STATE OF MICHIGAN.

MINES AND MINERAL STATISTICS

BY
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COMMISSIONER OF MINERAL STATISTICS.

BY AUTHORITY

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INTRODUCTION.

STATE OF MICHIGAN,
OFFICE OF THE COMMISSIONER OF MINERAL STATISTICS.
Houghton, Michigan, Aug. 1, 1892.

HON. EDWIN B. WINANS,
Governor 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.

In making this, my first report, I have been much indebted to the press, and also to the several mine inspectors for information and other assistance and courtesies rendered; particularly to mine inspectors, C. M. Boss, of Gogebic county; J. B. Knight of the Norway Current, and to the late inspector, Anthony Broad of Marquette.

A report being published every year makes it almost impossible to have it very original or entertaining to the "constant reader," as they must necessarily appear, more or less, a repetion of previous reports, as one year is like unto another year, even into details. In this report I have somewhat followed the plan pursued by my predecessor, in his earlier reports, and have endeavored to give a slight history of each mine for the year, where it has been possible to obtain, the information.

In attempting to make my report earlier in the year, I have encountered several obstacles tending to delay, and among them may be mentioned:

First, Owing to the fact of the specific tax law having been repealed, and that the Commissioner's request or demand for reports from the companies early in the year cannot be enforced, there being no penalty for refusal to comply with the demand, many mines have neglected, or refused, to report on the blanks furnished them;

Second, The want of uniformity in the time for making reports by the several companies to their stockholders; some making them in March, others not until late in the spring, or in the summer, and still others making no report at all.

And, further, although chapter 123 of Howell's Annotated Statutes, headed "Mining Smelting and Metal Manufacturing Companies," provides in section 4107, which is section 32, of act 113, public acts of 1877, as amended in 1891, that

"It shall be the duty of the president and secretary of each corporation annually, in the month of July, to make a report for the preceding year, ending December 31, containing a statement of:

First, The amount of cash paid in on the capital stock;

Second, The amount of capital paid in by the conveyance of property to the corporation;

Third, The entire amount invested in real estate;

Fourth, The amount of personal estate;

Fifth, The amount of unsecured or floating debt of the corporations, as near as may be;

Sixth, The amount of secured or bonded debt of the corporation;

Seventh, The amount due the corporation;

Eighth, The number of gross tons of copper obtained;

Ninth, The number of gross tons of two thousand two hundred and forty pounds each, of iron ore mined and shipped;

Tenth, The number of gross tons of mineral coal mined;

Eleventh, The number of gross tons of pig iron manufactured;

Twelfth, The number of tons of any other mineral or ore mined;

Thirteenth, The amount of slate or stone mined;

Fourteenth, The name and residence of each stockholder of record, and the number of shares held by him on the said 31st day of December, and when the stock is held in trust, or in some representative capacity, it shall be so stated.

And while section 4109 makes the failure to report a misdemeanor, it, provides no penalty for non-compliance, as did the law of 1853 (chapter 122, section 4022 Howell's Annotated Statutes).

Therefore many of the mines make no report to county clerks as required, and as one mine secretary and treasurer says "have made no report for years," thus it will be seen that the gleaning of accurate information is a matter of time and considerable difficulty. To make the report of the Commissioner of Mineral Statistics of any great value, the information from, which to compile it should be in his hands not later than the first day of February following, each year.

It would be advisable, therefore, that the law be amended by substituting the month of "January" for the month of "July" and that a penalty for non-conformance be revived, as in the law of 1853.

Another point in the interest of good reports, would be the appointment of the Commissioner for a stated period, and from and to a certain date, say May 1, giving him time to compile his report while in office. Under the existing law the Commissioner is required to make a report on the year ending December 31, and in event of a change in administration he might be removed on the 2d of January, following, under which circumstances he would not be entitled, or empowered to make any demand on, the mining companies as the law requires him to do. Whereas, were the mining companies required to make their report in January to the Commissioner, as well the county clerk, and on blanks furnished by him, and his term established as to end on the 30th of April, they and he would have sufficient time to make reports, that would be of much benefit and interest both, to the mining industry, and the general, public of the State.

