery is practically automatic and the plant is very complete and economically operated. Company's product is smelted at the Dollar Bay smelting works. The Tamarack is in the hands of good people who know copper mining and are doing it right.

President, A. S. Bigelow; Secretary-Treasurer, W. J. Ladd; General Manager, Norman W. Haire; Superintendent, W. J. Uren; Assistant Superintendent, John T. Been; Mining Captain, Thomas Maslin; Engineer, C. Hohl; Clerk, Jno. T. Reeder.

CENTENNIAL.

This property is located about one mile north of the town of Calumet with a section and a fraction of mineral land carrying the Calumet conglomerate, Osceola and Kearsarge amygdaloid lodes. The property could hardly be better located. It is connected on the south to the Calumet and Hecla and on the north to the South Kearsarge and Wolverine mines. Lands embrace all of Section 12, Town 56, Range 33; also a triangular corner of twenty acres joining the southeast corner of the main tract. The company is incorporated under the mining laws of the State of Michigan. Capitalization, $2,500,000 in 100,000 shares of par value of $25 each. 90,000 shares issued.

President, H. F. Fay; Secretary-Treasurer, Geo. C. Endicott; Superintendent, Jas. Chynoweth. General Office, 60 State St., Boston, Mass.; Mine Office, Calumet, Mich. The company is mining the Kearsarge lode through two shafts sunk on its plant. The Kearsarge lode is recognized as one of the most valuable cupriferous deposits mined in the district. It runs from eight to twenty feet wide, averages about fourteen pounds and yields from eighteen to thirty pounds of copper to the ton of rock treated. The best values develop with depth ranging from 900 to 3,000 feet below the earth’s surface. Mine workings are opened on broad practical lines with a view to its future as well as its present welfare; is ably managed and economically operated. Progress has been substantial. Management aims to develop it on lines somewhat commensurate with its scope so as to take out, in its natural course, the very best and practically all there may be in it. Thus far, the property is largely a developing proposition. The lode developed in the upper workings of the mine was irregular and bunchy. That, however, is characteristic of the belt, and particularly so in places, but the deepest openings continue to show increasing values and a better conditioned lode. The bunches of coppery ground are larger, wider and thicker than in the levels nearer surface. This condition was anticipated by the management and forms the principal reason for sinking so rapidly to great depth with limited lateral openings. No. 1 was sunk at record speed and present results reflects the wisdom of the work. Openings are now

believed to be entering the Wolverine-South Kearsarge chute of ground, which, by the way, is as good as anything found in the belt. Drifts going north and south are developing a first-rate grade of rock. It looks well and bears the features that denote stability of values. 260 men are employed and 24 machine drills operated. 84,890 tons of rock were stamped in 1905 and yielded 2,069,490 pounds mineral and 1,446,584 pounds refined copper.

Yield of refined copper per ton of rock treated, 17.04 pounds; balance of assets on hand, January 1, 1906, $331,779.76.

Number 1 is the southernmost shaft, down to the 29th level, 3,100 feet deep, 7 feet by 18 feet and three-compartment. No. 2 is practically a duplicate of No. 1; is finished to the 14th level and holed through with winzes and raises to the 27th. Portions of the shaft are completed between the 14th and 27th levels. Shafts are connected underground by various openings, making ventilation good, and the workings airy and comparatively comfortable places to work in. The condition of the mine shows steady improvement. The courses of the shafts are directed so that No. 1 shall be in position, as it proceeds downward, to command the southern half and No. 2 the northern half of the company's mineral territory. The usual number of drift slopes are going forward practically all through the lower workings into virgin ground developing fresh reserves in accordance with the policy of the management. Men are distributed in the workings to the best advantage. Product is taken out the best, most practical and economical way adapted for the formation. Back stoping with modifications is generally used. Rock is trammed by hand labor and skips counter-balance in shaft carrying five tons to a trip and dump automatically in rock house on grizzles. Rock house is well equipped and rock is economically manipulated. Surface equipment is of the best, practical and up-to-date. Buildings are substantial and advantageously arranged for the best results. Hoisting plant is good for years ahead. Shops are equipped with tools and fittings of the latest make and turn out practically everything needed at the mine except new machinery.

The company has a modern stamp mill located at Grosse Pointe about six miles from the mine and treats its own rock output besides that of the Allouez mine. The site is a magnificent one with an abundance of water the year round and sand room for the life of the mine. Mine will likely be more vigorous 25 years hence than at the present time. The mill is equipped with three powerful heads, which in turn are fitted with the best machinery for washing and saving copper. The mill plant is very complete and in first-class running order. The rock is hauled from mine to mill by the Mineral Range Railroad.

Mill Superintendent, Alex. G. Andrews; Mining Captain, John Penticost; Clerk, Alonzo Nicholas; Engineer, A. Goodale.

WOLVERINE MINE.

Wolverine mine is capitalized at $1,600,000, divided into 60,000 shares, of par value $25.00 each. The amount of cash paid in on the capital stock is $780,000. The first disbursement to stockholders was made in 1898, since which the aggregate amount received by them is $2,070,000. Including dividend of $8.00 per share paid April 1st, 1905, equal to $34.50 per share.

Wolverine forms one of the solid, substantial mining enterprises of the copper district and is well and widely known. Reference to its dividend record shows that disbursements to stockholders have been steady and continuous for years and that recent achievements in that line have been rarely equalled. As a mark of distinction, the mine is often referred to as the "little Calumet and Hecla of the Lake district." But it was not always so. The writer has been underground there when its future looked dark and uncertain enough. That, however, was before the present management became identified with it and before the characteristics of the Kearsarge lode, in which the mine is opened, were as well known as they are today. But ever since Mr. John Stanton became its president and Mr. Fred Smith its agent, the ultimate success of the enterprise was hardly ever in doubt. Under the new management, its development was started right—on practical methods and its growth has been continuous, and the different departments of the mine built on a substantial basis and carried to completion with marked ability.

The mine is situated about a mile and one-half north of the town of Calumet in Town 56, Range 32; adjoins South Kearsarge on the north, North Kearsarge on the south and has 320 acres of land carrying the Kearsarge amygdaloid and other mineral belts. Kearsarge amygdaloid develops values in Wolverine equivalent to about 30 pounds copper per ton of rock treated. The company's fiscal year ends June 30. In the last fiscal year ending June 30, 1905, the company treated at its stamp mill 321,813 tons of rock, which yielded 9,729,970 pounds of refined copper. The copper was made for the extremely low cost of 6.274 cents per pound, the lowest cost secured by any Lake Superior copper company. The following tabulation gives comparative results, costs and profits for the past three fiscal years:

	1905.	1904.	1903.
Pounds of fine copper produced	9,729,971	9,300,695	8,260,386
Tons rock stamped	321,813	314,091	279,011
Pounds copper per ton of rock	30.23	29.61	29.60
Operating expense per ton of rock	$1.88	$1.91	$1.96
Cost per ton of copper (cents)	6.22	6.46	6.63
Average price per pound received, cents.	13.83	12.75	12.48
Net earnings per share	$12.35	$9.28	$7.45

It will be noted that the richness of Wolverine rock is being more than maintained from year to year. At the beginning its rock yielded an average of only nineteen pounds to the ton.

The following comparison of dividends during the past five years may be interesting: 1901-2, $240,000; 1902-3, $270,000; 1903-4, $390,000; 1904-5, $540,000.

The company employs about 420 men and operates 30 machine drills. The mine is opened and worked through three working shafts, Nos. 2, 3 and 4, sunk in the lode at an angle of forty-one degrees from perpendicular. Shafts are substantial and in the best condition. No. 2 shaft is 1,700 feet deep and bottomed there. It is used only for lowering and lifting men and supplies. In January, 1906, No. 3 was 2,800 feet deep and sinking to the 26th level. No. 4 was sinking to the 26th level. In the lower workings, levels are 100 feet apart, and from 75 to 80 feet apart in the upper workings. All three shafts are connected underground on different levels and various other places. Air circulates freely through underground workings, making ventilation good. Wolverine is a comfortable mine and men like to work in it. It is in excellent physical condition and opened up for years ahead. Openings in the lode are 3,000 feet in length and about sixteen feet wide. Deepest point penetrated carries values fully as good as the average of the mine. The rock output comes from stopes located practically all over the mine and hoisted through Nos. 3 and 4 shafts. Openings into new ground averages about 600 feet a month, and the average ground reserves are fully maintained. Mine began its career by returning from sixteen to eighteen pounds copper per ton of rock; then it rose to twenty, followed by gradual steps to thirty where it now remains.

The mechanical equipment is of the best; powerful, highly efficient and economically operated. Power and machinery houses are substantially built and generally of stone and conveniently located for direct work and the best results. Each shaft has a separate hoisting plant and shaft rock house equipment. Skips counterbalance in shaft carrying four tons of rock to a trip and dump automatically on grizzles in the rock house. A new hoisting engine for No. 4 shaft has been ordered and will be installed this summer and that will make the equipment practically complete.

The Wolverine has a new stamp mill located near the mouth of Tobacco river, on Traverse Bay, Lake Superior. The structure is built of steel on stone foundation, 180 feet by 206 feet in dimensions. It is equipped with two Nordberg heads striking about 106 blows a minute and the best machinery known for washing and saving copper and works satisfactorily. Daily capacity of the mill is about 1,050 tons rock. The mill is practically new, one of the best in the district and connected with the mine by the Mohawk and Traverse Bay Railroad. Rock is hauled by the Mineral Range Railroad Company. The mill and mine locations are well provided with comfortable dwellings for the employees and rented them on very liberal terms. Order and system prevails all over the property and the company's affairs are transacted with efficiency and exacting knowledge. Buildings and locations are lighted by electricity.

President, Joseph E. Gay; Secretary-Treasurer, John R. Stanton; Agent, Fred Smith. William Pollard, Mining Captain; Chas. Noetzel, Clerk. Main Office, 15 William St., N. Y. Mine Office, Kearsarge, Mich.

This company sustained a severe loss in the death of Mr. John Stanton February 23rd, 1906. Mr. Stanton was president and a director of the Company since its organization

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ARCADIAN COPPER COMPANY.

The Arcadian Copper Company was organized under the laws of New Jersey in March, 1899, with a capital of $3,750,000, divided into 150,000 shares, par value, $25 each. The company owns 4,000 acres of mineral land adjoining the Quincy and Franklin mines and comprise six old mines, which had been worked in early days. The property was opened up with great vigor during 1899 and 1901, and equipped with a magnificent machinery plant and buildings of the most modern and costly design and a fine stamp mill at Grosse Pointe. But operations proved decidedly unprofitable and in 1903 all work was suspended. The mineral lands owned by the company consist of some 4,000 acres extending from the lake shore at Ripley to Boston dam and across the entire Mineral Range. Besides the lode which the company works, the Kearsarge, Baltic and all the other identified copper bearing beds of the distant run through the property from south to north. Since the Arcadian people suspended operations in 1903, the Kearsarge lode has been opened extensively for many miles in length and a great deal of exploratory work is being done in that excellent and popular formation. There is little question that the lode extends southward through the Arcadian property, but whether it carries commercial values or not can only be determined by its systematic exploration. Last fall Arcadian people started to sink a new shaft for the purpose of proving up the values contained in a lode located about 1,500 feet east of the Arcadian vein formerly worked by the company. The shaft is now 170 feet deep with results quite encouraging. The lode is widening and becoming softer with depth. It is planned to sink to a depth of 200 feet or more and explore this vein and then crosscut east a distance of 75 feet to intersect another copper bed believed by some people to be the Baltic lode. There are many people on the Lake, who believe the Arcadian to contain important values and that they will be found and mined. Fourteen men are employed and substantial progress is being made. The company has a complete hoisting plant capable of exploring to a depth of 500 feet.

President, Albert C. Burrage; Secretary-Treasurer, Chas. D. Burrage; Agent, Robert H. Shields. Main Office, 85 Ames Bldg., Boston, Mass; Mine Office, Houghton, Michigan.

HANCOCK MINING COMPANY.

Land owned, 160 acres, located southwest of the Quincy mine and partly covered by the City of Hancock. This company was organized in 5 1859 and in 1862 made its first product. Its total production was 2,854 5 tons, 1,384 pounds ingot copper. The mine has been idle since 1885. There has been some talk recently of reopening this mine and working it on modern methods. Mr. August Mette, of Hancock, is agent.

RHODE ISLAND.

This is an exploring proposition situated about midway between the towns of Calumet and Hancock; centrally located, well within the mineral range and adjoining the Franklin Junior mine on the north. The company's realty holdings are large, consisting of 800 acres including all of Section 5 and the S. W. ¼ of Section 4 in Town 56 North, 33 West. The property is traversed by the Calumet and Allouez conglomerates; the Osceola and Kearsarge amygdaloids, besides what are locally known as the "East and West lodes," and in which the company is looking for a mine. The East lode is probably a continuation of the Pewabic lode and the West lode a continuation of the Quincy lode. The company employs about 25 men and operates two machine drills. Two shafts, Nos. 1 and 2, are sunk in the East lode 1,200 feet apart. Shafts are duplicates in dimensions, being 8 by 18 feet inside measurement and three-compartment. No. 1 is 500 feet deep; No. 2, 1,265 feet deep. Considerable ground was opened Up and tested in the 1st, 2nd and 3rd levels of No. 1 and some bunches found showing fair values, but not sufficient to pay for working. From this shaft crosscuts were driven east to the Allouez conglomerate and west to the West lode, and extensive explorations carried on in these belts. Developments there were disappointing and the shaft allowed to fill with water. West lode, however, looks the best of the three and since 1902, exploratory work has been conducted principally in that belt through No. 2 shaft. The 8th and 10th levels are continued into new ground, and the property is being systematically explored. At the present writing, the bottom level looks better and shows up a little copper. The mine is well located and only 500 feet north of the Franklin Jr., carrying the northern continuation of the lode worked in that mine. Any valuable developments made in the latter mine ought to help Rhode Island. Last fall, the management succeeded in finding the Kearsarge lode with the diamond drill.

Rhode Island is well thought of and some good people think it contains important values. People behind the organization are enterprising and desire to be rewarded for the money spent and time devoted in the interest of the district.

Surface equipment is adequate for present requirements and includes, besides mine machinery, a number of comfortable dwellings for employes. Capitalization, $2,500,000, par value $25 each, and divided into 100,000 shares. Balance of assets, January 1, 1906, $21,952.

President, W. R. Todd; Secretary-Treasurer, W. A. O. Paul; Superintendent, Thomas Dennis.

TECUMSEH.

This Mining Company owns 560 acres of land adjoining the Osceola mine on the south. Lands are favorably situated and carry the Calumet conglomerate, Osceola and Kearsarge amygdaloid beds, and perhaps, others of less note. Considerable exploratory work has been done on the property, from time to time, and a good deal of money spent. Nothing, however, of decided values had been located there until last summer when the present management succeeded in finding distinctive and encouraging values in the Kearsarge lode with the diamond drill. I was over there some time ago and saw some first-rate rock that came out of the shaft. The company is now sinking a fine three-compartment shaft in this formation for the purpose of testing its values with depth. Shaft is 300 feet deep and sinking. In the last hundred feet or so sunk, the lode has turned out some good looking rock carrying strong copper. Lode looks very well indeed and certainly worth testing. If it continues to improve with depth, there is no question but what a profitable mine will be developed in Tecumseh. Property is in competent hands and equipped with a developing plant adequate for present requirements. Fifty men are employed. Capitalization, $2,500,000, par value $25 each. 44,000 shares in treasury. President, John C. Watson; Secretary-Treasurer, D. L. Demmon; Superintendent, R. M. Edwards; William Skews, Mining Captain.

ONECO.

The Oneco is a 100,000-share company, organized under Michigan laws in 1899. The property was originally known as the Hungarian and more recently, for a short time as the Fitzgerald. The earliest work was done in 1862, when a shaft was put down less than 100 feet. The next was done in 1890, but it was only limited. Then in 1898, Mr. Fitzgerald financed some exploration before the present company was organized. The property is an extensive one, consisting of 800 acres lying in Sections 2, 3 and 10, Town 55, Range 33. Various copper bearing belts traverse the lands and Mr. Edwin J. Hulbert, discoverer of the famous Calumet conglomerate, maintains that at least one of them carries substantial values. I have read letters written by Mr. Hulbert to Mr. Fitzgerald, president of the Oneco, making this claim. Oneco location is situated east of the channel in which occurs the Calumet and Hecla, Quincy, Osceola, Wolverine and some other successful mines on the North Range, but years ago, the feeling was quite general that a lode or lodes carrying important values did exist somewhere in these eastern lands. And

conglomerate floats, just as rich in copper as the Calumet conglomerate, have been discovered from time to time along the trend of the mineral beds in this quarter. I have broken pieces of conglomerate rock just east of Oneco that assayed 11 per cent. copper. The float or whatever the thing may be, from which I broke the stuff, lies there exposed at the present time. Whether the floats are fragments detached from the Calumet Conglomerate or from some other bed and carried where found in the wash or by glacial action in early ages or from some nearby deposit is anybody's guess. On the property of the Torch Lake Mining Company, which joins Oneco on the north, a careful and pretty thorough investigation of a cross section was made a few years ago by diamond drilling conducted by Mr. W. W. Stockley, of Hancock, Mich. In this work, Mr. Stockley discovered about ten lodes, some of which he thinks may be developed into profitable properties. The most promising proved to be amygdaloid and not conglomerates. In 1899-1900, a shaft was sunk in an amygdaloid bed in Oneco to a depth of about 500 feet and some drifting done. Shaft is double compartment with a single skip-way. It is well timbered, has been under water ever since and should be in a state of good preservation. The lode opened and investigated was not rich by any means, but it developed some fair seams of copper ground that looked very well. Great depth and further investigation might reveal better values. In the spring, so soon as the weather permits, the company plans to further explore the property. Developments there will be watched with much interest.

President, W. F. Fitzgerald; Treasurer, S. S. Miller; Mining Captain, Joseph Hocking.

OLD COLONY.

An exploring proposition adjoining the Calumet and Hecla on the east, Osceola and Mayflower on the north, and the St. Louis and the Canal lands on the south. Company was incorporated in 1899 under the Michigan Mining law. Capitalization, $2,500,000, par value $25 each, in 100,000 shares. Lands consist of 1,200 acres located about a mile and a half northeast of the town of Calumet in Sections 17 and 18, Town 56, and Range 32. For years, exploratory work has been conducted in the Old Colony by trenching, sinking, drifting, cross-cutting and also by diamond drilling and a number of lodes carrying more or less values were discovered. No important disclosures have resulted from this exploration, however, and it has been determined to see if greater depth may prove more successful in finding copper values in paying quantities. It is hoped with additional depth, at least, one lode may be found containing sufficient values to make a profitable mine. Sinking, which was discontinued at a depth of 560 feet has been taken up again and it is proposed to run the shaft down to a depth of 1,000 feet and form a base for conducting the work. At that depth, drifting and cross-cutting will be carried on and the property thoroughly and systematically explored. People behind Old Colony are of the best made, progressive and up-to-date. They deserve to find something good and lasting.

President, H. F. Fay; Secretary-Treasurer, George C. Endicott; Superintendent, James Chynoweth.

Balance of assets, October, 1905, $33,181.55.

MAYFLOWER.

Like the Old Colony, this is an exploring proposition adjoining the Osceola, Wolverine and Old Colony mines and own 840 acres land in Town 56, Range 32. This company was organized and incorporated in 1899 under the mining laws of Michigan. Capitalization, $2,500,000, par value $25 each in 100,000 shares. For a number of years, this company has been carrying on extensive explorations on its lands by trenching, sinking, drifting, crosscutting and deep borings with the diamond drill. A number of amygdaloids and a wide conglomerate, all carrying more or less copper values, were located in the property. Some of them carried bunches of nice copper ground that promised well, but upon investigation, they invariably proved too small and contracted to warrant systematic development and expensive equipment with a view of forming a substantial profitable mine. Mining operations have been directed skilfully, with a thorough knowledge of the work and a large area of the Company's territory tested. The work continues and the property will be thoroughly and systematically tested. People behind the enterprise are of the best type, enterprising and progressive and deserves to be rewarded. Surface equipment is adequate for requirements and running satisfactorily.

President, H. F. Fay; Secretary-Treasurer, Geo. C. Endicott; Superintendent, Jas. Chynoweth.

Balance of assets on hand January 1, 1906, $11,698.24.

Work on this property was discontinued March 31, 1906.

ATLANTIC MINING COMPANY.

Atlantic is among the best known copper mines in the Upper Peninsula of Michigan, and all things considered, there are but very few, if any, that have achieved more substantial results. The property has an excellent record, and is frequently referred to as a first-rate example of the well-managed mines of Lake Superior district. The company mines the Atlantic and Ashbed amygdaloid, the poorest lode in the world, it is believed, worked at a profit. The rock yields something less than 14 pounds per ton stamped and yet the mine pays its way, and makes a little for dividends. In 1905 the company treated 295,220 tons of rock which yielded 5,475,704 pounds of mineral and 4,049,731 pounds refined copper. The average yield per ton was 13.7 pounds as against 13.63 for 1904, which shows no particular change in rock values.

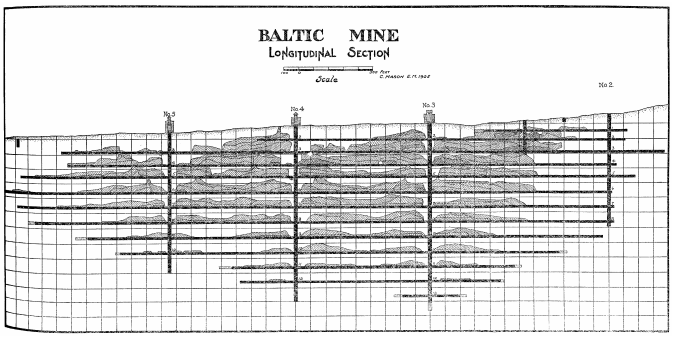
The following statement taken from the annual report for 1905 shows the company to be in a strong position financially:

Received from sale of copper	$642,305.80
Working expenses, including freight, smelting, etc.	562,347.07
Mining profit	$79,958.73
Less cost of exploring Section 16.	15,095.92
Net gain for year	$64,862.81
Add surplus	300,357.21
Balance assets	$365,220.02

Drifting in 1905 aggregated 7,790 feet against 4,910 feet the previous year.

Atlantic Mining Company was organized in 1872 under the mining laws of the State of Michigan with an authorized capital of $2,500,000 divided into 100,000 shares of par value of $25 each. The mine has been successfully operated for about thirty-four years and proved a fine business enterprise. Assessments to the amount of $980,000 were levied and $990,000 paid in dividends. Besides paying this amount to the stockholders the mine has been developed underground and on surface. Furthermore, a mine location has been built up with comfortable dwellings and substantial houses that might do credit to almost any country town. The location is well laid out and contains about 500 dwellings. About one-half of the buildings are owned by the people employed by the company, and the other half being owned by the Atlantic Company. Lands owned consist of 1,280 acres holding the lode for 6,200 feet in length. The mine location is situated about two miles south of Portage Lake, and four miles southwest of the town of Houghton on the line of the Copper Range Railway, in the south half of Section four and north half Section 9, Town 54, Range 34. 596 men are employed, and 39 machine drills operated on an average. The mine is developed and worked through two active shafts: B and D. Shaft B is three-compartment down to the 30th level, and 2,516 feet deep. Two compartments are used for hoisting rock with skips counterbalancing in the shafts. Third compartment is used for lowering and lifting men and supplies in and out of the mine. D shaft is 1,418 feet south of B, three-compartment, down to the 36th level and 3,045 feet deep. In dimensions and construction, this shaft is practically a duplicate of shaft B operating counterbalancing skips. As before mentioned the company is mining the Atlantic amygdaloid, locally named “Ashbed” on account of its great resemblance to a bed of coal ashes that hasn’t been disturbed for a considerable period of time. Underground openings are developed on practical lines and the lode taken out on the best method adapted for the work. Lode averages about 16 feet and dips 54 degrees from horizontal. Both width and angle are about perfect for the best results. It is soft, yet hard enough to make it big breaking, and exploded holes tear down big burdens. A feature of the bed is its uniformity and stability of values. Copper makes practically from foot to hanging and nearly all the bed is taken out and shipped to mill with scarcely any selection. No place in the mine looks better than the deepest openings. Underground workings are opened up well ahead and during the past year have been constantly improving in physical condition. Methods of extracting the lode have been undergoing modifications, which have been somewhat expensive, but when completed will result in reducing operating costs and strengthening the position of the mine. In the past, the lode has been taken out on the “back stoping” method typical of the district, which is perhaps the best known for a belt of medium width until great depth has been reached, and it becomes necessary to support the hanging wall with strong, costly timber. It has now been planned, however, to use the “back-filling-in” system for recovering the lode. This system is used in Baltic and other South Range mines with much success and satisfaction. Shafts and levels are connected underground and ventilation is good. Atlantic is a comfortable mine and men like to work in it. Six levels are being driven north of B shaft and one south opening up the usual quantity of new ground. At D shaft thirteen levels are going forward, six north and seven south. The lode developed in these openings show full average values of the mine and look well. The product comes from the stopes scattered over the openings and economically mined. Rock is trammed by hand labor. Cars dump directly into skips, which in turn when hoisted to the surface dump directly into rock crushers. The work is efficiently and economically performed. The mechanical equipment is of the best in good running order and doing satisfactory service. B shaft has a 24 in. by 60 in. hoisting engine with two parallel drums each twelve feet in diameter. Two 125 H. P. each locomotive type boilers furnish power for operating the equipment. D shaft has a 32 in. by 72 in. hoisting engine with double type drums good for 5,000 feet deep. Buildings are substantially fitted with the best machinery and located for direct efficient service. Buildings and location are lighted by means of electricity. The company has a fine stampmill located for direct efficient service. Buildings and location are lighted by means of electricity. The company has a fine stampmill located at Redridge, on the shore of Lake Superior, six miles from the mine. Site is an excellent one with water for all purposes the year round and practically unlimited room for waste sands. Mill is 151 feet by 224 feet and equipped with six heads in solid foundation, and all the necessary machinery for washing and dressing copper. The plant is in good running order and has a daily capacity of 1,810 tons of rock. The mill is now treating about 1,100 tons of rock daily. Rock is hauled from mine to mill over the Atlantic Railroad, which is owned and operated by the company. Atlantic Company is now exploring its Section 16 for the Baltic lode, which underlies practically the whole of the square mile of land. This section joins the Baltic mine on the north, and Superior on the south. It is a physical impossibility for the lode to pass anywhere but through the section and the Atlantic people will find it. Baltic has it and so has Superior and carrying good values. A shaft was started and a drift is being extended from the Baltic workings. As soon as the lode has been located, the shaft will be

continued right down and the formation systematically developed. The Atlantic mine is in a prosperous condition, but there are better things ahead for the company.



Main Office, 15 William St., New York City; Mine Office, Atlantic, Michigan; Frank McM. Stanton, Agent; Theo. Dengler, Superintendent; A. D. Edwards, Chief Clerk; Joseph E. Gay, Mining Captain; Fred G. Coggin, Mill Superintendent; Anton Winckler, Engineer.

This Company sustained severe loss in the death of Mr. John Stanton on February 23rd, 1906. Mr. Stanton was president and a director of the Company since its organization.

Since writing the foregoing, all underground work and a good deal of that conducted on surface at the Atlantic, have been discontinued for the time being. This action becomes necessary on account of a crushing in or subsidence of the footwall side of the mine, resulting in partially closing in some of the main workings and rendering the underground department unsafe for men to work in. It had been known for a long time that a settling of the ground was going on very gradually, but the disastrous movement which necessitated the suspension of operations occurred when quite unexpected and unlocked for by the management or anybody connected with the property. At the time of the mishap and previous to it, considerable repair and reconstruction work was underway for the purpost of strengthening the position of the mine and increasing the product of copper. To be cut off from making a product just now when the price of copper is high and mining decidedly profitable, comes rather hard for stockholders. The copper, however, will keep in the lode until it can be recovered. It will neither diminish in quantity or deteriorate in quality. Just as soon as the creeping ground comes to a rest and finds a lodging place the work of repairing the shafts and putting them in condition for service again can be started up. The loss to the Company will be considerable, but not so heavy, it is hoped, as many appear to imagine. It may be found necessary to leave a level of ground standing for a new foundation, so to speak, or a support for the crushing ground and that quantity may prove sufficient to hold it up forever. Then using the "filling in method" for taking out the product, which was adopted sometime ago, the Atlantic mine may be operated for years to come just as safely and just as profitable as it has ever been in the past. But is it impossible to say what the future policy of the company will be, until the ground disturbances cease, and the management can venture underground and make an investigation of the damage wrought.

PACIFIC MINING COMPANY.

Pacific Copper Company was organized in 1890. Lands, 960 acres, adjoining the Atlantic mine and carrying the Atlantic amygdaloid lode. Mine has never been a producer of copper. At the time of organization, 20,000 shares of stock was issued to pay for the land and 20,000 shares were subscribed for at $2.00 per share.

Balance assets, January 1, 1906, $922.00.

Arthur G. Stanwood, Secretary-Treasurer; Office, Boston, Mass.

ISLE ROYALE CONSOLIDATED MINING COMPANY.

This company was incorporated under the mining laws of Michigan in 1897 with a capital of $2,500,000 divided into 100,000 shares of par value of $25 each. The corporation embraced the Huron, Isle Royale and Grand Portage, three very old mines. The company's mine location is situated south of Portage Lake and about a mile from the town of Houghton, the county seat. In 1899 the company was consolidated with the Miner's Copper Company, and the capitalization increased to $3,750,000 and the number of shares to 150,000 and incorporated under the laws of New Jersey. Isle Royale has an immense acreage consisting of 3,040 acres of mineral land and practically all well located within the mineral range of the region besides a mill site of 40 acres. The lands are in direct line of the big producers and carry the Isle Royale, Grand Portage, and Baltic lodes on their strike like for two miles in length. The mine is worked through two activity shafts—No. 2 and Section 11 Shaft. No. 2 is an exceptionally fine shaft 7 feet by 25 feet, and four-compartment of the 17th level and three-compartment below the 17th to the 20th, the bottom, 1,977 ft. below the surface. The Isle Royale and Portage lodes are mined through these shafts, and the

amount of underground openings both sides of No. 2 will approximate 25,000 feet. Levels 17, 18 and 19 are being extended north and south of the shaft, and the usual amount of new ground developed. Ground reserves opened up and developed are very large and carry the regular values, such as belong to the formation. Upon the whole, the south side openings are considered to show the best grade of rock, which is fully as good as the average of the mine. The lode is bunchy and irregular with copper values making sometimes in one part of the belt and then again somewhere else. It ranges from a narrow bar to as much as 30 feet wide. In order to get the best results, large bodies must be developed so that the profitable bunches may be mined, and the unprofitable left standing in the mine, and that is the policy the management maintains. About 15 per cent. of the rock mined is discarded. Rock yields about sixteen pounds to the ton stamped. In 1905, the company stamped 195,150 tons of rock and produced 2,973,761 pounds of fine copper as against 2,442,905 for 1904. About 293 men are employed and 25 machine drills are operated; twenty-one in No. 2 shaft, three in Section 11, and one in Section 12. Section 11 shaft is 8,500 feet south of No. 2. It is 7x10 feet within timbers, two-compartment and 135 feet deep to the second level. First level is extended 637 feet north and 594 feet south of the shaft in the lode. The openings disclose a lode showing fair values and fully as good or something better than the average of the mine. This is a development proposition and in about a year or so, will be in condition to furnish rock for one stamp head. The future outlook for the property is much brighter and more assuring now than it has been for some time in the past. The mine is in good physical condition and well managed. The management takes a lively interest in its welfare and anticipates future conditions and requirements and provides for them. On the Baltic lode, test pits have been sunk and diamond drill work has been done. Cores showing copper have been taken out and the identity of the best has been established. This quarter will likely prove an exceptionally valuable asset for the company. A shaft is now down about 100 feet in this formation. The lode seems to be settled and quite well defined. Openings are yet too limited for classification, but they look very well and will no doubt develop values. The Company's mechanical plant is one of the best on the Lake. It is modern and practically new. Buildings are substantial and in first-class condition. Shafts have separate equipments. No. 2 has a 44½ foot by 64 foot steel rock house with four crushers and 32 in. by 72 in. double cylinder direct hoist with 18½-foot conical drum. Machinery is operated by steam and the location is lighted by electricity. Plant is fully adequate for requirements. Stampmill is located on the shore of Portage Lake with a fine site. Mill and mine are connected by the Isle Royale railroad owned by the company. Stampmill building is 134 feet by 210 feet, built of steel, with three heads—one compounded. Its daily capacity is 700 tons. Supplementary fittings and washing machinery is of the best. The works are very complete, in fine condition and works satisfactory. Both mine and mill locations are well provided with dwellings for employes.

ASSETS AND LIABILITIES.

ASSETS.

Cash and accounts receivable at Boston, and copper on hand, sold but not paid for	$613,709.66	
Lake Superior Smelting Co. stock	32,000.00	
Cash and accounts receivable at mine	2,505.84	
Supplies and fuel on hand at mine	25,140.65	
		$673,356.15

LIABILITIES.

Accounts payable at mine	$ 45,875.79	
Accounts payable at Boston	11,854.63	
		57,730.42
Balance assets December 31st, 1905		$615,625.73

President, A. S. Bigelow; Secretary-Treasurer, W. J. Ladd; General Manager, Norman W. Haire.; Superintendent, W. J. Uren.

COPPER RANGE CONSOLIDATED COMPANY.

This company is a security holdings organization incorporated under the laws of the State of New Jersey. Capital stock, $38,364,900 in 383,649 shares of $100 each.

President, William A. Paine; Secretary-Treasurer, Frederic Stanwood. Main Office, 26-27 Brazer Building, Boston, Mass.

Primarily the company was organized for the purpose of acquiring the stock of the Copper Range Company and the Baltic Mining Company. It now controls and practically owns the Baltic and Trimountain mines and one-half the Champion mine, the Copper Range Company, Copper Range Railroad Company and the Michigan Smelting Company. These several companies are referred to at some length elsewhere in this report. Although the company is young, as age goes, it already produces through its subsidiary properties an annual product of well into 40,000,000 pounds of copper. All six properties forming the organization are money makers and have solid merit; are excellently located, practically young and in fine physical condition with plenty of room for further grown and expansion; are well managed and certain to appreciate in value for years to come. Copper Range Consolidated has had a remarkable growth and achieved decided success in practically all its departments. Nothing can now come up to prevent it from becoming one of the greatest and most successful producers of copper in the Lake Superior district. In 1905, the company had a very successful year and paid four quarterly dividends of $1 each, aggregating $1,534,596. The mines embraced in the Copper Range Consolidated, including the Globe, now under option to and being developed by the Copper Range Company, own the lands containing the strike of the Baltic lode for a distance of upwards of five miles in length and it is on

this lode that the Baltic, Champion and Trimountain mines are opened and that the Globe people are exploring for copper in paying quantities.

Among the assets of the company are:
99,659 shares of the Baltic Mining Company,
99,674 shares of the Copper Range Company,
98,649 shares of the Trimountain Mining Company,
829 shares of the Copper Range Consolidated Company held by the treasurer for exchange for the outstanding shares of the Baltic Mining Company and the Copper Range Company,
$615,000 Copper Range Railroad Company bonds at par,
1,398,600 Copper Range Railroad Company stock at par.

BALTIC MINING COMPANY.

The Baltic is an interest mine, has solid merit and a great future. As age goes with mines, Baltic is a young concern, having been started only about eight years ago and then in a wilderness with primeval forest all around. It is now established on a firm basis and here to stay. The mine location is about two and one-half miles south of Atlantic, six miles from the town of Houghton and about ten minutes walk from the town of South Range on a line of the Copper Range Railroad. Lands lie in Sections 20 and 21, Town 54, Range 34, and consists of 800 acres. The success achieved thus far is of the very best, the kind that counts and lasts and that will not be found wanting in future years. The mine is opened on broad practical lines and the lode taken out on a method that is splendidly adapted for a wide irregular formation that develops its best values in bunches, sometimes in the foot, sometimes in the hanging and then again somewhere else. The management aims to develop and work the mine on lines somewhat commensurate with its scope and possibilities and to recover practically all the values there may be in it the best way. Progress has been continual and substantial. In the course of its natural development big sums of money have been spent in sinking shafts, driving levels and blocking out ground and also in equipping the property with a modern plant of great power and efficiency. The work has been done well and the mine is in physical condition with every department running almost to perfection. The company was organized in 1897 under the mining laws of the State of Michigan with an authorized capital of $2,500,000 divided in 100,000 shares, par value $25 each. $18 per share has been paid in.

General Office, Boston, Massachusetts; Mine Office, South Range, Houghton County, Michigan. President, W. A. Paine: Secretary-Treasurer, Frederic Stanwood; Agent, Frank McM. Stanton; Superintendent, F. W. Denton; Mining Captain, John Jolly; Clerk, William C. Cole; Chas. Mason, Engineer.

The following tabulation shows the annual products of copper made for the past four years:

1902, 6,285,819; 1903, 10,580,997; 1904, 12,177,729; 1905, 14,384,684.

The comparison shows a healthy growth and most satisfactory condition of affairs. There are still better things ahead for the Company. $1,250,000 or $10 per share was paid in dividends during 1905. The mine is opened and developed in the Baltic lode through four active shafts—2, 3, 4 and 5—numbered from south to north. Baltic lode is hard and wide and as before remarked, irregular with different grades of copper unevenly diffused between its two walls. Dips to the westward at an angle of 70 degrees, runs from ten to seventy feet wide and averages twenty-five feet wide. It is twice the average width of Calumet conglomerate, Osceola or Kearsarge amygdaloids and three times that of Pewabic worked by the Quincy mine. The belt is practically inexhaustible and rated among the most valuable in the district. Assorted rock yields about twenty-three pounds to the ton treated. Nine hundred men are employed and 65 machine drills operated on an average. About 30 per cent. of the rock mined is left underground and 8 per cent. discarded in the rock house. All waste is used for filling in purposes underground where the lode has been taken out. Company treats about 2,000 tons rock daily at its stampmill. The “back-filling-in or caving” system is used for recovering the product and it works admirably. It is practically safe for men and convenient for mining. But little timber is used in the work. Waste rock answers for sticks of timber. That means a great deal today for timber costs soon run into some big sums of money. Expense of tramming and hoisting waste rock is nominal. No effort or expense, however, is spared to make the workings safe and comfortable for working in. Sanitary conditions are good and air circulates freely through shafts and levels. Shafts are sunk on the plane of the formation and levels or stations established 100 feet apart in depth. Levels are extended on the drift-stope method and continued to the end of the boundary of the property or to the end of copper ground desired to be taken out. Drift-stopes run from eight to ten feet high and carry the whole width of the lode. Tram tracks follow at convenient distances. Most of the rock is assorted underground instead of on surface, which saves cost of tramming and hoisting the wastes. While the cutting-out work is in hand waste!! rock is piled along the sides of levels and later built into dry walls about eight feet high and on which rest cross timbers forming new floors for the convenience of miners in breaking down the backs and the men engaged in assorting broken rock. Raises are started from the backs of stope drifts and run up as high as necessary to form breasts of ground for commencing fresh stopes in the process of breaking down the product. Following the advancement of the stopes, circular mills or chutes four feet in diameter are built of rock about sixty feet apart. The levels below and stoping floors above are connected with the mills. Bottoms of mills are fitted with aprons

operated by levers. Assorted rock is pitched into the mills which in turn is run into cars, trammed to the shaft and dumped into skips carrying from three to four tons to a trip. Stopes are usually carried towards the shafts and practically all the lode is taken out. The work is skillfully and economically done. All stoping is done on company account, drifting and sinking on contract. The policy of the management is to open up large bodies of copper ground ahead that may be drawn upon whenever needed and in which miners may be distributed to advantage and get the best results. Baltic's four shafts are practically duplicates and three-compartment. Two compartments of each are used for hoisting rock and the third for ladders and pipes. Skips counter-balance in shafts. No. 2 is the southernmost, down to the 8th level and over 800 feet deep, No. 3 is 1,300 feet north of No. 2, down to the 13th level and sinking to the 14th level. No. 4 is 900 feet north of No. 3 and 1,200 feet deep to the 13th level. No. 5 is 950 feet north of No. 4 and down to the 11th level. This shaft has attracted a great deal of attention owing to its nearness to Section 16 owned by the Atlantic Company, and where Atlantic people are exploring for the Baltic lode. Developments in the north end of the Baltic mine indicate that the lode entering Section 16 is making almost east and west instead of north and south, the general trend of the copper belts in Houghton County. The sixth level drift northward lost the lode entirely throughout the last 75 feet before entering the Atlantic territory, 1,200 feet north of No. 5 shaft. Several times before this the lode had been similarly lost but had always been found by crosscutting. The seventh level northward, now approaching the Atlantic boundary, has been more satisfactory in its results than the sixth and is now in good pay rock. The fifth level is also being pushed in the same direction. All four shafts of the Baltic are connected underground on different levels. Levels in turn are connected by raises or winzes and the workings form a complete network 1,300 feet deep, and 4,600 feet long. The deepest openings look as well as any part of the mine and show up the regular values belonging to the formation. Shafts are sinking, levels going forward and the usual amount of ground is being developed. Mine is in fine form and ground opened up years ahead and in a prosperous condition. Product comes from practically all over the mine with Nos. 3, 4 and 5 lifting the output. No. 2 will go to the commission and the product increased in the near future. Baltic has a modern plant of great power and efficiency, fairly automatic and laid out for handling a large output. It is practically new and up-to-date and embraces some of the best machinery known for mining work combined with economical service. The machinery and powerhouses, with one or two exceptions, are built either of stone or steel or a combination of both. They are substantial and located for direct work and the best results. There is nothing old or antiquated connected with the works. The company has a complete electric light plant for lighting buildings and location. The hoisting engines are modern with direct action. Two are good for 3,000 feet each, the third for 2,000 feet, and the fourth for 4,000 feet. Shafts and rockhouses are of the combination build and equipped with powerful rock crushers and trip hammers operated by engine located in the same building. Skips dump automatically on grizzles. Fine stuff passes between the grizzle bars, the coarse runs through crushers and the product is ready for stampmill. Poor rock that has been hoisted is dumped in a sub-shaft located about 100 feet from main shaft and used for filling-in purposes underground. The whole work is readily and economically done. Rock is hauled from mine to mill over the Copper Range Railroad. The company's stampmill is located at Redridge, on the shore of Lake Superior. Site is an excellent one with an abundance of water for all purposes the year round. The mill is 175 feet by 195 feet, built of steel and equipped with four modern heads and the best machinery and fittings for washing and dressing copper. Its daily capacity is 2,500 tons. F. G. Coggin is Mill Superintendent.