One other question is of great interest to the general mining public, and that is the appointment or election of county mine inspectors, their qualifications, duties, and their compensation. This is a question that cannot be disposed of in a few words, but it is a subject for much thought, and the opinions on it are greatly at variance. A few suggestions may not be inopportune. The present method of appointment by the board of supervisors, who in almost every instance are the agents or clerks of mining corporations, and are therefore interested parties, is certainly open, to serious objections, as would be, probably, the election by the people. But this latter is certainly better than, the system of appointment by the supervisors. Probably the better method would be the appointment of inspectors by a State board under competitive examination as to their several qualifications. That the inspector should be as thoroughly qualified as those who have charge of the mines stands to reason. And in fact he should be better qualified both as a mining engineer and practical expert, than, those who are generally employed in charge of the workings. He should have scientific knowledge to suggest proper methods for economical and safe mining, and practical experience enough to be able to detect any defects in workmanship, or faulty conditions in the formation by which life might be endangered.

His compensation should be commensurate with his abilities and the responsibilities attached to his position, and should be regulated by law, thus making him independent of those with whom he would be brought in contact in the discharge of his duties.

With these few suggestions, which I think will meet with the approbation of the majority of mining men, I have the honor to be,

Very respectfully your obedient servant,
JAMES P. EDWARDS,
Commissioner of Mineral Statistics.

COPPER RANGE.

The great Copper Range of Michigan extends from the Montreal river, the western boundary of the state, northeasterly for a distance of 140 miles, and only terminates at the extreme end of Keweenaw point, and is about four and one-half miles in width.

The range west of Ontonagon has been but slightly explored, but little real work having been clone, and none is being done at present. In the Ontonagon district the National has absorbed the old Minnesota mine, and legitimate mining has once more been attempted, but the results thus far have not been very satisfactory.

All other mine work that has been done has been under tribute, and has been fairly profitable to the miners. In the fall the Adventure company made a new departure, and with fair prospects. It would seem from the records

of the past that all that is needed to place Ontonagon mines once more among the profitable copper producers is *money, modern appliances* and *proper management*. Since the palmy days of the "old Minnesota," the primitive methods of our fathers have been the order in this district, and even with no other help than the hammer and drill scores of tributers have been fattening on the "treasures of the underground world."

Between the Ontonagon district and the Portage lake district, a distance of 30 miles, no work has been done with the exception of two or three explorations—back in the fifties—the reopening and extending of the exploring pits at the Winona, some 25 miles south of Houghton, by Hon. J. A. Hubbell during the summer of 1890, where the showing was more than fair; and the Ryan exploration near the Six-Mile hill, or six miles from Houghton. This exploration is certainly one of the best showings for the labor performed that this section has ever produced, and why it should have been abandoned is not generally understood.

The general characteristics of the Portage lake and Keweenaw districts have been so often and fully described by my predecessor, Prof. C. D. Lawton, that I shall not at this time attempt to describe them, but shall confine myself to the details of the work of the several mines for the year.

The copper situation during the year has been one of constant solicitude to the smaller mines, on account of the falling market, January opening with copper at 15c, and December finding sales at 10½c. Yet, on the whole, Lake Superior has fared well, as the average price for the year has been about 13c.

No particularly new devices have beeen introduced during the year for the advancement of copper mining, although all of the larger mining plants have been improved, more particularly the Quincy and North Quincy.

In the Keweenaw district but three mines are working. Little or no mention will be made of the idle properties.

ONTONAGON DISTRICT.

The first working mine that comes to our notice in the Ontonagon district is

THE NATIONAL MINE.

The NATIONAL in February, 1891 was looking very well for copper, and the miners were stripping one of the masses that was partly exposed in 1883 or 1884, and there were good indications that a large mass—one of the "old timers" was awaiting the manipulations of the copper cutters. Several other pieces of copper, that were left behind about the same time, were taken out.

In March sinking was carried on at No. 2 shaft, below the 13th level, and It was expected to reach the 14th level about the middle of May.