This Company sustained a severe loss in the death of Mr. John Stanton on February 23rd, 1906. Mr. Stanton was president and a director of the company since its organization.

TRIMOUNTAIN MINE.

Trimountain is joined on the south by the Champion mine, on the north by the Baltic mine and possesses 1,120 acres of land in Sections 19, 20, 29 and 30 in Town 54, Range 39, purchased from the St. Mary's Canal Mineral Land Company for $800,000. The Company was incorporated under the mining laws of the State of Michigan in 1899. Capitalization $2,500,000 divided into 100,000 shares, par value $25 each. Paid in, $20 per share. Main office, 27 State St., Boston, Mass.; Mine Office, Trimountain, Michigan. President, William A. Paine; Secretary-Treasurer, Frederick Stanwood; Superintendent, F. W. Denton; Mining Captain, John Jolly; Clerk, B. D. Noetzel; Engineer, H. T. Mercer.

The Trimountain is a subsidiary property of the Copper Range Consolidated. Control passed to this company in 1903. Of 100,000 shares issued, the Copper Range Consolidated control 98,649. Mr. H. F. Fay and other Boston capitalists organized the company and floated the stock for the purpose of mining the Baltic lode. At that time the Baltic lode was a new thing and developed only in the Baltic mine. The diamond drill, however, had been at work and several rock cores carrying substantial values were taken out. The present mine location was then a part oil the wilderness with primeval forests all around. Mr. H. F. Fay was president of the company and Capt. James Chynoweth its superintendent. With the change of control came a change of management. Mr. William A. Paine succeded Mr. Fay and Capt. Chynoweth was succeeded by Mr. F. W. Denton, the present superintendent.

In 1905 the company treated 570,843 tons of rock and produced 10,476,462 pounds of fine copper as aganist

534,640 tons of rock treated and 10,211,230 pounds of line copper produced in 1904.

Trimountain is now a fine mine and a profitable business enterprise. Nine hundred men are employed and 70 machine drills operated on an average. The mine is opened and developed through four active shafts sunk in the Baltic lode. Operations are conducted with great vigor and shafts may be sunk to a great depth. All four are uniform in size, being 8 feet by 22 feet and three-compartment with two skipways each for hoisting rock. Third compartments are used for ladders and pipes.

Baltic lode averages in Trimountain about 30 feet wide and the rock when selected yields about 18 pounds to the ton treated. A considerable portion of the product comes out in the form of mass and barrel work—chunks of copper weighing from a pound or two to as much as half a ton and sometimes more. The lode, however, is a stampmill proposition with remarkable stability of values and strongly organized. The mine is opened up on broad, practical lines and skilfully managed. For some time past changes in the method used for taking out the lode have been going on that promises to result in reducing operating costs and strengthening the position of the mine. Shafts are numbered from south to north and located about 1,000 feet apart. All four are connected underground on different levels and with various other openings that keep the workings well ventilated, cool and comparatively comfortable for working in. From end to end the underground openings approximate 4,500 feet in length and hold enormous ground reserves carrying the average values of the mine. No place looks better than the deepest openings and the mine is opened up well ahead. The product is recovered through the "filling-in or caving system" and it answers to perfection for the Baltic lode. This system is described at some length in the report on Baltic mine. All stoping is done on company account; drifting and sinking on contract. The product comes from stopes and openings scattered practically all over the mine. Each shaft lifts its quota of rock. Shafts are going down and the usual number of drift-stopes going forward into new ground, developing reserves in accordance with the policy of the management. No. 1 shaft is sinking below the 12th level and about 1,300 feet deep. No. 2 to the 12th level; No. 3 to the 11th level and No. 4 to the 7th. The four shafts are substantially constructed and in good running order. Skips counter-balance in shafts, and carry from three to four tons of rock to a trip and dump automatically on grizzles. The mine equipment is practically new, up-to-date and arranged for handling a large product. Of course, with a great mine, young, stretching out for bigger and better things, there is always an open construction account. And such a condition shows a healthy growth. Future requirements must be anticipated and provided for or the cost sheet will soon show that something is wrong. Powerhouses are substantial, well located for direct service and filled with the best tools for mine work. Each shaft has a separate plant. Mechanical equipment is of the best. Hoisting engines for Nos. 1, 2 and 3 shafts are practically duplicates with 36 in. by 72 in. cylinders and 18-foot conical drums, good for 3,000 feet deep each. No. 4 has a temporary hoist but good for some time yet. Each shaft has a combination rock-shafthouse equipped with 18 in. by 24 in. crushers and trip hammer for breaking large rocks. The machinery is operated by an engine located in the building. The Copper Range Railroad connects the mine with the company's stampmill located at Beacon Hill, on the shore of Lake Superior and haul the mine rock. The mill site consists of 100 acres with about a mile of Lake frontage. The stampmill building is 176 by 205 feet, built of steel, well lighted and equipped with four stamps of the steeple compound type. The works are modern and include separating jigs, grinding mills, slime tables and supplementary appliances that go to make the mill complete and practically automatic. Water for concentrating purposes is secured through a pipe line extending 2,000 feet in the lake from the shore. Daily capacity of the mill is 2,500 tons. Number tons stamped daily, 1,800. A 20,000,000-gallon capacity pump raises the water. Machinery is operated by steam. Mine and mill are in good physical condition and well managed. Order prevails everywhere. Both locations are well provided with comfortable dwellings for employees and lighted with electricity.

CHAMPION MINE.

This mine is located about seven miles south of the City of Houghton on a line of the Copper Range Railroad. Adjoins Trimountain mine on the north and the Globe property on the south. The company was incorporated in 1899 under the mining laws of the State of Michigan. Capitalization, $2,500,000 in 100,000 shares of a par value of $25 each.

President, William A. Paine; Vice-President, F. Stanwood; Secretary and Treasurer, Frederic Stanwood; General Manager, F. W. Denton; General Office, State Street, Boston, Mass.; Mine Office, Painesdale, Mich.

One-half the capital stock issue, 50,000 shares, is owned by the St. Mary's Canal Mineral Land Company. The Copper Range Consolidated owns the other 50,000 shares.

The mine location lies in Sections 30 and 31 in Town 54, Range 34, and in Sections 25 and 36, Town 54, Range 35. The lands owned consists of 1,240 acres and carries the Baltic lode, in which the mine is opened for over 9,000 feet in length. The Baltic lode is a great, big strong amygdaloid bed ranging from fifteen to seventy feet wide and averaging about thirty feet. It is one of the most substantial mineral bearing amygdaloids in the district and yields in the Champion mine about twenty-six pounds of copper per ton of rock treated. A considerable portion of the product comes out in the form of mass and barrel work. When at the mine last summer, I saw masses in a pile there from a ton to a ton and a half in weight. The mine is opened on broad,

practical lines, and results accomplished show that it is economically operated. The management aims to work it on a scale somewhat commensurate with its scope and to get out the best there is in it. Progress has been substantial and continuous. The mine is in a prosperous condition. The following comparisons for three years illustrate its growth:

	1905.	1904.	1903.
Tons rock stamped	603,745	442,161	389,082
Pounds copper obtained	15,707,426	12,212,954	10,564,147
Pounds of copper per ton of rock	26.	27.6	27.02

In 1905, the company paid $1,000,000 in dividends or $10 per share as against $2 per share in 1904 and $3 in 1902.

All stoping work is done on company account, sinking and drifting on contract. All told, there are 1,100 names on the payroll and on an average, seventy machine drills are operated. The mine is opened through four fine shafts located about 1,000 feet apart on the strike line of the lode. Shafts are uniform in dimensions, three-compartment with average depth of 1,100 feet. Two compartments of each are used for hoisting rock, the third for ladder and pipes. All four shafts are connected underground on different levels and with various other openings that keep the mine well ventilated, cool, dry and comfortable for working in. Underground openings from end to end of the mine are over 5,000 feet in length and hold an enormous amount of ground reserves containing the average values of the Baltic lode. The lode looks well all over and nowhere better than in the latest points penetrated. The product comes from various stopes and openings on different levels, but all tributary to the four shafts, each sending out its allotted quota of rock. Shafts are going down and the usual number of drift stopes are going forward into new ground, developing fresh reserves in accordance with the policy of the management. The “back-caving-filling-in” method is used for taking out the lode and it works admirably. It is comparatively safe for men and requires but little timber and that means something today. Timber expense runs into big money and soon show on the cost sheet. Skips are counter-balanced in the shafts carrying from two to four tons of rock to a trip and dumps automatically on grizzles. Practically all the rock selecting is done underground.

The mine is young and its equipments modern and up-to-date—is arranged for handling a large product economically and with dispatch. Power and equipment buildings are substantial and centrally located for direct and the best service. Shops are equipped with the best tools and fittings and turn out practically everything needed at the mine except new machinery. A complete plant is provided for each shaft, embracing hoist, shaft-rockhouse and supplementary additions. Steam power is used for operating machinery. Champion equipment is of the best, practically complete and economical in operation. The property, however, has a great future and each department will need to be enforced from time to time to handle a gradually increasing product and to harmonize with its natural growth.

The Champion stamp mill is located at Freda on the shore of Lake Superior, a splendid place for the works, and the Copper Range Railroad hauls the stamp rock. Mill is modern—one of the best, and equipped with four powerful stamp heads. They in turn are filled with the best machinery known for washing and saving copper. Facilities are at hand for increasing the efficiency of the mill and treating a greater quantity of rock, which means a large product of copper. The management is experimenting with a new process whereby it is thought an additional pound of copper per ton can be saved. The plant is in excellent condition and looks well. Location and works are electrically lighted.

Underground and on surface, the Champion is in fine physical form, economically operated and with anything like a fair price for copper, good for many years of successful, profitable operation.

COPPER RANGE COMPANY.

The Copper Range Company was organized in 1899 to construct a Railroad in the copper district of Michigan and managed to secure the rights and franchise of the Northern Michigan R. R. Company. It was afterwards reorganized under the title of the Copper Range Railroad Company. The company owned about 10,000 acres of mineral land south of the Baltic mine and furnished one-half the land forming the Champion mine tract and on which the mine is located. The St. Mary’s Canal Mineral Land Company provided the other half.

The Copper Range Company organized and incorporated the Champion Copper Mining Co., in 1899, and though the company’s mine is practically new, it now forms one of the most valuable copper properties in the Lake district.

Included in the company’s assets are 9,360 acres of land, 50,000 shares of the Champion Copper Company’s stock and 26,051 shares of the Copper Range Railroad Company.

President, William A. Paine; Secretary-Treasurer, Frederic Stanwood.

COPPER RANGE RAILROAD COMPANY.

This company was organized in 1899 under the law of the State of Michigan. Authorized capital, $5,000,000, par value, $100.00. Issued, $3,886,900.

President, W. A. Paine; Secretary-Treasurer, Frederic Stanwood; General Manager, R. T. McKeever; General Superintendent, C. S. Fales; Main Office, Boston, Mass; Local Office, Houghton, Michigan.

The Copper Range Railroad runs form Calumet to Mass City, a distance of 59 miles. It connects with the Chicago, Milwaukee and St. Paul Railroad at Mass for all points southeast and west, runs through the center of

the mining district of the South Range and crosses Portage Lake at Houghton and Hancock; extends to Calumet and Laurium and will connect with the Keweenaw Central Railroad, which is building along the North Range to Lac La Belle and Copper Harbor. The Copper Range equipment is of modern type, its engines are of the finest and all passenger trains are made up of Pullman coaches. The road runs through a prosperous country and its business, both passenger and freight, is steadily increasing.

ST. MARY'S MINERAL LAND COMPANY.

Capital stock, 150,000 shares; Main Office, Boston, Mass. President, Nathaniel Thayer; Secretary-Treasurer, Arthur G. Stanwood. Local Office, Houghton, Michigan; R. R. Goodell, Agent; Dr. L. L. Hubbard, Mine Superintendent.

The following is a copy of the directors' report slightly modified for the year 1905. Sales during the year were as follows:

724 1-100ths acres of land, in fee simple for	$207,690.00
426 acres of land, the mineral right to which were reserved	11,752.00
Wood and timber	6,350.00
Total sales	$225,792.00

The real property of the Company, December 31, 1905, consisted of 95,838 82-100ths acres besides which the Company owns the mineral rights in 14,619 26-100ths additional acres. A full statement of the real and personal property of the Company will be found in this report.

Total receipts	$678,949.37
Total expenditures	501,654.39
Cash on hand, Dec. 31, 1905	$177,294.98

A sale of 724 1-100ths acres of land was made to the King Philip Copper Company, a new company which was organized in November, 1905, with a capital stock of 100,000 shares to acquire and operate on 1040 acres of land contiguous to the property of the Winona Copper Company. In payment for the land, the King Philip Copper Company issued, pro rata, to the owners of the land, 50,000 shares of its capital stock, with $6.00 per share endorsed as paid in.

The Winona property was brought out in 1898 and has been opened very extensively, the underground work having been carried on without interruption since the organization of the company. The character of the openings in the Winona has been variable; some have been poor, as is the case in all mines, and some have been good. The best ground has been found near the dividing line betwen the Winona and King Philip, the third and fourth levels having been carried to that point, and discontinued, as they go no further. On the strength of these developments and the result of our own diamond drilling on the King Philip property, it was decided to organize a company to acquire 724 1-100ths acres of land, and 320 acres belonging to other owners but necessary to make a compact body of land, and to sink a shaft to a considerable depth. Sinking was begun in December, and the shaft is down some forty feet in the overburden, there being about seventy-five feet of it to penetrate in order to reach the ledge. The plan is to sink the shaft to a depth of about 700 or 800 feet, at the rate of about sixty feet a month, and at that depth to explore the lode thoroughly. The King Philip Company has been provided with cash by the sale to our Company of 20,000 shares of its capital stock at $6.00 per share. 50,000 shares of its capital stock were issued to pay for its land as already stated, and there remains 30,000 shares in the treasury. From the proceeds of the sale of 20,000 shares the King Philip Company repaid to this Company the sum of $17,084.70, which had been spent by us in exploring the tract.

The work at the Challenge location has been continued through the year. The shaft has been sunk to a depth of 431 feet, which is as far as it can go with the present hoist. New machinery has been obtained, and is being installed, which will make it possible to sink an additional thousand feet. The shaft is a perpendicular one and passed through what is supposed to be the Baltic-Champion lode soon after entering the ledge. The lode dips at an angle of about seventy degrees, so that it is getting further from the shaft with every foot sunk. It is planned, when the sinking is resumed, to make a turn in the shaft, so as to bring it under the vein. As this will require several hundred feet of sinking, it will be some time before we can investigate the vein below the point now reached. We have begun a crosscut from the bottom of the shaft, however, and expect to reach the vein in a few weeks. A crosscut was made at a depth of 301 feet, and drifting was done north and south of the vein, which was from 35 to 45 feet wide. Some small patches of very good ground were encountered and the character of the rock leads us to hope that the good ground may be more extensive at greater depth. To provide the means for the present and future needs of the Company a circular has been issued offering to the stockholders 10,000 shares of our capital stock at $50 per share. There were employed at the Challenge on an average, about 50 men and two machine drills were operated.

The high price of copper, from which, however, we have not yet realized any greatly increased profits, has started up more or less interest in mining land at the Lake, and we may expect that there will be opportunities to convert some of our land into cash while the interest lasts. The possibilities of the St. Mary's Company are enormous and can hardly be measured by ordinary mathematics. So far as any one knows the vast acreage of the Company may hold many Baltics, perhaps Calumet and Hecla, for the lands are located in one of the richest copper bearing districts on the globe and that has scarcely been more than pin-pricked.

ASSETS—December 31, 1905.

Land unsold, 95,838 82-100ths acres.
Mineral rights to 14,619 26-100ths acres.
Challenge Prospect.
50,000 shares of stock in the Champion Copper Company.
55,691 shares of stock in the King Philip Copper Company.
20,000 shares of stock in the Pacific Copper Company.
208 shares of stock of the Copper Range Consolidated Copper Company.
842 shares of stock in the Winona Copper Company.
80 shares of stock in the Old Colony Copper Company.
25,000 shares of stock in the Mayflower Mining Company.
600 shares of stock in St. Mary's Mineral Land Company.

Notes receivable	$99,000.00
Wood contracts in force	1,600.00
Cash on deposit	177,294.98

LIABILITIES.

Notes payable on demand	$50,000.00

KING PHILIP COMPANY.

The King Philip Copper Company was organized in November, 1905, for the purpose of developing a mining claim immediately south of Winona, consisting of 1,040 acres of land situated for the most part on the property of the St. Mary's Canal Company.

The official description of the land is as follows: N. W. ¼ of Section 30; N. W. ¼ of S. E. ¼ of 30; N. W. ¼ of 31. All in Township 52, Range 36. E. ½ of Section 25; S. W. ¼ of 25; N. E. ¼ of 36. All in Township 52, Range 37.

The eastern officers of the King Philip Comapny are: Nathaniel Thayer, President; Chas. J. Paine and J. Henry Brooks, Vice-Presidents; Arthur G. Stanwood, Secretary-Treasurer; Directors: Samuel N. Brown, Albert S. Bigelow, Chas. E. Perkus, George P. Gardner, Walter Hunnewell, Chas. N. King and Nathaniel Stone. R. R. Goodell is the local manager, and Dr. L. L. Hubbard is the Superintendent.

The King Philip Company issued 100,000 shares. 50,000 of these go to the original holders in payment for property. 20,000 are purchased by the St. Mary's Canal Company. 30,000 are reserved in the treasury for future developments. No stocks is to be put on the market.