In May the cross-cut north from the main lode, cut the amygdaloid lode 140 feet distant. This is at a point 500 feet deeper than where it was worked some years ago. No. 2. shaft was down to the 14th level at this time, making 200 feet sunk at this point since the work was commenced. In June the sinking of the shaft was progressing at a favorable rate, and the drift, winzes and stopes on the amygdaloid continued to look very promising. The vein continued to hold a width of from 8 to 10 feet, and was well filled with copper throughout. The cross-cut in from the 12th level, on the main lode of the amygdaloid was in June being pushed as rapidly as possible.

The company started its new stamp mill July 29 with satisfactory results. The rock treated in August was from the north, or amygdaloid lode, which carried copper in paying quantities, and the product of the mill which ran but half time was 21 tons. It will be remembered, by those familiar with the mine, that this lode from the surface to the 6th level was opened in several places, but at the points attacked did not yield copper in paying quantities.

The present management, however, believing that at some deeper point "pay dirt" would be found, drove a cross-cut at the 11th level (from the main lode to the Amygdaloid which is 140 feet distant) or 500 feet below the former workings, and tapped It at that point with results named above. The 11th level has been opened each side of the cross-cut between 100 and 200 feet, giving an opening on the lode of between 300 and 400 feet.

Stoping was in August progressing at this point, and the rock treated was taken from there. The management were so much encouraged by the outlook, that they were sinking a winze from the 11th to 12th level, and driving a cross-cut from the 12th to intercept the same. The shaft on the south side vein was down about 1,500 feet and the drift at bottom was looking fair.

In September the north lode was struck at the 15th level and showed up well in copper. No. 2 shaft had reached the 15th and fifteen feet of drifting was done at the bottom of the shaft, but the lode was poor at that point.

Stamping was stopped for a short time in October. Development work, however, continued, and the work of opening up on both lodes was going forward.

In November quite a number of men were discharged at the mine. The work had been a disappointment, as the development did not prove as favorable as expected.

The total product of the mine for the year, chiefly from the stamp mill, was 69 tons, 1,379 pounds mineral, which yielded 103,884 pounds of refined copper.

Total yield of refined copper from beginning of operations to December 31, 1891, 5,802 tons, 1,847 pounds.

THE RIDGE MINE.

The work at this mine in 1891 was confined to tributing, a few men having tried their fortunes in the upper and abandoned levels. A product of 26 tons of mineral or 21 tons, 1,04,9 pounds of refined copper, was the result.

The yield of refined copper In past years, up to the close of 1890, amounted to 2,641 tons.

THE MASS MINE.

The charter of the Mass Mining Company having expired, the property was sold at auction under the statute of limitation, and Capt. Chynoweth, of Houghton, is at this writing in possession of the trustee's deed.

In September, 1891, Mr. B. F. Chynoweth visited Pittsburgh, Pa., for the purpose of effecting a reorganization of the company, and assisting in the formation of more liberal and enlarged plan of future operations.

The property continued to be worked by tributers during 1891, as it has been worked (when active) ever since the company ceased operations on its own account in 1884, and the product In ingot copper for the year was 30,114 pounds. Total product since beginning of operations—1857 to 1892—2,521 tons 1,844 pounds refined copper.

The tributers did very well, turning out a product of 19 tons 677 pounds mineral, which yielded 77.86 per cent of pure metal.

ADVENTURE MINE.

During the past year exploratory work has been carried on at the ADVENTURE, on the Knowlton vein, and at every point where openings were made, it looked well, so the company decided to sink a shaft on it. This work was going on in the winter of 1891, and it was expected the 2d level would be reached before spring, when some drifting will be done to prove the value of the vein in depth by stoping. A little tributing has been done by miners, and they have produced 3 tons 1,000 pounds of mineral.

Mining men acquainted with the surroundings think the management acted wisely in selecting the Knowlton vein from the many which traverse the property, as it is the most productive and regular of the whole group.

No shipments have been made from the openings in 1891, but from the history of the vein in adjoining mines there is little doubt of ultimate success. At the Hilton, Ridge, Mass and Knowlton mines there has been produced in the past, up to the close of 1890, refined copper as follows:

	Tons.	Pounds.
Hilton	61	1,688
Ridge	2,641	468
Mass	2,506	1,730
Knowlton	235	1,138
Total yield refined copper	5,445	1,024

PORTAGE LAKE DISTRICT.