At the present writing, the company is sinking a shaft for the purpose of opening up and testing the southern continuation of the Winona lode. The necessary buildings are up and the machinery in place for carrying on the work. Operations will be conducted systematicaly and the property vigorously and thoroughly explored.

SUPERIOR COPPER COMPANY.

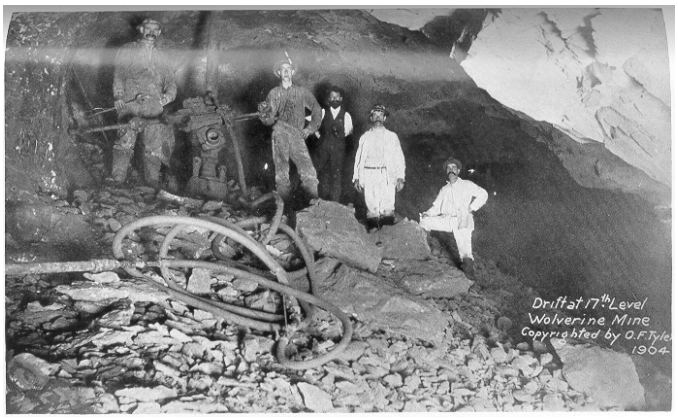
The Superior Copper Company was organized in 1904, under the laws of the State of Michigan, with capitalization of $2,500,000 in 100,000 shares, par value $25.00 each. The Company has 400 acres of land in Section 15, Township 54 North of Range 34 West, in Houghton County, Michigan. It is situated just east of Section 16, belonging to the Atlantic mine, which is next, north of the Baltic Copper Mining Company, belonging to the Copper Range Consolidated Company group of mines.

It has about one mile of outcrop of the "Baltic" lode and has about 400 acres of surface with underlay of the lode. This vein was opened by test pits and trenches in different places, for a length of over 3,000 feet and showed copper and copper indications at nearly every point opened and in these trenches, the vein was shown to be about forty to forty-five feet in width. At the point where the shaft was started the vein was shown to be about forty feet in width, the copper well disseminated throughout the width of vein. The shaft was sunk to a depth of about 70 feet where a cross-cut was made showing the vein to be about the same width and with a decided improvement in the copper contents of the rock.

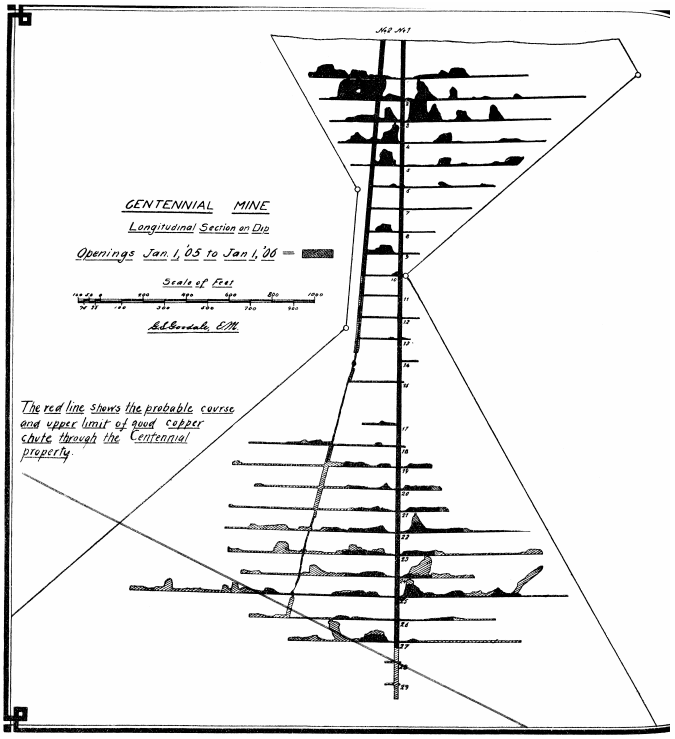
Drifting was extended at this level, 50 feet north and 50 feet south. The shaft was then sunk 100 feet to the second level. At this point the vein was cross-cut and found about the same width. From this cross cut drifts were extended both north and south for a distance of about 250 feet each way. Copper was in evidence at all times in both drifts. In the south drift it being especially rich, comparing well with the richer portions of this vein as found in the Baltic mine.

Drifting was discontinued and sinking to the third level was resumed as rapidly as possible. A new shaft house has been erected and a skip-road is in operation. A new boiler, compressor and hoist are in place and in operation with a capacity to sink the shaft and open drifts to a depth of 1,500 feet. Drifting will be started as soon as the next level is reached and the cross cut has been made.

I was underground in this mine last fall and looked over some of the ground then opened up and exposed. A considerable portion looked first rate, particularly in the south drift. There was, in that drift, a run of ground about 70 feet in length, I should judge that looked first rate. Heavy copper was jutting out in many places and the formation contained practically all the recognized features that denote permanence and stability of values. There is no doubt in my mind about the identity of the lode under development. It is the Baltic lode and I look to see Superior develop into a substantial mine. Development of the mine is under the direct supervision of Mr. James MacNaughton, General Manager of the Calumet and Hecla Mining Company. About eighteen men are employed at this time. The directors are J. H. Rice, R. S. Shelden, R. C. Pryor, J. P. Edwards and C. C. Douglass. Reginald C. Pryor, President; R. Skiff Shelden, Vice-President; C. C. Douglass, Secretary-Treasurer.



Drift at 17th Level, Wolverine Mine.
Photo by O. F. Tyler



WINONA.

The Winona mine is organized under the laws of the State of Michigan and capitalized in 100,000 shares, par value, $25 each. The company owned 1,568 acres of mineral land with the Winona amygdaloid outcropping thereon for a mile and one-half in length. The principal shaft which is No. 2, has been sunk to the 10th level, about 1,000 feet deep. The mineral lode is a strong, wide amygdaloid varying in width from a few feet to 40 feet and that promises to yield from 20 pounds of copper to the ton of rock with ordinary selecting. Being unusually wide, the lode is big breaking and can be mined for a comparatively low cost. It dips at an angle of 70 degrees to the horizon. The development work has been carried on principally on the south of No. 2 shaft, for in that direction, the best copper values have been encountered and the mineral courses seem to make that way. The deepest opening discloses the lode strong and robust and containing mineral values that will compare quite favorably with the average of the portions mined for the mill test, which was commenced in 1902 and continued to December, 1903. In 1902-3 the company made an exhaustive test of the mine rock for the purpose of learning as closely as possible the actual percentages of copper contained in the lode. A head was leased in the Atlantic stamp-mill and 89,237 tons of rock stamped, which produced 1,784,157 pounds refined copper, or an average of 20 pounds per ton. While such a mineralization is far from the best, it is considered fair and sufficient for profitable mining when worked on up-to-date methods. Production was then discontinued and the work of opening up and developing the mine on broad, practical lines begun, and continued without intermission up to the present time. There are now large blocks of ground, carrying the regular values of the lode, opened up that will make good stoping, and when the word is given to start producing again, the mine will be in condition to send out a good round product and maintain it.

I went through the mine at the time the test was going on and saw the stopes that furnish the rock for the trial and thought the selection was made about as fair as it very well could be. The stopes were not directly under each other, but quite well scattered through the workings. Developments are carried on through Nos. 2 and 3 shafts, which are uniform in dimensions, being 6 feet by 18 feet inside measurement and three-compartment. No. 2 is the northernmost shaft, 1,000 feet deep and down to the 10th level. No. 3 is 800 feet deep and sinking to the 9th level. From end to end the length of ground opened is 3,500 feet. Shafts have been connected underground and ventilation is good. Sinking and drifting are done on contract, stoping when going on the company ground. There are 125 names on the payroll and eleven machine drills are operated. Surface equipment is adequate for developing purposes, but will need strengthening when the property is placed among the permanent producers of the district.

President, John Stanton; Treasurer, John R. Stanton; Superintendent, F. W. Denton; Mining Captain, John O. Peterson.

ELM RIVER MINING COMPANY.

Main Office, 60 State St., Boston, Mass.; Mine Office, Winona, Houghton County, Michigan; H. F. Fay, President; George C. Endicott, Secretary-Treasurer; James Chynoweth, Superintendent.

This company was organized and incorporated in the spring of 1899, under the laws of the State of New Jersey, with a capital of $1,200,000 divided into 100,000 shares, par value $12 each, fully paid and issued. The company owns 2,300 acres of mineral land situated in the heart of the mineral range and in the mine of the master lodes of the Lake Superior copper district. It is

located some distance south of the Champion and north of the Winona mines in Town 52 North, Range 36 West.

Elm River is really an exploring-development proposition and a great deal of opening work has been accomplished. The work has been intelligently conducted and executed with ability. Progress has been substantial and of the nature that counts. Shafts have been sunk, drifts and cross cuts extended into new ground and its values tested in a thorough and practical way. The company's land is crossed by the Copper Range Railroad. It carries the Winona lode and a number of others containing different grades of copper, but thus far, have been unable to discover one sufficiently rich to warrant the company equipping the property with a permanent plant for manipulating a product. The people behind this enterprise know the business of exploring thoroughly and do it right. They are enterprising and deserve to be rewarded. Company has a good treasury.

The following extract is taken from Captain Chynoweth's report for 1904:

Some formations, which were not well mineralized at shallow depths have been found exceedingly rich at greater depths, probably because they were changed or filled with their mineral contents from below.

These usually attain a greater width and a more uniform character in their downward course. Therefore, No. 1 shaft on the Winona lode, which has been given quite a thorough test at its present depth of 525 feet, should be sunk to much greater depth and thoroughly explored there. At the same time it should be opened further to the northeast on our property where I think there is a probability of finding good deposits of copper.

At the present time, we are driving a crosscut west and also opening a level north of the crosscut on lode No. 8 west of the shaft. This level is now nearly 300 feet long. It is our purpose to continue this drift further north and also investigate it south of the crosscut.

WYANDOTTE COPPER COMPANY.

This company was organized and incorporated under the mining laws of the State of Michigan in 1899. Capitalization, $2,500,000 divided into 100,000 shares, par value $25 each. The realty holdings of the company consists of 1,040 acres located in Town 52, Range 36. The property adjoins the Winona mine in the northwest and carries the Winona lode for a mile and a half or more in length besides other unidentified beds containing more or less copper values. The efforts of the management thus far have been confined to exploring the property with the hope of finding a lode carrying copper enough to develop a profitable mine. The company is exploring the Winona lode through one shaft 8 by 10 feet inside measurement down to the 6th level. It is now down 600 feet and still sinking. Levels extended from the shaft in the formation as much as 360 feet. About 25 men are employed and the work is conducted practically and economically. The Winona lode averages about thirty feet wide with the copper generally making in bunches. In order to make a profitable mine in such a formation, shafts must be sunk, levels extended and large reserves of ground developed, so that the men may be distributed through the workings to the best advantage. That is just what the Wyandotte people are doing. They know the business and are doing it right. Operations are conducted by the best plans and substantial progress has been made. It is hoped that with additional depth, the lode may be found carrying sufficient quantities of copper to warrant the company in building a stamp mill and placing the property among the permanent producers of the district.

Surface equipment is adequate for requirements and include double cylinder hoist good for 1,000 feet, a seven-ton Burt boiler, air compressor capacity to operate a dozen drills, besides supplementary additions and dwellings for employes.

President, Henry Stackpole; Secretary-Treasurer, Wm. O. Gay; Superintendent, F. L. Van Orden; Clerk, W. C. Van Orden.

ERIE-ONTARIO DEVELOPMENT COMPANY.

The following lands are held under option by the Erie-Ontario Development Company:

S. W. ¼-29-53-35.
S. E. ¼ 30-53-35.
N. E. ¼ 31-53-35.
N. W. ¼ 32-53-35.

H. F. Fay, President; Geo. C. Endicott, Secretary-Treasurer; James Chynoweth, Superintendent.

The company was organized in January, 1905. A limited number of shares were sold and work began on the property in February of the same year. Several amygdaloid lodes were uncovered by trenching test pits. None of the lodes exposed by this method of operation were of sufficient value to warrant extensive mining on them.

The Winona lode outcrops on the property and finally a shaft was started at a point on the property where this lode is exposed at the surface. This shaft was sunk 100 feet. At this point a short crosscut was extended west where it intersected the lode and levels opened on its strike line a distance of three hundred feet. Some copper was discovered but not in sufficient quantities to make it of any commercial value. It is the opinion of the management that greater values will be obtained at deeper points, therefore, sinking was resumed with the intention of investigating the lode by extensive openings five hundred feet deeper.

The mine is equipped with the necessary machinery to accomplish the amount of work laid out. Two power drills are at work sinking the shaft which is going down very rapidly.

These lands are well located on the mineral range or what is known as the copper bearing territory which lies between the eastern and western sandstones.

Undoubtedly the Baltic lode traverses these lands, and also the vast area of unexplored territory in that distance, and what is now a virgin forest will at some time in the future become great mining communities where thousands of men will be employed which will add millions of dollars to the wealth of Houghton County.

KEWEENAW COUNTY MINES.

Nine hundred and three men were employed in and about the mines of Keweenaw County during 1905.

AHMEEK.

Is a Keweenaw property of decided merit and a coming mine of the Lake district. This fact has been pretty thoroughly demonstrated by extensive developments on the Kearsarge lode, which the company is opening through two shafts sunk in the formation. The mine was opened up about a year and a half ago, and progress has been substantial and continuous. Developments have been conducted on practical lines and up-to-date methods, and the underground department is in fine physical form and approaching a condition where a substantial rock output can be produced and maintained. Rock from the openings has been stamped at the Osceola mill, but no particular effort at production has yet been commenced. The rock stamped, however, returned satisfactory values yielding about 20 pounds to the ton treated, although no material selection of ground could be made under such conditions. A little over twenty-six tons of rock were discarded in the rock house. The mine is ably managed and economically operated. The company's mineral land forms an irregular tract consisting of 920 acres in Town 57, Range 32, adjoining the Mohawk, North Kearsarge and Allouez mines. The lode averages fourteen feet wide and underlies practically the 920 acres. Its two shafts are numbered from south to north, 1,434 feet apart and sunk at an angle of about 42 degrees from horizontal. Both are three-compartment, 17 ft. 2 in. by 8 feet inside measurement with double skipways and substantially constructed. Stringers are made with concrete, which answers admirably in place of timber. The Ahmeek was the first in the district to substitute concrete for timber. Other mines have now adopted the same material in shaft construction. No. 1 is 740 feet and No. 2 is 853 feet deep. Levels below the first are 125 feet apart. The 1st, 2nd 3rd and 5th level drifts are going forward on both sides of the shaft and the usual amount of new ground is being developed that contain average values. Air circulates freely through the workings and every precaution is taken to make the mine safe and comfortable for working in. One hundred and ninety-three men are employed and 10 machine drills operated, the maximum capacity of the compressor in service.

Seventy-eight thousand three hundred and sixty tons rock was treated in 1905, which yielded 1,552,957 pounds refined copper. The product will be materially increased in 1906. The company is installing a permanent equipment designed for the property, which will be good for many years to come. Machinery and power buildings are substantially constructed of stone trimmed with brick and look well. All are conveniently located for direct economical work and the best results. When finished and in full running order, it will be very complete and form one of the most economical and efficient plants in the district. One central power house located on the foot wall side of the lode will contain separate powerful hoists for each shaft lifting counter-balancing skips carrying seven tons of rock to a trip. A 45-drill capacity compressor will be installed in the same building. Machinery will be Nordburg build. One central rockhouse will also be used for both shafts. Skips will dump automatically in trams; and they, in turn, will dump on grizzles in the rock house. The fine stuff passing through to rock bins. The coarse stuff is broken with rock crushers. The rock output will be manipulated readily and economically. During the past summer the company built a number of comfortable dwellings for the use of their employees.

President, A. S. Bigelow; Secretary-Treasurer, W. J. Ladd; General Manager, Norman W. Haire; Superintendent, W. J. Uren; Surface Superintendent, Russell Smith; Mining Captain, Thomas Rapson.

ALLOUEZ MINE.

Allouez is a deep level mine and works the western continuation of the Kearsarge Amygdaloid lode, as it passes to the westward through the land of the Ahmeek mine to that of the Allouez. The company's main tract of land in which the mine is opened consists of 640 acres situated in Section 31, Town 57, Range 32, and carries the Calumet and Allouez conglomerates, Osceola amygdaloid and the underlay of the lode which the company mines. Allouez has no outcrop of the Kearsarge lode, but reaches it and recovers the product through a large shaft over 2,000 feet deep. The lode outcrops come to the surface in the lands of the Ahmeek, some distance east of the Allouez workings and dips westward and down into the interior of the earth on an incline plane of 38½ degrees from horizontal. In its onward course to the west, it reaches the Allouez land, which underlies every foot of it and sinks away down to unknown depth and distance. Shafts in this mine can be sunk to over 9,000 feet before reaching the company's western boundary lines. The Allouez people take up the lode and develops their mine about 50 or 100 feet beyond where the Ahmeek must eventually drop it. The lands stand in similar relation to the Ahmeek lands that Tamarack lands do to the Calumet

and Hecla. The mine forms a very interesting proposition possessing some notable features and from the start has attracted wide attention. The company is capitalized at $2,500,000 divided into 100,000 shares, par value $25 each.

H. F. Fay, President; Geo. C. Endicott, Secretary-Treasurer; James Chynoweth, Superintendent; Absalom Warn, Mining Captain.

The mine is being developed through two fine working shafts uniform in dimensions and 2,000 feet apart. They are constructed of nothing but the best and soundest material and no reasonable expense of time or money has been spared in making them solid, safe and permament. Dimensions, 9 feet by 18 feet inside measurement and three-compartment. Two compartments are used for hoisting rock, the third for ladder-way, pipes, etc. No. 1 is down into and mining the lode with remarkable success, and so far as I am aware, unequaled results for the time the work has been in hand. Number two is still in the wash or overburden, but will likely duplicate the record of No. 1 in practically every particular—even to the quality of the lode when struck. No. 1 was sunk at a remarkable rate—rarely equaled for an undertaking requiring so much in so many ways. The shaft is continued down to a depth of 1,270 feet or within 130 feet of the lode at an angle of 80 degrees. There a curve is formed that carries it to 38½ degrees or plane of the lode and its intersection. The work is executed with much skill and forms a fine job. Above the point of intersection, the lode is reached by cross cuts—below, the shaft runs away down in the lode. Changing a vertical shaft or practically so to one of the 38½ degrees was a new feature in Lake Copper mining, but it works like a charm. I have been over it in the skip and never detected any more jar or friction than anywhere else. Sinking this shaft was started May 25, 1903, and on February 17, 1905, the lode was cut at a depth of 1,400 feet from surface and on the plane of the lode, something over 2,000 feet. The lode was struck in the middle of February, 1905, and by the last day of the same year, there had been developed 3,060½ feet of opening work; 41,120 tons of vein rock hoisted and treated at the stamp mill; 1,167,957 pounds refined copper produced and sold, and a net profit of $19,143 made over all expenses of every kind. The product of rock was treated by one head and leased from the Centennial stamp-mill running half time from August 1, 1905, to January 1, 1906. Regarding these results, President Fay, in his annual report, says: "The production secured from the use of one stamp head half time, with no advantage accruing because of the advance in the price of copper early in December, 1905, is, we believe, without parallel in Michigan copper mining. With the full use of one stamp head, the unprecedented demand for copper which shows no sign of abatement, the satisfactory conditions now existing at No. 2 shaft and the continued richness of the lode at No. 1 shaft as evidenced at the 6th level, the outlook for this year is most encouraging."

The average number of men employed during the five months was 215, and average number of drills operated, 15½. The shaft came down on an exceptionally fine lode, from sixteen to eighteen feet wide and enriched from wall to wall with strong heavy copper. No. 1 equipment is new, of the best, and arranged for direct service and economical results. Hoist has direct action and capable of lifting ten-ton loads from a depth of 5,000 feet. The drum is double conical with a maximum diameter 18½ feet. Skips counter-balance in shaft, carry five tons of rock to a trip and dump on grizzles. Practically all stampmill size stuff pass through to rock bins. Large rocks roll by gravity to rock house floor directly by powerful crushers, through which they are run and the mine output is ready for the stamp-mill. The shaft rock house is bulit of steel, well lighted, spacious and among the best in the district. It has a fine appearance. Compressor plant, shop equipments and supplementary additions are also practical, about as good as there is going and located for the best results. Everything runs very smoothly and results must be satisfactory. Rock coming out is fully up to the average of the output and the future of the property looks very promising.

MOHAWK MINING COMPANY.

This company was incorporated under the mining laws of Michigan in November, 1898. Capitalization, $2,500,000 in 100,000 shares of a par value of $25 each.

The company operates the Mohawk mine situated in Town 57, Range 32, Keweenaw County, Michigan. Mine location consists of 800 acres mineral land forming an irregular tract, carrying the Kearsarge lode in which the mine is opened for over a mile and one-half in length. The Mohawk is the most important mine in Keweenaw county, and the first in the county to earn and pay a dividend working an amygdaloid vein. Mine adjoins the Ahmeek on the northwest and is about five miles from the town of Calumet and the famous Calumet and Hecla mine. This mine was opened in 1898 and paid its initial dividend of $200,000 or $2 per share in January, 1906. The matter of getting a property on a safe and sound financial basis before declaring dividends often proves a trifle tedious to stockholders, but in the long run, they realize that it is for their permanent benefit. The following statements, taken from the annual reports of the Company show:

	1905.	1904.
Total receipts	$1,460,587	$1,058,502
Total expenditures including freight, smelting, etc.	916,727	749,625
Mining profit	$ 543,860	$ 308,877
Construction account	131,687	178,400
Net profit	$ 412,173	$ 130,477
Previous surplus	383,941	253,464
Dec. 31, 1905, Balance assets	$ 796,114	$ 383,941

Product sold for an average of 15.53 cents per pound. Total openings for the year amounted to 10,812 feet of which 10,023 feet was drifting and 789 feet in shaft sinking. Total stoping was 32,410 fathoms of ground.

Average number of men employed is 768. Fifty machine drills are operated and about 50,000 tons of rock a month hoisted. Mine is being opened up on broad, practical lines and economically operated. Since the beginning of work, progress has been steady and substantial. Big sums of money have been spent in its development and equipment. Earnings year after year were spent in strengthening its position. Expenditures have been well placed and will prove an excellent investment. Mohawk is a substantial mine with a good future and opened up for years ahead. Amount of rock stamped in 1905 was 586,305 tons, which yielded 9,387,614 pounds refined copper. Seventeen pounds of copper to the ton is a low grade proposition and means that if substantial profits are to be made, a heavy rock output must be manipulated and rigid economy practiced. To that end, the management is shaping the policy of the mine and mining and milling rock for about $1.40 per ton. To anticipate the future is the most important object of human effort and intelligence. The mine is opened and developed through five shafts, Nos. I, 2, 3, 4 and 5, sunk in the lode at an angle about 36 degrees from vertical. All five shafts are three-compartment, located from 1,100 to 1,800 feet apart, with Nos. 1, 2, 3 and 4 connected underground on different levels. Levels in turn are connected by winzes or raises that bring good ventilation and make the workings airy, cool and comparatively comfortable for working in. No. 5 is the southernmost and much newer than the others. It is 300 feet deep, but has not yet been connected with its nearest neighbor, No. 4. That, however, will come in good time. The average depths of the four older shafts is about 1,150 feet. From end to end, the mine openings are over 6,000 feet in length. Aggregate openings in these four shafts will foot up five or six miles, perhaps more, and hold an enormous amount of developed lode carrying the usual values of the mine. The Kearsarge lode is a deep level proposition developing its best values from a depth varying from 1,000 to 3,000 feet below the surface. In Mohawk, it averages about 16 feet wide, which is about the general run of the belt. The deepest openings in the mine look the best. The last two or three levels developed show a considerable improvement over those above and the stamp mill reflects the improved condition.

Surface equipment is practically new, of the best and capable of doing the work of the mine efficiently and economically. Machinery and power houses are well located, constructed mostly of mine rock trimmed with sandstone and look well. Hoisting plants are modern, up-to-date, lifting skips counter-balancing in shafts carrying four tons to a trip. Nos. 1, 2, and 4 have permanent hoists; 3 and 5 temporary but good for some years yet. Each shaft has combination rock-shaft-house fitted with heavy crushers and trip hammer designed for the work. Skips dump automatically on grizzles. Fine stuff pass through to the rock bins; the coarse rolls to rockhouse floor and is then run through powerful crushers. The work is readily and economically done. The company's stamp mill is located at Gay, Traverse Bay, on the shore of Lake Superior about 13 miles from the mine. Site is an excellent one. The mine and mill are connected by a railroad owned by the Mohawk Mining Company and operated by the Mineral Range Railway Company. The mill is built of steel on rock foundation 178 by 216 feet in dimensions. It is equipped with three modern heads. One is of the steeple compound type. They in turn are equipped with the best machinery and fittings known for washing and saving copper. The mill is airy and light and among the best in the district. Machinery is actuated by steam power. It runs smoothly and gives general satisfaction. Both the mine and the mill locations are well provided with comfortable dwellings rented to employes on liberal terms. Both on surface and underground, the property is in fine physical condition.

President, Joseph E. Gay; Secretary and Treasurer, John R. Stanton; Superintendent, Fred Smith; Assistant Superintendent, Will G. Smith; Clerk, Frank Getchell; Mining Captain, John Trevarrow; Mill Superintendent, B. S. Shearer; Engineer, Wm. Hartman.

This company sustained a severe loss in the death of Mr. John Stanton on February 23rd, 1906. Mr. Stanton was president and a director of the company since its organization.

KEWEENAW COPPER COMPANY.

This company, as the title indicates, is a Keweenaw County corporation organized for the purpose of developing the mineral and other resources of that county. There are the very best of reasons for believing the company will prove a decided success and an excellent business enterprise. This and other companies may be the means of restoring to "Old Keweenaw" a portion, at least, of the fame and prestige the county once enjoyed as copper producers of Michigan and of the United States. The company owns 11,550 acres of mineral land, 920 acres of timber land and surface rights on 385 acres in Keweenaw County. The mineral lands lie in Town 58, Ranges, 29, 28 and 27 west and so situated as to encourage the belief that they contain valuable copper deposits. This company owns a complete diamond drill outfit and has succeeded in locating the Montreal lode and has taken out from that bed some well mineralized rock cores. Much of this land is known to be traversed by many copper bearing lodes. One of the formations—the Montreal River lode—which runs through the company's territory for great length—is being vigorously developed by the Calumet and Hecla Company in its Delaware tract through a shaft 100 feet. The lode here looks exceptionally well and carries heavy, strong copper from the grass roots to bottom and

quite evenly distributed throughout its entire width. And it bears all the "ear marks" that denote continuity and stability of values. It looks well. Keweenaw Central people have also located good values on its Mandan Medora property with the diamond drill. Besides a large portion of the land is covered by a heavy growth of forest that will prove very valuable for mining, domestic and other purposes. There is a pressing demand all over the peninsula for desirable mining and all other kinds of timber. The company will likely become something of a security holdings corporation by setting off and developing new mines. Its realty holdings are ample for such purposes and contain the mineral values requisite for its accomplishment. The preliminary work of the company will be the building of a railroad from Calumet to Lac La Belle, a distance of 32 miles. Lac La Belle is one of the finest natural harbors on Lake Superior, but suffers from shoal water, due to the formation of a sand bar across the mouth of the entry. This can be removed, however, at a small cost, and the harbor can be kept open by a small amount of dredging annually thereafter, as the bar forms slowly. The opening of this fine natural harbor will be hailed with joy by the marine interests, as it will afford to vesselmen, a much needed harbor of refuge on the eastern shore of the Keweenaw peninsula, a point that is noted for the severity of its storms, the inhospitable nature of its shores, and the scarcity of its harbors. The Keweenaw Central Railroad, it is expected, will be completed and in operation during the summer of 1906, and that it will furnish the old Keweenaw county with the long-needed railroad facilities, which should rapidly develop its mineral resources and prove a profitable adjunct to the Keweenaw Central Railroad company. The line of the Keweenaw Central Railroad running north from Calumet, where it connects with the Mineral Range and Copper Range Railroads passes through or close to in the order named the following mining properties: Centennial, South Kearsarge, Wolverine, North Kearsarge, Allouez, Ahmeek, Mohawk, Seneca, Cliff, Phoenix, Frontenac, and Manitou, the last having been operated in the summer of 1905 under the control and management of the Calumet and Hecla Mining Company. Its lands adjoin those of the Keweenaw Copper company. The Keweenaw Central Railroad is believed to be unique in railroad construction in America, in that it will be completed and put in permanent operation without a dollar in bonds or indebtedness. The funds for its construction are secured entirely from the sale of its stock, all of that which is sold having been taken by the Keweenaw Copper Company and further funds, as needed, will come from the same source. The Company will have, after the completion of the road's construction and equipment, fully $200,000 available, with which to conduct its exploratory and mining operations. The company has a capital of $10,000,000 divided into 400,000 shares at $25 each, of which 150,000 shares will be issued, the remainder will be kept in the treasury to be sold to meet future developments. The Keweenaw Copper Company has also acquired the Lac La Belle and Calumet railroad, which will be extended the coming summer.

President, Charles A. Wright; Secretary-Treasurer, C. A. Wright, Jr.; Vice-President, Spencer R. Hill; Thomas Hoatson, Second Vice-President and Mine Director.

PHOENIX.

Was organized under the mining laws of the State of Michigan in April, 1899, with an authorized capital of $2,500,000 divided into 100,000 shares, par value $25 each.

John R. Stanton, President; Secretary-Treasurer, J. Wheeler Hardley; Agent, Frank McM. Stanton; Eastern Office, 13 William St., New York; Mine Office, Phoenix, Keweenaw County, Michigan.

The property of the Phoenix Consolidated Copper Company is situated in Town 59 North, Range 31 West, and consists of 2,505 acres lying on the slope of the Mineral Range and embraces three old mines, namely: Phoenix, St. Clair and Garden City, besides a tract with a mile and one-half frontage on the shore of Lake Superior adjoining the port of Eagle Harbor.

The property was opened up in the early days and worked off and on for many years under different managements and produced considerable copper. The mine succeeded in paying one dividend in 1877 amounting to $20,000. A huge mass of almost pure copper weighing upward of 500 tons was taken out of the Phoenix property. It is supposed to have been the largest mass ever discovered in the history of copper mining. Several cupriferous veins fun through the property, but the most important ones thus far discovered are the Phoenix, West Phoenix, Armstrong and Robbins or West vein. The four fissures crosses the stratified belt at right angles. The mine is developed through two main working shafts and sunk on two fissures. The southwest one is about 1,000 feet deep and sunk on the Robbins or West vein. It is vertical, and was the Old Phoenix shaft cut down, enlarged with two compartments, one for skip way and the other for ladders, piping, etc. The levels have been extended laterally north and south, and in the upper levels, some very good ground was developed. The principal part of the product came out in the form of mass and barrel metallic copper. The vein is irregular in general characteristics and comparatively narrow, consequently, a great deal of new ground must be made right along in order to maintain a regular output of copper rock. Unable to pay expenses, the mine was closed down last year and is still idle. Product of fine copper made in 1905 was 273,219 pounds.

Phoenix company sustained a severe loss in the death of Mr. John Stanton on February 23rd, 1906. Mr. Stanton was president and a director of the present company since its organization.

SENECA MINING COMPANY.

Office, Boston, Mass.; A. S. Bigelow, President; W. J. Ladd, Secretary-Treasurer; Capitalization, $1,000,000; par value, $25.

Lands are located north of Mohawk and Ahmeek mines. Lands consist of 1,800 acres situated in Keweenaw County and undoubtedly hold important values. Idle.

MISKAWABICK MINING COMPANY.

This is a development association formed for the purpose of exploring a large tract of mineral land located in Keweenaw County. The property consists of some 1,000 acres and possesses the Kearsarge lode on its strike for a mile and one-half or more in length and in all probabilities, other unidentified mineral deposits. The association has been carrying on extensive exploratory work on the property in search of the Kearsarge lode carrying values sufficient to make a profitable mine. The work has been conducted on practical lines and substantial progress has been made. Nothing showing distinctive values, however, has been discovered although what was thought to be the Kearsarge lode was uncovered in three or four pits. A shaft was sunk 170 feet deep and drifts extended from both ends for considerable distance without finding anything to warrant continuing the drifting. The Kearsarge lode is a deep level proposition and in places, like a “Will-o’-the-Wisp.” From bottom of shaft, a diamond drill was then run down 500 feet deep without encountering the Kearsarge lode. Property is well located and a little persistent search should bring its reward.

Captain James Chynoweth has direct charge of the work.

Conglomerate Mining Company embracing the old Northwest, Pennsylvania, Delaware, Mindola, New Jersey, Maryland and Wyoming properties and the Central Mining Company's property have been absorbed by the Calumet and Hecla Mining Company; the Old Cliff by the Tamarack Mining Company. The Resolute, Mandan, Medore and a number of other different properties now form a part of the Keweenaw Central.

And word has just been received that the Washington property has also been absorbed by Keweenaw Central. The Washington has a large area in which it is possible for copper values to be found, and a mill site of considerable value.

CLIFF MINE.

This mine, from which there was taken more silver, it is claimed, than any other copper mine of Michigan, was first operated in 1846. From 1846 to 1853, sales of copper from this old mine netted, $1,328,406. Dividends paid during the same period amounted to $462,000. The depth attained was 462 feet and length of lateral openings about 1,200 feet. Owing to the impoverishment of the lode in the bottom levels, work was discontinued in 1870. From the beginning of operations up to this period, the company had paid to stockholders $2,627,660 or a little over 2[.]000 per cent. on the paid up capital. Two years later, in 1872, the mine was unwatered and started up again under a new organization, which continued until 1887, when all work was discontinued and the shafts allowed to fill with water. The Tamarack Mining Company now owns the Cliff property and it has recently been conducting some diamond drill work there for the purpose of learning with some degree of definiteness what values the lodes underlying the property may contain at moderate depth.

ASHBED MINING COMPANY.

In May, 1905, Superintendent Clark put a force of men to work on the Ashbed mine and put things in ship shape for actively and vigorously exploring the property. Things are already beginning to show the effects of systematic work and the property is taking out a new appearance. In early times, the Ashbed, or what was then known as the Petherick, was held in high esteem, and a gentleman who was on the ground when the mine was worekd by the late Captain John Uren tells the writer that the lodes there—Ashbed and Fissure both—were really rich and about as good looking copper belts as a man wished to see. Superintendent Clark has had many years’ experience with Keweenaw mineral beds, knows them thoroughly, and is splendidly equipped for the work. This Ashbed is practically of the same grade as the Atlantic lode with transportation facilities and metal selling at a fair price, its prospects are generally looked upon as quite favorable. The fact that Keweenaw County has never had railroad transportation, has always been an obstacle in the way of the development of the Ashbed lode. But once it is brought into communication with the outside world by rail, so that machinery may be brought in and production shipped out at less prohibitive prices, the aspect of the Ashbed lode on the various properties, which it traverses will be completely altered. The Ashbed formation underlies the Phoenix, Ashbed and Arnold properties, as well as all of the .properties to the northward in the same horizon. The company is sinking a shaft 7 feet by 10 feet in dimensions from the third to the fifth levels and drifting on the Ashbed bed and a fissure vein in order to show the quality of the rock at additional depth. The shaft is about 225 feet deep. Three machine drills are operated and twenty men are employed. Capitalization, $1,000,000, par value $25 each in 40,000 shares. Secretary, John Brooks; Superintendent, Wesley Clark.

ARNOLD MINING COMPANY.

Was incorporated under the general mining laws of the State of Michigan in 1864, and capitalized in $2,500,000 divided into 100,000 shares of par value of $25 each. Issued 60,000 shares. The property consists of 3,323 acres of land in Town 58 North, Range 30 West, Keweenaw County, Michigan. Its holdings are divided into two groups known as the Copper Falls mine and the Arnold; Copper Falls having been absorbed in 1898. Copper Falls was extensively worked in former years and produced 12,843 tons, 429 pounds and paid dividends to the amount of $100,000. The product was principally produced in the Owl Creek fissure vein. The Arnold property was developed on an ashbed amygdaloid of low grade. Has been idle since 1901.

President, C. Howard Weston; Agent, Wesley Clark; Main Office, Boston, Mass.; Mine Office, Copper Falls, Michigan.

HUMBOLDT COPPER COMPANY.

Lands of this Company lie just west of the Arnold and comprise 1,103 acres of mineral land. Capitalization, $1,000,000. Number of shares. 40,000, of par value of $25 each. Mine has been idle since 1901.

President, John C. Watson; Secretary-Treasurer, John Brooks; Superintendent, Wesley Clark.

MEADOW.

The Meadow adjoins the Humboldt and Phoenix properties. Lands, 364 acres. Has been slightly prospected.

President, W. F. Fitzgerald, Boston Mass.; Agent, Wesley Clark, Copper Falls, Michigan.

ONTONAGON COUNTY MINES.

ADVENTURE CONSOLIDATED.

Is one of the oldest mines in the Ontonagon district and in early days formed quite a factor in the copper district. Mine location is situated at Greenland, Michigan, in Sections 35 and 36, Town 51, Range 39, and in Sections 1 and 2, Town 50, Range 39, and consists of 1,706 acres of mineral land besides a mill site of 320 acres on which the Company has a modern stamp mill. Adventure Consolidated is capitalized at $2,500,000 divided into 100,000 shares, par value $25 each.

President, Isaac H. Messerve; Secretary-Treasurer, William R. Todd; Superintendent, Samuel Brady; Assistant Superintendent, S. Howard and Brady; Clerk, S. A. Prince; General Office, 45 Broadway, New York; Mine Office, Greenland, Michigan.

Three hundred men are employed and sixty power drills operated. In 1905, 130,985 tons of rock were treated that produced 2,700,208 pounds mineral which yielded 1,606,208 pounds refined copper. Average price realized per pound, 15.7 cents. Balance of assets, January 1, 1906, $53,753.79.

The mine is developed and operated through three shafts, Nos. 1, 3 and 4 are sunk on the Knowlton lode, although the bulk of the product comes from No. 3. During 1905 a limited amount of work only was done in No. 1 while No. 4 is practically a new shaft. The property is crossed by a number of copper bearing belts, most of which have been explored and investigated from time to time. Superintendent Brady gets the best results from the Knowlton, and practically all recent developments have been conducted in that formation. Like most of the amygdaloid beds of the region, the Knowlton is a strong, but irregular lode, with the best copper values making in bunches separated by bars of unprofitable ground, varying in extent. To secure the best results large reserves of ground must be opened up and developed ahead. Miners may then be distributed throughout the openings and select copper bearing courses to the best advantage. There is nothing like a few good backs held in reserve when a lode is bunchy and irregular. No. 1 shaft is 8 feet by 20 feet in dimensions, three-compartment and 765 feet deep. No. 3 is 8 feet by 18 feet, three-compartment, and 1,080 feet deep, and No. 4 is 210 feet and the same size as No. 1.

Shafts Nos. 1 and 2 are connected underground and ventilation is good. The usual amount of opening work is underway developing fresh reserves. The lode in No. 4 has looked very good from the start. It is unusually wide, fairly uniform and fully as rich in the different grades of copper as the average of the mine. Tributary to No. 3 the lode carries average values, perhaps a little better. Practically every department of the mine has been improved some during the past year or two, and its position materially strengthened. A little betterment here and a little there and “many a mickle makes a muckle.”

Surface equipment is powerful, practically new, highly efficient very complete and good for years to come. The machinery is in thorough repair and renders first-class service. The company’s stamp mill is 135 by 217 feet in dimensions, built of steel, and located at Edgemere, on the shore of Lake Superior. The site is an excellent one with water the year round. The mill is equipped with three heads and the necessary fittings and appliances for washing and dressing copper. Buildings and locations are lighted by electricity. Both mine and mill locations are provided with a number of comfortable dwellings for the use of employees. The property is well managed and economically operated.

MICHIGAN COPPER MINING COMPANY.