THE ATLANTIC MINE.

The results of the year's work at this steady-going and, in past years, uniformly productive mine were not as satisfactory to the directors and, presumably, not to the shareholders at large as usual.

A larger amount of work was done, both underground and at surface, than in any previous year, but owing to several causes, chief of which were the decline in price for copper of $2^{37}/_{100}$ cents per pound from the figures of 1889, and a decline of .7 of a pound of copper per ton of rock stamped, as compared with the yield from stamped rock in 1889. These items appear trifling at first glance, but the cold logic of figures shows that on a product of 3,653,671 pounds of refined copper a decline of 2.37 cents per pound amounts to $86,592; while on an output of 297,030 tons, rock stamped, a falling off (from the small average of about 14 pounds per ton) of even .7 of a pound per ton means a further loss of $26,356.70. Thus these two seemingly trifling changes in price of product and yield of stamp rock made a total of over $112,000.00 in the receipts for 1891, or that much less than they would have been had copper realized the same price and the rock stamped given the same yield as in 1890. In their annual report the directors find it difficult to account for the decline in the yield, but say "it must be assumed to be due to one of the fluctuations in yield common to mineral deposits, and from which the amygdaloid belts of Lake Superior are by no means exempt."

The amount of CONSTRUCTION WORK has been unusually large, but nothing was done that was not absolutely necessary to put the plant in efficient shape for economical production. The expenditure on this account was nearly $33,000, the principals being as follows:

AT MINE.

New shaft (at No. 3), $2,993; power drills, $750; No. 2 engine, $5,174; No. 2 engine house, $3,701; No. 2 boiler, accessories and labor, $1,937; one 42-ton locomotive, freight, hauling and labor on the same, addition, to locomotive house, car sheds, turn tables, rock cars and flat cars, $10,147; one double ½-story frame house and a warehouse for store, $1,318; electric light plant, $2,090.

AT MILL.

Eight jiggers complete, $1,159.20; solid foundation for one stamp, $2,552.76; new dam for reserve water, $789.29; bulkheads on harbor lines, $245.75.

The last item of construction calls attention to the difficulty of complying with the requirements of the Government in the matter of depositing stamp sands in Portage lake, and the directors say in their report that "in view of the expense of protecting the channel laid out, and the evident purpose of the Government to enforce stringent rules therefor upon riparian owners, which will

compel us to discontinue stamping at that point at no distant day, it is imperative that we should begin the work of removal as soon as practicable.

"The transfer of our stamping to a point free from liability to interference will involve the construction of 8 to 10 miles of railroad to our recently acquired lands on the shore of Lake Superior, and the erection of a stamp mill at that point, and in view of the large expenditure which must be incurred for these purposes, the directors believe that it would be unwise to diminish our resources by payment of a dividend at this time."

The following condensation of the financial exhibits contained in the official report for the year, will give additional data of interest relative to this excellently managed mine:

The statement of

ASSETS AND LIABILITIES

Shows assets in cash, copper-bills, loans, and copper on hand valued at 10⅝ cents per pound	$191,464 93
Coal, wood, supplies, and merchandise in store	103,868 27
Total assets	$295,333 20
Liabilities	42,498 51
Balance of assets	$252,834 69

Receipts.

The receipts from date of organization have been $8,684,105.74,—from capital stock, $980,000; sales of copper, $7,703,252.59; other sources, $853.15.

Expenditures.

Real estate at consolidation of Adams and South Pewabic	$659,642 11
Lands since purchased	46,632 57
	$706,274 68
Net expenditure for additional equipment, mining operations, etc.	$7,024,996 37

Balance of receipts, being net profit to date (Dec. 31, 1891), $952,834.69. From which balance deduct dividends paid—$700,000—and there remained a net surplus at the beginning of 1802, of $252,834.69, as shown above.

The working expenses for 1891 were as follows:

UNDERGROUND EXPENSES.

Sinking 106 feet, average $16.25 net		$1,722 99
Drifting 4,595.2 feet, average $4.92 net		22,607 22
Stoping 18,821.2 fathoms, average $4.33 net		81,546 61
Timbering, tramming and labor		79,882 07
Timber, materials and supplies		13,918 14
Pumping and operating air compressors:		
Labor	$7,951 66	
Fuel	14,521 90	
Supplies and materials	4,057 81	
	$26,531 37	
		$226,208 40

SURFACE EXPENSES.