This company was incorporated under the mining laws of the State of Michigan, June 15th, 1899, with an authorized capital of $2,500,000 divided into 100,000 shares of a par value of $25 each. The company owns 4,870 acres of mineral and 1,264 acres of timber lands located in Town 50 and Range 39 near Rockland, Ontonagon County, Michigan. The mine is not a new discovery but a consolidation of three old pioneer mines, the Minesota, Rockland and Superior. In early days they were considered substantial mines and are credited with having produced, previous to the present organization, 3,388 tons 1,640 pounds refined copper, besides considerable native silver, most of which the miners and trammers appropriated to their personal cabinets. The Michigan is developed and operated through two active shafts—A and B—sunk in the Calico lode. 308 men are employed and 34 machine drills operated. Shafts are 8 by 20 feet in dimensions, three-compartment and 1,781 feet deep. The Calico and Branch lodes are mined. The Calico is an amygdaloid of peculiar appearance usually breaking to a face and displaying on the same face varying colors. It is a strong, well defined belt, but like most other mineral formations of the district, irregular and bunchy. In order to get the best results long stretches must be developed so as to be enabled to select ground to the best advantage. I was over to the mine last summer and saw some nice rock from the Calico lode just as it was dumped in the shaft house. It looked well and carried good copper values. The Branch vein, however, promises to form the chief source of supply. It is a fissure running diagonally through the Calico and lies, on the 5th level, only about thirteen feet distant on the footwall side. It averages about four feet wide between well defined walls and promises a great deal for the future of the mine. Some of the openings there disclose exceptionally rich bunches of ground that will yield excellent values in mass and barrel rock and good stamp rock. Lying so closely together the two veins can be worked jointly to great advantage, as the rock from both can be hoisted through the same shaft and manipulated by the same surface equipment. The management is now developing this Branch vein in a northerly direction towards the Old Rockland, now forming a part of the Michigan. Continuous and substantial progress has been made. This vein is reached by a series of crosscuts driven from the workings in the Calico lode at B shaft, and about one-third of the product comes out in the form of mass and barrel copper. The 8th, 9th and 10th levels have been driven as much as 1000 feet from B towards C shaft, and some fine stretches of ground carrying heavy copper developed. The company has a large block of territory in this direction practically unexplored and indications are that it contains substantial and important values. It has no stampmill but treats its rock output at the mill of the Mass Mining Company. In 1905 there was stamped 151,440 tons of rock, which yielded 3,983,736 pounds of mineral and 2,891,796 pounds refined copper or something over nineteen pounds to the ton of rock treated. The Mass mill did very well, but the time is not far distant when Michigan will likely need a mill of its own. The company owns a good site consisting of 150 acres adjoining the Mass mill site. The property is in good physical condition and economically operated. Mechanical equipment is mostly modern and up-to-date. In the natural course of development, it will need strengthening from time to time to care for bigger and better things.

John Stanton, President; Jno. R. Stanton, Treasurer; Samuel Brady, Superintendent; S. Howard Brady, Assistant Superintendent; Henri Stubansky, Clerk.

Boston, April 28.—The Michigan Copper Mining Company reports for the year ended December 31, 1905, as follows:

	1905.	1904.	1903.	1902.
Pounds copper sold	2,891,796	2,746,127	275,078	166,898
Received for copper	15.69c	13.05c	12.58c	12.17c
Received for copper	$453,683	$358,540	$34,532	$1,114
Received from assessments		59,424	252,328	190,471
Received from interest		1,020	1,387	
On hand January 1	108,020	43,945	60,932	13,972
Total credits	$561,703	$463,114	$349,179	$225,876
Expenditures—				
Expenses at mine	$362,277	$319,727	$288,272	$157,564
Other expenses	45,490	35,367	16,691	7,380
Construction	46,687			
For "Superior" property	4,000			
Total expenses	$458,454	$355,094	$305,233	$164,944
Surplus December 31	$103,249	$108,020	$43,946	$60,932

The balance sheet as of December 31, 1905, compares as follows:

ASSETS.

	1905.	1904.	1903.	1902.
Cash	$ 8,502	$ 9,066	$ 1,498	$ 6,199
Dep. in trust company	5,482	15,537	63,349	47,387
Cash and supplies at mine	22,941	18,956	13,093	18,550
Copper on hand sold	125,601	96,668		

	1905.	1904.	1903.	1902.
Accounts receivable	2,284	927	25,370	8,089
Total	$164,811	$141,154	$103,310	80,225

LIABILITIES.

	1905.	1904.	1903.	1902.
Indebted at mine	$ 48,614	$ 24,488	$ 18,594	$12,550
Loans		38,500	38,500	6,492
Accounts payable	12,947	8,646	2,270	251
Surplus	103,249	108,020	43,946	60,932
Total	164,811	141,154	103,310	80,225

The report says: Production has continued steadily during the year and toward the end of the year attained about the limit of our stamping capacity. It has been decided to erect a stampmill to contain two head of stamps and all necessary machinery to operate the same, of the most modern type. The mill will be erected on the site at Keweenaw Bay owned by the company. The "Branch vein" from which most of the year's product was derived still continues to look well for the future.

Considerable exploring has been done at several points on our property and while the work done on the old Minesota lode did not reveal copper in paying quantities, the work at other points was invariably encouraging.

This Company sustained a severe loss in the death of Mr. John Stanton on February 23rd, 1906. Mr. Stanton

was president and a direrton of the company since its organization.

MASS CONSOLIDATED.

The mineral lands of this company consist of about 2,400 acres, including the properties of the Ridge, Mass, Ogima, Merrimac and Hazard, the first three are old mines that were worked many years ago, one of which, the Ridge, paid dividends of $100,000, and the last two were never more than prospects. The lands are in Sections 33, 34 and 35, Town 51 North, Range 38 West, and in Section 1, Town 50, North 39 West; and six of the several mineral bearing belts of the range outcrop on the Company's lands, while the several properties are compact and advantageously grouped for economical and extensive mining.

The Knowlton, the most northerly of the mineral belts traversing the properties, is a strong, healthy formation and well defined, and in the bulges, frequently quite rich in mass and barrel copper and stamp rock. One hundred and twenty feet south of the Knowlton is the Mass vein, which is irregular and pockety as to mineral contents. Two hundred and ninety feet south from the Mass is the Butler, sometimes called the Champion, resembling the Knowlton in general characteristics. It ranges from ten to thirty feet in width with an average of about sixteen feet. Some ninety feet still further south extends the Ogima which is narrower than the others, and classed as a stamp mill proposition of low grade. The Evergreen, the most southerly belt, is 290 feet from the Ogima, and is considered one of the best copper bearing belts in the Ontonagon district. These belts are all amygdaloid and run parallel to the stratification of the range.

The Ontonagon mines are not new discoveries, the Ridge and Adventure being opened in 1850, and the old Mass in 1856. In 1860 the Ogima was opened and worked at intervals for some eight years.

Up to the time of the organization of the present company, the aggregate production of the mines forming the Mass Consolidated, were 5,567 tons 449 pounds of copper, and the Ridge was the only property to make any returns to the stockholders.

Once established that the several formations can be worked jointly and made to furnish sufficient copper, and returns to pay all expenses with fair interest on money invested, and success would be assured, as the Mass Consolidated can be worked on a prodigious scale, there being 7½ miles of lode outcropping within the Company's boundary lines, with practically inexhaustible supplies of copper rock.

Thus briefly referred to are the properties which the Mass Consolidated Copper Company was organized to develop and operate for the production of copper along methods of modern mining.

The present organization was incorporated in 1899 with an authorized capital of $2,500,000 divided into 100,000 shares, par value $25 each.

The company employs 350 men and operates a 50-drill air compressor. The mine is opened and operated through three shafts, A, B, and C, sunk in the lodes. A. and B. are sunk in the Evergreen belt and C. in the Butler. A. shaft is three-compartment, down to the 15th level and 1,600 feet deep. B. is 1,700 feet deep to the 16th level and C. is 600 feet deep to the 5th level. Crosscuts connect the Evergreen with the Butler on the 9th, 10th, 11th, 12th and 14th levels. Shafts are connected on different levels and the mine is systematically opened up for the best results. Levels are extending both sides of the shaft developing blocks of ground containing average values of the mine. Levels are connected by winzes that ventilate the workings and make them comfortable for working in. Every precaution is taken to make the underground workings safe for taking out the product. The "back filling or caving" system is used for taking out the product and it seems to answer admirably for the belts the company mine. There is scarcely any timber used in the work. About 25 per cent. of the rock broken is left underground for filling in purposes. There is no cost going away in tramming and hoisting this waste. Underground workings are in good physical condition and well managed. Management is conservative and aims to get out the best there is in the property. Future requirements are anticipated and provided for well in advance. Reserves of ground have been added to with a view of increasing the mine product. During the past year, the company operated but one head of its stamp mill, but has decided to put the second in commission in the near future.

Results for two years compare as follows:

	1905.	1904.
Total receipts from copper, silver and interest.	$ 334,534.00	$ 289,465.00
Total expenses for all purposes	279.454.00	258,134.00
Surplus receipts for year	55,079.00	31,330.00

Product compare as follows:

	1905.	1904.
Tons rock stamped	143,430	105,614
Mineral obtained, pounds	2,761,490	2,909,830
Fine copper obtained, pounds	2,007,950	2,182,931

Mechanical equipment is highly efficient, in good running order and economically operated. Buildings and location are lighted by electricity. The company has a modern two-head stamp mill with latest in concentrating appliances for washing and saving copper. Its daily capacity is 1,100 tons of rock. It now treats about 550 tons daily. The mill is located on Keweenaw Bay about 33 miles from the mine.

During the year 1905 the company opened up, all told, 9,208 feet or well on towards two miles of new ground distributed as follows:

Shaft sinking	626 feet
Drifting on lodes	7,128 feet
Cross-cutting	1,454 feet
Total..	9,208 feet

Superintendent Wilcox, on "General Remarks" in closing his report, writes:

"At C Shaft a rock house is under construction; the foundation walls are finished, and the contractor is now engaged in erecting the superstructure. Great delay has been caused by the difficulty in getting timber. The timber is now all on the way, and the work will be pushed to completion.

During the fall months the Mineral Range Railroad Company extended their tracks to the rockhouse at C Shaft, and shipments of rock at this point will commence as soon as the rock house is finished.

The openings in the mine are so far in advance of the stoping, and the general conditions so promising, that we planned to make use of both stamp heads in our mill as soon as the contract with the Michigan Copper Mining Company expires.

In conclusion, I am greatly elated by the good showing in the mine and the prospects for excellent results when we get the second head, and the rock coming from C Shaft."

President, Charles A. Lamb; Secretary-Treasurer, W. A. Bancroft; Superintendent, J. M. Wilcox; Clerk, W. A. Brown; Mining Captain, Thomas Hall.

VICTORIA COPPER MINING COMPANY.

This company was incorporated January 16, 1899, under the general mining laws of the State of Michigan with an authorized capitalization of $2,500,000, divided into 100,000 shares of par value of $25 per share.

Eastern Office, 53 State St., Boston, Mass.; Mine Office, Victoria, Ontonagon County, Michigan; President, Calvin Austin; Secretary-Treasurer James P. Graves; Superintendent, Thomas Hooper; Mining Captain, George Hooper.

The company owns a very large, but rather irregular tract of mineral and timber lands consisting of 2,340 acres in Town 50, Ranges 39 and 40, Ontonagon County, Michigan. The lands are situated west of the Ontonagon river, and about three miles west of the Village of Rockland and something like a mile from the Chicago, Milwaukee & St. Paul Railway. The mine location occupies a very conspicuous place on the top of a hill or plateau, and is the westernmost producing mine in the Lake Superior Copper district with the Michigan, Mass and Adventure situated a short distance to the northeast. The Michigan is the nearest mine.

An ample supply of pure water for domestic purposes is obtained from a large well sunk on the location and pumped by a steam windmill to places convenient of access.

The mine is opened and developed through one working shaft sunk on the Evergreen lode, which runs through the property for 3,000 feet in length. The shaft is 8x12 feet in dimensions, two-compartment and 2,089 feet deep. The underground department is systematically opened up and developed by levels and winzes for practical, economical mining and the lode looks well. The lode may be classed as medium grade. It runs as much as thirty feet wide in places and averages about ten feet wide throughout. It is estimated that there is three-years' ground opened up in the mine without sinking or drifting another foot. There is a large stock pile well up to the average of Lake Superior rock stored near the shaft and easily reached for manipulation.

The Company is putting the finishing touches on a modern stamp-mill located about a mile from the mine. It is equipped with one Cuyahoga head with capacity for treating 350 tons of rock daily. Water for concentrating will run through the works by gravity and the plant should be operated very economically. A very powerful hydraulic air compressor from 2,500 to 5,000 H. P. designed to run most of the mine machinery is nearly completed and will be ready for starting up in the near future. When completed, the company will have a cheap operating plant and will likely be in a position to make copper at as low a cost as any mine in the district.

The whole equipment is compact, conveniently located and arranged for direct and economical service and practically adequate for requirements.

LAKE COPPER COMPANY.

This company was organized in November, 1905, under the mining laws of the State of Michigan and capitalized for $2,500,000 divided into 100,000 shares of par value of $25 each. The property owned by the Lake Company was formerly the Old Belt of Ontonagon County, but reorganized and incorporated for the purpose of acquiring, exploring, developing and operating this property. The realty holdings of the Company consisting of 720 acres, are large, and located in the direct line of the principal copper bearing lodes of the Ontonagon district. The Knowlton, Evergreen and other lodes stretch through the lands of the company for a mile or more in length and shafts can be sunk on them to great depth and worked on a large scale. Of course, the values must be developed. Adventure, Mass and Michigan—all three are mining the Knowlton lode with fair prospects for developing profitable mines and good business enterprises. The Knowlton, it might not be amiss to remark, is a great big lode apparently thrown together with but little regard for uniformity. It runs from a few feet to as much as fifty feet wide averaging, perhaps, twenty feet with the copper contents occurring sometimes in once part and then again somewhere else. With a view to locating the best bunches of ground contained in the copper lodes to be tested and developed, the company has decided to do most of the exploring work with the diamond drill and by trenching. The people behind the enterprise are mostly local and well skilled in the most practical and successful methods for developing new propositions. With the average

values of the district located, the organization should be a decided success. The future outlook of the proposition looks promising, and it has been planned to give it a practical trial on modern methods of mining. The work will be conducted under the management of Reginald C. Pryor.

Officers and Directors: Regniald C. Pryor, William D. Calverly, B. F. Chynoweth, John H. Rice, R. M. Edwards, Deen Robinson, E. M. Ingram.

NATIONAL MINING COMPANY.

A corporation organized under the general mining laws of the State of Michigan and located in Ontonagon County, Michigan. The company owns a very large mineral property adjoining the Michigan Copper Mining Company. The National is a very old mine and was first opened in 1848. For a number of years, it was a large producer of copper and paid dividends to the amount of $320,000. The property has been idle since 1893.

President, John C. Watson; Secretary-Treasurer, D. L. Demmon; Main Office, 19 Congress St., Boston, Massachusetts.

COPPER CROWN MINING COMPANY.

This company is capitalized in $2,500,000 divided in 100,000 shares, par value $25 each. 25,000 shares in the treasury.

Main office, St. Louis, Mo.; Local Office, Matchwood, Michigan.

The mine location is situated near Matchwood in Towns 48 and 49 and consist of 3,700 acres of land. Property embraces six old mines, the Hamilton, Trap Rock, Essex, Windsor, Norwich and Lafayette. In former years, these properties were explored in a small way and some copper values were discovered. The work done on them, however, was in a narrow, crude way and too limited to prove, what values they contained in depth, or beyond a small area. The present company employs about twenty-five men and is engaged in exploring the lands in a systematic, practical manner by a method of tunneling. A long tunnel is being driven in the side of a hill through which the mineral formation, under investigation crosses. Bunches of ground carrying copper values have been opened into and the management feels much encouraged over the future outlook for the company.

Baxter L. Brown, General Manager; H. B. Kirkpatrick, Clerk; J. T. Finnegan, Mining Captain.

Just as this report was about to be handed to the printer, a letter and a prospectus, describing the company's property were received.

Following is a part of the letter:

The property known as the Essex Copper Company, and the Lafayette Mining Company, we are now pleased to state are owned by this company. These, together with the Hamilton property originally purchased gives us a total acreage of 3,740 acres. Of this, 1,000 acres is the amount purchased of the Lafayette Mining Company and as it lies considerable distance from our original property we will not attempt to do anything with it at present.

On the Norwich, the land previously owned by the Essex Copper Company, there is an old tunnel driven quite a number of years ago about 950 feet in length, also a shaft about 270 feet deep and cross cuts on the 30-foot vein aggregating probably 1,100 or 1,200 feet. These workings are now being unwatered and I have not yet had time to have any accurate measurements made, consequently the above figures are only approximate.

On the Hamilton property we have an 8x8-foot tunnel driven 602 feet cutting the 6-foot and 30-foot veins. On the 30-foot vein we have drifted about 500 feet; all in good ore.

We are at present working about 16 to 25 men are contemplating the erection of a mill this season, but whether it will be done or postponed another year is an open question at present.

AZTEC-ALGOMAH.

This is a development proposition held under option by local people. The property is well located, being situated just east of the Adventure and west of Lake. It consists of a large acreage that is traversed by Knowlton and other well known lodes of the district. The property was worked in early days, but never extensively and under the methods of a former age. Present organization was formed for the purpose of giving it a new trial and it will be systematically explored under modern methods. A shaft was started on the Knowlton lode last December and at this time it is about sixty feet deep. The showing is promising. The lode is wide, fairly well settled and contains some strong bright copper. Seven or eight men are employed.

President, R. C. Pryor; Secretary-Treasurer, W. D. Calverley.

ESSEX COPPER COMPANY.

A dividend of $1.00 per share has been paid stockholders of this company from sum received for sale of property to Copper Crown Mining Company. Another liquidation, will, it is said, be paid shortly.

LAFAYETTE MINING COMPANY.

This company has paid a dividend of $2.42 per share to stockholders from sum received from sale of property to Copper Crown Mining Company.

SMELTING AND COPPER REFINING PLANTS.

As stated in the report of the Calumet and Hecla mine, found elsewhere in this volume, the copper smelters and refineries of the Company are located at Hubbell, Houghton County, Mich., on the shore of Torch Lake and at Buffalo, N. Y.

The company's product of mineral is refined, melted into bars and ingots and prepared for the market at these works.

MICHIGAN SMELTING COMPANY.

This company was organized in 1903 under the laws of the State of Michigan. Capital, $500,000. Par, $25.

W. A. Paine, President; Secretary-Treasurer, Frederic Stanwood; Main Office, Boston, Mass.; Local Office, Houghton, Michigan; Frederick I. Cairns, Superintendent; W. H. Rowe, Clerk.

The smelters and refineries of this company are located about three miles west of Houghton, on the shore of Portage Lake. At these works, the mineral products of the Atlantic, Baltic, Champion, Michigan, Mohawk and Wolverine mines are refined and prepared for the market. About 125 men are employed.

QUINCY SMELTING PLANT.

This plant is also referred to in the report on the Quincy mine found elsewhere in this volume. Besides the mineral product of the Qunicy, those of the Franklin, Centennial, Allouez, Mass and Adventure mines are refined and prepared for market at these works. Also a little miscellaneous mineral.

Location, Hancock, Michigan. Will P. Smith, Superintendent.

THE LAKE SUPERIOR SMELTING COMPANY.

The plant of the company is located at Dollar Bay, Houghton County, Michigan. Company refines the mineral products of the Osceola, Tamarack, Isle Royale and Ahmeek mines.

H. D. Conant, Superintendent; Joseph Thebo, Assistant Superintendent; James McRae, Clerk; J. C. Dunstan, Clerk. Postoffice address, Dollar Bay, Michigan.

TAMARACK MINE FIRE.

In January a fire broke out in No. 2 shaft Tamarack, and since that date no product has been made in neither this shaft nor No. 1.

The shafts are connected underground and the gas and smoke filled up the workings of both making it impossible for men to work in them. Three men were smothered to death and several others narrowly escaped a similar fate. There is still a little gas coming out of the mine but indications are such as to lead the management to think the fire is out. Hope is very general that is. At this time it is impossible to form any estimate whatever with regard to the extent of the damage done to the mine.

SALT

Like most all other industrial enterprises, the salt-producing companies, operating in Michigan, had a busy season during the year 1905. The total output of the State for the year was 5,671,253 barrels, an increase over that of 1904 of 280,841 barrels. Michigan forms one of the chief salt producing sections of the country and manufacture about 24 per cent. of the total production of the United States. In the summer of 1905, I visited some of the salt producing properties in the lower part of the State and found them in a prosperous condition. When on this visit, I learned that Mr. Edwin A. Wildey, State Inspector of Salt, was attending to the interests of the State and rendering satisfactory service to all connected with the industry. To Mr. Wildey, I wish to acknowledge my obligation for much of the information contained in this report.

SALT PRODUCING DISTRICTS.

The salt producing territory of the State is divided into eight districts, although during the past year, there was no salt manufactured in Districts Nos. 4 and 5.

District No. 1, Saginaw County, has ten salt plants with capacity of 615,000 barrels per year. 143 men are employed. It has nine steam blocks and one solar plant with 53 covers. The New Plate Glass Company's plant will have a capacity of 1,000 barrels per day and will begin to make salt early in 1906.

Name of Producers.	No. Bbls. Man'f'd.
Ed. Germain	11,951
A. C. White	11,215
Bliss and Van Auken	17,905
Saginaw Valley Traction Co.	20,704
S. L. Eastman	16,602
Crescent Salt Co.	239
Mershon, Schutte, Parker & Co.	28,564
Saginaw Salt Co.	45,858
Crystal Salt Co.	3,940
	156,978

District No. 2, Bay County, has four salt companies, with a capacity of 450,000 barrels per annum.

Name of Companies.	No. Bbls. Man'f'd.
Kern Manufacturing Company	23,565
Theo. Hine & Co.	8,176
North American Chemical Company	318,554
Mershon, Schutte, Parker & Co.	16,673
	366,968

District No. 3, St. Clair County, has eight steam plants, thirty grainers and eight vacuum pans, are employing in the six plants in active operation four hundred and ninety-eight men, and when all are operated will produce 1,691,000 barrels annually. This district produces a large amount of fine dairy salt as well as the coarser grades. These salt blocks are using improved machinery and live steam.

Name of Companies.	No. Bbls. Man'f'd.
Davidson & Womsey	219,284
Sicken Salt and Stave Co.	53,938
Diamond Crystal Salt Co.	248,695
Thompson Bros.	86,032
Port Huron Salt Co.	684,701
Michigan Salt Works	230,180
Walton Salt Association	1,993
A. Miller, Jr.	15,700
	1,540,513

District No. 4, Iosco County, has one salt company, a steam block and a manufacturing capacity of fifty thousand barrels. None manufactured in 1905.

District No. 5, Midland County, has one salt company, one steam block and a manufacturing capacity of thirty thousand barrels of salt. None manufactured in 1905.

District No. 6, Manistee County, has seven salt companies, seven steam and three vacuum pan blocks, employing four hundred ninety-seven men, and a capacity of 3,810,600 barrels per annum. The Manistee Lumber Company and the Dennis Bros. have closed their plants owing to the fact that they have finished cutting their timber.

Name of Companies.	No. Bbls. Man'f'd.
Buckley Douglas Lumber Company	523,121
Manistee Lumber Company	61,457
Louis Sands Blocks, 1 and 2	347,394
Kilzinger & Babcock	5,180
R. G. Peters Salt and Lumber Co.	674,929
State Lumber Co.	263,647
Filer & Sons	39,083
	1,921,634

District No. 7, Mason County, has three salt companies with four salt blocks, two vacuum and two grainer blocks, employing 175 men, and a capacity of 1,650,000 per annum. These plants, with the exception of the Stearns Salt and Lumber Company, will close down for the winter, but will ship as long as boats can be had.

Name of Companies.	No. Bbls. Man'f'd.
Stearns Salt and Lumber Co.	285,026
Anchor Salt Company, Block 1	168,630
Butters Salt and Lumber Co.	158,673
Stearns Salt and Lumber Co., Block 2	45,593
Anchor Salt Co., Block 2	7,079
	665,001

Quincy Hill
Photo by O. F. Tyler

District No. 8, Wayne County, has nine salt companies, with twenty vacuum pans and thirty steam grainers, and a manufacturing capacity of 2,000,000 barrels of salt. They are employing at present about four hundred men.

Name of Companies.	No. Bbls. Man'f'd.
Delray Salt Company	7,394
Pennsylvania Salt Co.	405,179
Morton Salt Company	167,734
Detroit Salt Company	252,668
Detroit Salt Company, No. 2	73,064
Detroit Salt Company, No. 3	58,533
Peninsular Salt Co.	13,504
Hiawatha Salt Co.	42,083
	1,020,159

RECAPITULATION.

District.	Total.	Per Cent.
Saginaw County, District No. 1	156,978	2.75
Bay County, District No. 2	366,968	6.35
St. Clair County, District No. 3	1,540,513	27.16
Manistee County, District No. 6	1,921,634	33.44
Mason County, District No. 7	665,001	12.36
Wayne County, District No. 8	1,020,159	17.94
	5,671,253	100

Comparative tables of salt manufactured in the State of Michigan during the last ten years:

1896	3,336,242
1897	3,622,764
1898	4,171,916
1899	4,732,699
1900	4,738,085
1901	5,580,101
1902	4,994,245
1903	4,387,982
1904	5,390,812
1905	5,671,253

Mr. Wildey, in his annual report touching the future of the salt industry in Michigan has this to say: "The conditions surrounding the salt industry continue favorable, and the indications are that the coming year will see fully as much manufactured as the past year. The only change that can be foretold will be the installation of plants of larger capacity and more improved methods of manufacturing. Each year sees a number of blocks closed because of lack of cheap fuel.

COAL.

In line with other industries of vital importance to the welfare of the State, coal mining in Michigan during 1905 was active and the number of tons produced together with the force employed during twelve months, will compare favorably with those of previous years. This industry, like that of Portland Cement and others, has been fully written up and described in the "Annual Report of the Michigan Bureau of Labor and Statistics." The report was prepared by Hon. Andrew Stephenson, Inspector of Coal Mines. It is very complete and covers practically every essential feature connected with the industry. I may state, however, that the information here submitted with but one or two exceptions, is official, having come to me directly from the managers in charge of mines. Blanks and letters were mailed to each manager for the necessary data. When products are omitted, unless the mines were idle, managers in charge failed to fill in and return the blanks to this office. The total number of tons of coal mined in Michigan in 1905, as reported to me by the managers of the operating companies, was 1,420,347 as against 1,414,834 for 1904.

Following are the coal mines operated in Michigan during 1905 with products made as reported to me by the companies. Also names and addresses of managers:

Names of Mines.	Products in tons.	Names of Managers.	P. O. Addresses
Allen & Walker	1,300	Verne Allen	Grand Ledge
Bay Coal Mining Co.	49,357	L. M. Davies	Bay City
Barnard Mine	133,214	R. M. Randall	Saginaw
Carbon Mine	3,000	Thomas M. Jones	Jackson
Cass River Coal Co.	5,051	George Walker	Saginaw
Chappell & Fordney	25,549	R. M. Randall	Saginaw
Central Mine	40,893	George Walker	Saginaw
Eagle Mine	2,200	Frank Reed	Grand Ledge
Grand Ledge Coal Co.	692	Fargo Boyle	Grand Ledge
Jenkins Mine	120	Thomas Jenkins	Grand Ledge
Michigan Mine	24,422	E. P. Young	Bay City
New Hope Mine	8,326	George Jenkins	Jackson
Northern Coal Co.	35,853	R. M. Randall	Saginaw
Pere Marquette Mine	138,560	R. M. Randall	Saginaw
Riverside Coal Co.	65,053	George Walker	Saginaw
Robert Gage Coal Co.	145,814	Charles Corryell	Bay City
Saginaw Mine	39,685	R. M. Randall	Saginaw
Salzbury Mine	28,985	M. J. O'Malley	Bay City

Names of Mines	Products in tons.	Names of Managers.	P. O. Addresses
Standard Mine No. 1	522	George Walker	Saginaw
Standard Mine No. 2	21,024	George Walker	Saginaw
Shiawasse Mine	85,925	R. M. Randall	Saginaw
Somer Mine No. 1	84,643	James Somers	St. Charles
Somer Mine No. 2	72,493	James Somers	St. Charles
Somer Mine No. 3	37,394	James Somers	St Charles
Uncle Henry Mine	18,686	R. M. Randall	Saginaw
What Cheer Mine	37,000	F. B. Foss	Bay City
Wenona Beach Mine	135,000	F. B. Foss	Bay City
Whittier Mine		Thomas Whittier	Sebewaing
Wright Mine	700	Eban Wright	Grand Ledge
Wolverine Mine No. 2	18,867	R. M. Randall	Saginaw
Wolverine Mine No. 3	170,019	R. M. Randall	Saginaw
	1,420,347		

The Barnard Coal Company is located at Saginaw, West Side, Mich. J. Weaver is Superintendent. The company employs in its underground department 225 men and whole number employed is 205. 1905 product was 133,214 tons of coal. Average depth of openings in the mine is about 190 feet, and daily capacity, 600 tons.

Cass River Coal Company is located at Saginaw, Mich. It is a new mine, not fully developed, operating one pit when working and in 1905 produced 5,051 tons of coal. Average length of openings in coal body is about 400 feet. The coal seam is 30 inches wide. Superintendent, George Waller

Central Coal Mining Company is located at Bay City, Michigan. Company employs in its underground department 100 men, whole number employed, 125. One shaft is operated and the 1905 product was 40,893 tons of coal. Average depth of openings is about 135 feet, and average length of openings in coal body is 1,500 feet. Width of coal seam is from 36 to 70 inches. Equipment includes 300-horsepower Boiler, Motion Hoist, Tipple, Etc. Daily capacity of mine is 600 tons. Superintendent, George Waller.

The Chappell & Fordney Mine is located at Saginaw, Michigan, W. S. The number of men employed underground is 90 and the whole number is 125. One shaft is operated and the average depth of openings is about 190 feet. Daily capacity of mine is 300 tons. In 1905, the company produced 25,549 tons of coal. Superintendent, Richard Strenton.

The Michigan Coal Mining Company is located at West Bay City, Michigan. Superintendent is S. R. Wonderdolf. Mine is well ventilated and 65 men are employed underground, whole number employed is 75. On shaft 175 feet deep is operated. 24,422 wet tons of coal were produced in 1905. Average length of openings in coal body is about 4,000 feet, and width of coal seam from 3 to 5 1-6 feet, and includes equipment of about 300 tons. Daily capacity is 5 Air Puncher and one air Chain Machine. They are about to abandon old workings and are opening up a new pocket of coal of the same vein close to the bottom of shaft in coal seam.

New Hope Mine is located two miles northwest of Jackson, Mich. The manager is George W. Jenkins. Whole number employed is 24 and one shaft 116 feet deep is operated. Product of coal in 1905 was 8,326 tons. Average length of openings in coal body is 1,200 feet. Equipment is fair with daily capacity of from 20 to 50 tons. Future outlook is considered poor unless management succeeds in finding extension of the coal seam by drilling.

Corunna Coal Company did not get their shaft in shape to mine coal until about the 1st of January, 1906, therefore, had nothing to report worth while for the year 1905. Tod Kincaid, President.

The Northern Mine is located in James Township, Saginaw County, Michigan. Average number employed underground is 125, and whole number employed is

150. Company operates one shaft 190 feet deep and produced during 1905 35,853 tons of coal. Daily capacity is 300 tons. Superintendent, T. Westwood. Postoffice Address, James, Saginaw Co., Michigan.

Owosso Mine is located in Caledonia Township, Shiawassee County, Michigan. Carl Pickert is Superintendent. The mine was shut down in December, 1904. Expect to pump it out this spring.

Pere Marquette is located at Saginaw, W. S., Michigan. Average number employed underground, 250, and whole number employed is 275. Company operates one shaft with average openings 190 feet deep and produced during 1905, 138,560 tons. Daily capacity is 600 tons. The mine has a fine equipment and is ably managed. Superintendent, W. H. Smith, Postoffice Address, Saginaw, W. S., Michigan.

Riverside Mine is located in James Township, Saginaw County, Michigan. 120 men are employed underground and the whole number is 135. Company works one shaft with average depth of openings about 180 feet. Average length of openings in coal body is 2,000 feet, and width of coal seam is from 30 to 38 inches. 1905 product was 65,053 tons of coal. Equipment includes 50o-horsepower Boiler, First Motion Engine, Tipple, 150 K. W. generator, two 5-ton motors, eight mining machines. Daily capacity is 500 tons. Property is well managed and economically operated. Superintendent, George Waller. Postofiice Address, James, Saginaw County, Michigan.

The Robert Gage Coal Company operates two properties, the Robert Gage and the Auburn, located at St. Charles, Michigan, and Coryell, Michigan. Whole number employed at St. Charles is 200 and at Coryell is 205 men. Two shafts are operated, and average depth of openings about St. Charles is 200 feet, and Coryell, 155 feet. Combined coal output for 1905 was 145,814 tons, which came principally from the St. Charles mine, our Auburn mine being new. It, however, is hoisting now more than St. Charles. Daily capacity of mine, St. Charles, 500 tons; Coryell, 600. These properties are skillfully managed and have efficient equipments. Superintendent, Elias Mathews.

Shiawassee is located in James Township, Saginaw County, Mich. Average number of men employed is 125 underground and whole number is 150. Company works through one shaft with average depth of openings about 190 feet. Property has a good equipment and is well managed. Daily capacity is 600 tons. Product for 1905, 85,925 tons of coal. Superintendent, C. L. McKinnon. Postoffice Address, James, Saginaw County, Michigan.

Saginaw mine is located in Beuna Vista Township, Saginaw County, Michigan. Number employed underground on an average is 115. Whole number, 135. Company works one shaft 190 feet deep. Product for 1905 was 39,685 tons of coal. Daily capacity is 300 tons. Property is well managed. Superintendent, J. E. Edwards. Postoffice Address, Buena Vista, Saginaw County, Michigan.

Somers No. 1 is located at St. Charles, Michigan. Superintendent, J. O. Somers. Average number employed underground is 190 and whole number employed, 225. This is one of the most important coal mines in the state and operates three shafts. The 1905 product was 84,643 tons. Average depth of openings is about 200 feet with length of coal seam three-fourths of a mile. Equipment includes electric haulage, electric machines, etc. Daily capacity, 700 tons. Company has a very large acreage and the No. 1 mine will have a very long life.

Somers No. 2 is located at St. Charles, Michigan. Superintendent, J. O. Somers. Average number employed underground, 225, and whole number, 265. In 1905 the company produced 72,493 tons of coal. The average depth of the openings is about 200 feet and average length of openings in coal body is 2,000 feet with length of coal seam three-fourths of a mile. Mine is well equipped. Has two electric locomotives, ten electric mining machines, two generators and supplementary fittings. Daily capacity is 800 tons. Property has a bright future with at least fifteen years supply ahead.

Somers Mine No. 3 is located at St. Charles, Michigan. The superintendent is J. O. Somers. In the underground department 110 men are employed. Whole number employed, 130. Product for 1905 was 37,394 tons of coal. The average depth of openings is about 200 feet with length of openings in coal body, 1,000 feet. Length of coal seam is one-half mile. Daily capacity is 400 tons. Future outlook of property is good with ten years of life ahead.

Standard Mine No. 1 dug out 522 tons of coal in 1905 and abandoned the property.

Standard Mine No. 2 is located in Bridgeport Township, Saginaw County, Michigan. Superintendent, George Waller. Average number employed underground is 100 and whole number, 120. Company operates one shaft 140 feet deep with average length of openings in coal seams, 1,000 feet. Width of coal seam is thirty-six inches. Product in 1905 was 21,024 tons of coal. Equipment includes 500 H. P. boilers, geared double hoist, tipple, etc. Daily capacity of mine is 300 tons.

Wolverine No. 2 is located in Monitor Township, Bay County, Michigan. A. McIllaney, Superintendent. Number employed underground on an average is 175. Whole number, 200. One shaft 190 feet is operated. During 1905 18,867 tons of coal was produced. Daily capacity of mine is 600 tons.

Uncle Henry mine is located in Bloomfield township, Saginaw County, Michigan. Superintendent, John Snowball. Average number employed underground, 80, and whole number, 100. Company operated one shaft and produced during 1905 18,686 tons of coal. Average depth of openings is about 190 feet. Daily capacity of mine is 300 tons. Future outlook is satisfactory.

Wolverine Mine No. 3 is located in Williams Township, Bay County, Michigan. Two hundred and fifty men are

employed in the underground department, while the whole number employed is 275. One shaft with average depth of openings about 190 feet is operated. Daily capacity of mine is 1,000 tons. Company's product for 1905 was 170,019 tons of coal. The superintendent is Thomas Thompson.

The "Jamestown" or "Northern" coal mine is located in James Township, Saginaw County, Michigan. Robert M. Randall is manager. Number employed underground, 125. Whole number, 150. Company operates one shaft 190 feet deep and produced during 1905 35,853 tons of coal.

Bay Mine No. 2 is located at Franklinlust, Bay County, Michigan. M. L. Davies, Manager. Whole number employed is 70. Company operates one hoisting shaft and one air shaft and produced during 1905, 49,357 short tons of coal. Average length of openings in coal body about 1,000 feet. Length of coal seam about 3,000 feet and four feet wide. Property is fully equipped with cable haulage system. Daily capacity is 200 tons.

Wenona Coal & Mining Company operates the Wenona Mine located in Bangor Township, Bay County, Michigan. J. C. Gallagher is superintendent. Company employs 300 men and produced during 1905, 125,000 tons of coal. Mine is developed through one shaft 134 feet deep with average length of openings in coal body 2,000 feet. Width of coal seam in company's property is one mine and the future outlook for Wenona is said to be bright.

What Cheer Coal Mining Company operates the What Cheer mine located in Merritt Township, Bay County, Michigan. Company employs 100 men and produced during 1905, 37,000 tons of coal. Mine is opened up through one shaft with average depth of openings about 200 feet. Average length of openings in coal body is 600 feet, and width of coal seam is one-half a mile. Daily capacity of mine is 1,000 tons and future outlook is reported bright. J. C. Gallagher, Superintendent,

The Carbon Mine is located at Jackson, Michigan. There are twelve men employed underground and the whole number employed is eighteen. Property is developed through one shaft 42 feet deep, with extensive lateral openings and the product of coal during 1905 was about 3,000 tons. Average length of openings in coal body including all, about 3,000 yards. Width of coal seam, about 300 yards. Distance from shaft about 300 feet. Future outlook is reported not very good. Thomas M. Jones, Superintendent.

The Grand Ledge Coal Company operates at Grand Ledge, Eaton County, Michigan. Six men are employed and in 1905 the company produced 692 tons of coal. Product is recovered through two drifts with average length of openings in coal seam 500 feet and depth four feet. Coal seam, eighteen inches high. Daily capacity of works, three tons per day. Future outlook is reported not very bright. Fargo Boyle, Manager.

Allen & Walker Mine is located near Grand Ledge, Eaton County, Michigan. There are twelve men employed and the product is recovered through one drift mine with two openings. Product of coal in 1905 was 1,300 tons. Average depth of openings about 250 feet and average length of openings in coal body, 260 feet. Width of coal seam from eighteen to twenty-eight inches. Horse power is used for lifting the output and the daily capacity of the mine Is from five to twenty-five tons. Future outlook for the property is considered very good. Verne Allen, Manager.

The Eagle mine, sometimes known as Alben, is located at Grand Ledge. There are seven men employed and the property is operated through one drift. The product for the year 1905 was 2,200 tons. Average depth of openings about drift in bank and average length of openings in coal body is 400 feet, and the coal seam is two feet, four inches wide. Cable and cars are hauled by horse power. The daily capacity of the mine is nine tons. Mine depends on local consumption for support. T. L. Reed, Manager.

Whittier is located at Sebewiang, Huron County, in Town 15, North, Range 9 East. There are 134 men employed and the mine is developed through one hoisting and one air shaft. Equipment includes washer plant, 400-ton cacacity, with supplementary additions and fittings. Future outlook is fair. Thomas P. Whittier, Manager.

The Stark Mine, sometimes known as the "Jenkins," is located at Eagle Township, Clinton County, Michigan. One man is employed and the property operated through a drift about forty feet in length. Product of coal for 1905 was 120 tons. Average length of openings in coal body is 300 feet, and width of coal seam is 24 inches. T. M. Jenkins, Manager.

The Wrights Mine is located at Grand Ledge. There are seven men employed and property is developed through one shaft about 40 feet. Seven hundred tons of coal was produced during 1905. Average length of openings in coal body is 300 feet and width of coal seam is twenty inches. Output is hoisted by horse power and its maximum daily capacity is twenty-five tons per day. Future outlook is reported better than for some time. Mine is not run to its full capacity as trade conditions at present do not warrant it. Eben Wright, Manager.

Michigan Vitrified Brick Company is located at Frankenlust, Bay County, Michigan. Twenty-five or thirty men are employed and there is one active shaft, which was not operated during 1905. Average depth of openings, about 124 feet and average length of openings in coal body is a few hundred feet. Width of coal seam, two and one-half to three feet. Equipment includes complete tipple, hoisting apparatus, boiler and engine house, etc. Daily capacity of mine at present is about twenty tons. Future outlook is reported problematical. Manager, E. L. Mather. The Old Valley mine is now owned by the Michigan Vitrified Brick Company, and is used only for mining a small amount of

coal, enough for our own use, none going outside. It has been idle for the past two years and only recently started to take out coal now not exceeding twenty tons per day, and do not class themselves as coal miners, but brick makers, mining about 80 tons of clay per day.

SALZBURY COAL MINING COMPANY.

This company operates the Salzbury mine, located at Bay City, Michigan. Company employed, all told, sixty-eight men and produced in 1905, 28,985 tons of coal. The mine is developed through one shaft with average length of openings in coal body about 1,500 feet in extent. Width of coal seam owned, forty acres, with depth running from three to six feet. Mechanical equipment includes two electric machines, Jeffry make, and supplementary appliances and buildings adequate for requirements. Future outlook for the mine is considered very good. W. J. O'Malley, Manager.

PORTLAND CEMENT.

The manufacture of Portland Cement in Michigan has developed into one of the substantial, important industries of the State and there is a larger force engaged in its production now than any previous period. While there has been no substantial features in its development, the progress made has been wholesome, contiuous and steady. Demand for supplies is greater than ever before and industries consuming the product are expanding in a substantial manner. New works are constantly starting up that must absorb cement in enormous quantities and the future outlook for its manufacture is about all that could be desired. Manufacturers of cement are kept busy and appear to be in a prosperous condition. During the past few years, many important improvements have been introduced in methods of operation and in the mechanical equipments employed in the manufacture of Portland Cement. The result is that the efficiency and capacity of plants have been increased and the position of producing companies materially strengthened. A very full and complete report on the cement industry of Michigan may be found in the Annual Report of the Michigan Bureau of Labor and Industrial Statistics. The report is made under the direction of Hon. Scott Griswold, Commissioner of Labor, Lansing, Michigan. In view of this provision, a lengthy report from me seems unnecessary and unexpected. My remarks on the industry are brief, but I may state that the information submitted, in practically every particular, is official, having come to me direct from the managers in charge of the different works.

PORTLAND CEMENT PLANTS IN OPERATION IN MICHIGAN.

Name of Organization.	Location of Plant.	Name of Manager.	Address of Manager.
Aetna Portland Cem't Co.	Fenton	E. M. Prince	Detroit, Mich.
Alpena Portland Cem't Co.	Alpena	J. P. Hughes	Alpena, Mich
Bronson, Kalamazoo			Bronson, Kalamazoo
Portland Cement Co.	Bronson	S. W. Pritchard	Bronson, Mich.
Elk Cement & Lime Co.	Elk Rapids	Homer Sly	Elk Rapids, Mich.
Egyptian Portland Cem't Co.	Fenton		
Farwell Portland Cem't Co.	Farwell	J. S. Littlefield	Farwell, Mich.
Great Northern Portland Cement Co.	Marlborough	C. R. Rinchart	Marlborough, Mich.
Newaygo P'tland Cem't Co.	Newaygo	W. J. Bell	Newaygo, Mich.
Omega P'tland Cem't Co.	Mosherville	Geo. H. Sharp	Jonesville, Mich.
Peninsular P. Cem't Co.	Cement City	F. E. Smith	Cement City, Mich.
Peerless P. Cem't Co.	Union City	A. Lundteign	Union City, Mich.
Toledo P. Cem't Co.	Manchester	W. L. Watkins	Ann Arbor, Mich.
White Portland Cem't Co.	Chelsea	H. W. White	Chelsea, Mich.
Wolverine P. Cem't.	Coldwater	J. C. Smallshaw	Coldwater, Mich.
Wolverine No. 2 P. Cem't.	Quincy	E. J. Davis	Quincy, Mich.
Wyandotte P. Cem't.	Wyandotte	J. W. Frederick	Wyandotte, Mich.
Burt P. Cement Co.	Bellevue	G. R. Burt	Bellevue, Mich.

PORTLAND CEMENT STATISTICS.

Name.	Average No. Men Employed in 1905.	No. bbls. Cement Produced in 1905.
Aetna	118	280,000
Alpena	160	351,000
Bronson	65	93,000
Elk	65	50,000
*Egyptian	..	.....
*Farwell	..	.....
Great Northern	150	about 100,000
Newaygo	135	310,000
Omega	70	130,000
Peninsular	140	33,400
Peerless	125	356,000
*Toledo	..	.....
White	85	20,000
Wolverine	300	250,000
Wolverine No. 2	350	400,000
Wyandotte	65	145,000
Burt	..	100,000
Total		2,618,400

* Not operated in 1905.

The Aetna Portland Cement Company is manufacturing cement at Fenton and has a very complete equipment, including eight rotaries, 60x6 feet. Daily capacity, 1,000 barrels finished. One hundred and eighteen men are employed and 280,000 barrels were manufactured in 1905. Management reports the future of for cement, fair. Superintendent, E. M. Prince. Postoffice address, Detroit, Michigan.

The Alpena Portland Cement Company is located at Alpena, Michigan. Company has a very complete plant efficiently operated and 160 men are employed. 351,000 barrels cement was manufactured during 1905 and the daily capacity is 1,500 barrels. Outlook for 1906 is reported excellent, and the annual capacity will be increased to 450,000 barrels this winter. Superintendent, J. P. Hughes. Postoffice address, Alpena, Michigan.

The Bronson Kalamazoo Portland Cement Company, located at Bronson, Michigan. It employs 65 men and manufactured during 1905 93,000 barrels cement. The equipment includes ten rotary kilns and other necessary machinery for this number of kilns. Daily capacity of works is 1,000 barrels and the outlook for 1906 is very good. S. W. Pritchard, Superintendent. Postoffice address, Bronson, Michigan.

The Elk Cement & Lime Company is located at Elk Rapids, Michigan. Sixty-five people are employed and number of barrels cement manufactured during 1905 was 50,000. Equipment includes two kilns, 6 feet by 86 feet. Daily capacity of works, 550 barrels. Management reported the outlook for 1906 good. The plant began to make cement July, 1905, on dry process and plans to increase daily capacity to 1,250 barrels for 1907. Manager, Homer Sly. Postoffice address, Elk Rapids, Michigan.

The Egyptian Portland Cement Company is now in a state of reorganization and did not operate last year. Company expects to be able to start up by May 1st, 1906.

The Farwell Portland Cement Company is located at Farwell, Michigan. Plant is not yet in operation, but management expects to have it completed and going the coming season. J. S. Littlefield, Manager.

The Great Northern Portland Cement Company is located at Marlborough, Michigan. Charles R. Rinchart is Superintendent. This company employs about 150 men and manufactured during 1905 about 100,000 barrels cement. The equipment is complete and first-class, with a daily capacity of works now 1,400 barrels, but most of the machinery installed for increasing it to 2,000 barrels daily. Management reports outlook for 1906 good. Postoffice address, Marlborough, Michigan.

The Newaygo Portland Cement Company is located at Newaygo, Michigan. It has an up-to-date equipment, and economically operated. One hundred and thirty-five men are employed. Daily capacity is 1,400 barrels. 310,000 barrels cement was manufactured in 1905 and the management considers the future outlook quite favorable. Superintendent, W. J. Bell. Postoffice address, Newaygo, Michigan.

Omega Portland Cement Company is located at Mosherville, Michigan. Company employs about seventy men and manufactured during 1905, 130,000 barrels. The equipment consists of 60-foot kilns. Daily capacity is 600 barrels. The management considers the outlook for 1906 unusually good. Superintendent, George H. Sharp. Postoffice address, Jonesville, Michigan.

The Peninsular Portland Cement Company is located at Cement City, Michigan, and has a fine plant efficiently conducted. Daily capacity of works, 1,400 barrels cement. One hundred and forty men are employed, and 33,440 barrels were manufactured during 1905. Management reports the outlook for 1906 excellent. Superintendent, F. E. Smith. Postoffice address, Cement City, Michigan.

The Peerless Portland Cement Company is located at Union City, Michigan, and has an up-to-date equipment, including nine rotary kilns. Daily capacity, 1,600 barrels. One hundred and twenty-five men are employed and 356,000 barrels were manufactured in 1905. Management reports the outlook for 1906 promising. Works are economically operated. General Manager, A. Lundteign. Postoffice address, Union City, Mich.

The Toledo Portland Cement Company's works are located at Manchester, Michigan. The plant is designed for 1,000 barrels, daily capacity. It was never completed and is now in receivership with W. L. Watkins, of Ann Arbor, Mich., as receiver.

The White Portland Cement Company is located at Four Mile Lake, Chelsea, Michigan. The company employs eighty-five men, and manufactured during 1905 20,000 barrels of cement. Real estate owned consists of 700 acres. Cost of plant, approximately $225,000.00. Equipment embraces twelve upright kilns, German process, with daily capacity of works 350 barrels. Outlook for 1906 is reported extremely bright, but company made an assignment during October last and is at present in the hands of Paul B. Moody, receiver. Owing to litigation, it is doubtful if it will be in operation for the season of 1906. Superintendent, H. W. White.

The Wolverine Portland Cement Company is located at Coldwater, Michigan. The company has a fine plant and 300 men are employed. 250,000 barrels of cement was manufactured during 1905. Equipment includes fourteen rotaries, with eight in operation. Daily capacity of the works is 2,100 barrels. The management reports the outlook for 1906 excellent and extending all fourteen rotaries from 60 feet to 90 feet in length. Superintendent, John C. Smallshaw. Postoffice address, Coldwater, Michigan, Branch County.

The Wolverine Portland Cement Company No. 2 is located at Quincy, Michigan. This company has a very complete plant and employs 350 men. 400,600 barrels cement was manufactured during 1905. Equipment includes fourteen rotaries in firstclass condition. Daily capacity of works is 1,500 barrels and the management reports the outlook for 1906 excellent. Superintendent, E. J. Davis. Postoffice address, Quincy, Michigan, Branch County.

The Wyandotte Portland Cement Company is located at Wyandotte, Michigan. In 1905, sixty-five men were employed and 145,000 barrels cement manufactured. Equipment includes three kilns 60 feet by 6 feet. Daily capacity of works is now 400 barrels, but the company is increasing to about 800 barrels daily, and the 300,000 barrels annually. Management reports outlook for 1906 good. Superintendent, J. W. Frederick. Postoffice address, Wyandotte, Michigan.

MISCELLANEOUS MINERALS.

ASBESTOS.

Extensive deposits of this mineral of good quality have been discovered in various places in Michigan, but its development for commercial purposes, like that of marble and many other minerals of usefulness, has been neglected. This condition of affairs, however, cannot likely last forever. The value of these deposits are sure to be recognized sooner or later and the work towards recovering them for general use, commenced. The market for asbestos is broadening and the demand for supplies constantly increasing. The industries consuming the mineral are growing in size and increasing in number. One of these days, some company will come along and start to work them, and perhaps, succeed in building up a fine business enterprise. All that is needed is for some concern to make the start.

MARBLE.

For many years marble has been known to exist in at least four counties in Michigan. Dickinson, Iron, Mackinaw and Marquette. So far as I have been able to learn, however, no particular efforts have been put forth to build up a marble industry in this State. Some years ago, a little shipping and quarrying was started in Dickinson County, but the undertaking must have turned out unsatisfactory for the works were soon closed and still remain so.

SLATE.

There is a quarry of good slate at L'Anse, Baraga County, but it is idle. A little slate was taken out of there some years ago, only, however, in limited quantities.

GYPSUM.

Gypsum is found in remarkable abundance and purity at Grand Rapids and Alabaster, and in moderate quantities at various other places. This mineral is very properly classed among the useful products of the State and its production and manufacture form an important, growing industry. While the growth of the industry has been somewhat slow, yet it has been steady, wholesome and continuous. There is more capital invested in the business now than ever before, and producing companies, generally, are in a prosperous condition. The market for finished products is constantly broadening and more men are employed in the gypsum industry at the present time than in any former period in its history. The stratum of gypsum at Grand Rapids is about eighteen or twenty feet in thickness and from a foot or two to sixteen feet below the surface, and fully a thousand acres in extent, affording practically an inexhaustible supply to draw upon. The development of the Gypsum industry in this State, while in a healthy condition, is practically confined to the city of Grand Rapids where the product is quarried in considerable quantities, ground and prepared as a basis for wall tintings, wall decorations, stucco work, plasters, fertilizers and for other uses. For wall tinting and decorating, alabastine and allied gypsum products are among the best things made for such purposes. On account of the excellent sanitary properties of the articles and the ease with which the different preparations may be applied, they are becoming quite popular all over the United States and in many parts of Europe. Calcium gypsum is known as plaster of Paris. The finer grades are carefully reground and sold for dental plates, for casts and moulds and also for works of art and architecture. The demand for these products is constantly increasing and the outlook for the gypsum industry is reported very promising.

BUILDING STONE.

PORTAGE ENTRY QUARRIES COMPANY.

Red Stone Quarry Office, Calumet, Michigan. General Offices, 520 Chamber of Commerce, Chicago, Ill. J. W. Wyckoff, Manager.

This company operates the Traverse Bay Quarry, Portage Entry Quarry and Marquette Quarry.

The Traverse Bay Quarry is situated in Keweenaw County on the line of the Mineral Range Railroad, and ships their product by rail, but also have dock facilities at Traverse Bay and ship their eastern trade by boat. The stone is principally shipped to Chicago, Cleveland, Buffalo, Detroit and Toronto, also by rail to all western points, as far as Seattle, Washington. Following is a summary of the stone production of the Traverse Bay Quarry for the season of 1905:

Total number of cubic feet of Building Stone quarried, 30,000.

Total number of cubic feet of Rubble (foundation) stone, 126,000.

(14 cubic feet of stone equals one ton).

The above Company's quarry at Portage Entry did not produce any stone 1905.

AT THE MARQUETTE QUARRY.

The total amount of merchantable stone quarried was 84,834 cubic feet, divided as follows: Building stone, 35,709 feet, and rubble (foundation) stone, 40,125 feet, used by the Duluth, South Shore & Atlantic Railway to prevent the incursion of the Lake on their right-of-way immediately south of Marquette, 9,000 feet. Manager, James Thomlinson.

GOLD.

Gold exists in Marquette County, about three miles northeast of the City of Ishpeming, in Section 29, 48-27. I have seen exceedingly rich and beautiful specimens that came from there. The quartz was literally laced and hung together with strings of pure gold. Some specimens are said to have yielded at the rate of $160,000 per ton and I don't doubt it for a moment. No companies, however, at the present time, are mining the deposit containing the precious metal. Some years ago, three organizations, the Ropes Gold and Silver Mining Company, Michigan Gold Company and Fire Centre Gold Mining Company, were formed for the purpose of mining the gold bearing deposit. Each company worked it more or less extensively, but the Ropes people developed their property in the most practical way and suceeded in getting the best results. They opened up quite a rangy mine, equipped it with an extensive plant, treated a considerable output of ore and produced gold bullion to the value of several hundred thousand dollars. The mine received a pretty fair trial, but results turnout out unprofitable and unsatisfactory. Under the methods of mining practiced, neither company was able to make both ends meet and all work was stopped.

SILVER.

Silver is found in the Lake Superior district associated with copper, but there are no companies in Michigan engaged in mining exclusively for this metal.

GRAPHITE.

Graphite is produced at L'Anse, Michigan, by the Hathaway Graphite Manufacturing Company and the Detroit Graphic Paint Company. Besides these two, the United States Graphite Company operates at Saginaw, Mich., but receives its supplies of crude graphite from Mexico.

HATHAWAY GRAPHITE MANUFACTURING

This Company has a graphite mine near L'Anse, Baraga County, and controls 160 acres of graphite land, with plant for grinding the ore located at the mine. Three men can handle the plant, when running full capacity, the ore being handled by machinery which is run by water power. It also has an engine for use if necessary. Capacity of plant about five hundred tons per year, made into three grades which market at from $25 to $60 per ton. This graphite is most suitable for paint purposes and foundry facings. The company mined no graphite during 1905. One man was employed for full year, three men for about one month. Main Office, Detroit, Michigan. Manager, P. MacDuff.

DETROIT GRAPHITE PAINT COMPANY.

In 1905 the Detroit Graphite Paint Company mined and shipped to Detroit about 500 tons of Crude Graphite, which was all used in the manufacture of graphite paints. It is used only as a paint pigment. Main Office, Detroit, Michigan; Local Office, L'Anse, Michigan; A. A. Boutell, President; R. C. Williams, Agent.

MICHIGAN COLLEGE OF MINES.

The Michigan College of Mines at Houghton, is a State institution established by an act of the legislature of 1885, and opened for the reception of students in September, 1886. The College exists for the purpose of training men to take an active pat in the development of the mineral wealth of the state and nation, and concentrates its efforts on this particular line of work.

The methods of instruction give great prominence to laboratory work and trips of inspection to plants which exemplify often on a large scale the application of principles taught in the classroom to problems of commercial operation.

It is plain that an engineering school must derive immense advantage from a location in which its immediate surroundings continually illustrate and enforce the principles which it teaches. Even without effort on the part of the school, such environment must serve as an efficient aid to the instruction. But when those in control of these operations are in sympathy with the institution—are ready to place plants under their charge at its service for instruction, and when the institution makes wise use of opportunities thus afforded, these plants become truly a part of its equipment, and the location then becomes a factor which must increase the efficiency of the instruction by an amount hardly to be over-estimated. Such is the relation of the adjacent mines, mills and smelters to the College, giving students access to the vast equipment of many of the most successful mines in the world.

The location of the College in a district where its students live in a mining atmosphere, together with its special methods of instruction, and the manner of using the mining environment have brought to the institution a large measure of success. It is a noteworthy fact that of the three hundred and twenty-eight men graduated to date, but seven have left engineering for other pursuits.

Most of the students of the .College have been from Michigan, as it is a Michigan institution, but it has trained men from all parts of the United States and from a number of foreign countries in both hemispheres.

During its twenty years of existence the Michigan College of Mines has accomplished an incalculable amount of good in training and fitting young men for filling responsible positions requiring practical as well as technical knowledge. The practical knowledge is acquired, in a measure, from personal observation and investigation of methods of operation used in some of the most vigorously worked and successful iron and copper mines on the globe. The college is well organized with each branch of learning in charge of instructors eminently qualified by education and experience for the training work of which the institution makes a specialty.

At its head is Professor F. W. McNair, deeply learned and highly accomplished in the sciences taught, and possessing the rare faculty of being able to impart, in a clear, terse style, the knowledge and instruction that always proves helpful to the progress of students.

The board of control is made up of the following well-known gentlemen: James MacNaughton, General Manager Calumet and Hecla Mine, Calumet; Norman W. Haire, General Manager Osceola, Tamarack, Isle Royale and Ahmeek Mines, Houghton; Dr. L. L. Hubbard, General Manager Challenge, King Phillip and Winona Mines, Houghton; M. M. Duncan, General Manager Cleveland-Cliffs Iron Company, Ishpeming; William Kelly, General Manager Penn Iron Mining Company, Vulcan, and Hon. J. M. Longyear, Marquette, Michigan.