Superintendence, and labor of all kinds, less sundry credit items	$26,061 70	
Supplies and materials	7,833 55	
Fuel	19,399 15	
Specific tax on copper	1,356 82	
Fire insurance	516 00	
Taxes	4,949 92	
Canal tools on copper	198 00	
Expenses and sundry repairs	1,339 46	
	$61,654 60	
Less amount received for rents	4,811 85	
		56,842 75

RAILROAD EXPENSES.

Labor	$7,267 79	
Fuel	2,685 50	
Supplies	1,786 05	
	$11,739 34	
Less received for transportation	280 00	
		11,459 34

STAMP MILL EXPENSES.

Labor	$28,517 33	
Fuel	35,558 00	
Supplies	10,298 24	
Fire insurance	1,023 75	
Teaming mineral, etc.	1,558 46	
	$76,985 78	
Less received for dockage	285 00	76,700 78
Total working expenses		$371,211 27

CONSTRUCTION ACCOUNT.

At Mine.

No. 3 shaft: (new shaft)		
Miners, laborers and timbermen	$2,204 05	
Supplies and surveying	789 24	2,993 29
Power drills:		
One Ingersoll-Sergeant air drill, complete	$277 00	
One Ingersoll-Sergeant air cylinder	473 00	750 00
No. 2 engine:		
Cost of engine	$2,400 00	
Mechanics and laborers	1,265 65	
Supplies and teaming	1,508 42	5,174 07
No. 2 Engine House:		
Mechanics and laborers	$1,196 03	
Supplies and materials	2,505 18	$3,701 21
No. 2 boiler:		
One fire box boiler	$1,375 00	
Smoke stack for same	188 10	
Labor and mechanics	89 53	
Covering pipes and boiler	144 90	
Supplies and teaming	140 46	1,937 99
Railroad:		
One 42 ton locomotive	$6,975 00	
Freight, hauling and labor on same	678 44	
Addition to locomotive house	267 77	
Car sheds	119 41	
Turntables	879 26	
Rock cars	1,185 83	
Flat cars	41 79	10,147 50
Buildings, etc.:		
One double 1½ story frame house	$527 78	
Warehouse for store	790 22	1,318 00
Electric light plant:		
Cost of plant, as per contract	$1,983 70	
Labor	55 84	
Supplies, etc.	51 19	2,090 73

At Mill.

Eight jigs complete	$1,159 20	
Solid foundation for one stamp	2,552 76	
New dam for reserve water	789 29	
Bulkheads on harbor lines	245 75	4,747 00
Total expenditure		$404,071 06

SUMMARY OF RESULTS.

Ground broken, openings and stopes	20,591.1 fathoms
Rock stamped	297,030 tons
Product of mineral	5,089,700 lbs.
Product of refined copper	3,653,671 "
Yield of refined copper per cubic fathom of ground broken	177.4 "
Yield of rock treated, $12\frac{3}{10}$ lbs. copper per ton, or	0.615 per cent
Gross value of product, per ton of rock treated	$1.5467
Cost per ton of mining, selecting and breaking, and all surface expenses, including taxes	.9529
Cost per ton of transportation to mill	.0386
Cost per ton of stamping and separating	.2582
Cost per ton of working expenses at mine	1.2497
Cost per ton of freight, smelting and marketing product, including New York office expenses	.1847
Cost per ton of running expenses	1.4344
Total expenditure per ton of rock treated	1.5451

THE PACIFIC

Mining Company was organized in August, 1890, for the purpose of testing and developing the Atlantic vein, on the N. E. ¼ of S. 4, T. 54, R. 34, which adjoins the Atlantic mine on the north.

A vertical shaft was sunk on the hanging wall side, about 200 feet from the outcrop, to a depth of about 90 feet, a cross-cut then being made to the vein. But the vein after

a thorough test by drifting proved worthless and work was discontinued early in the year, the shaft house being dismantled and the shaft covered.

THE HURON

has been under "dark clouds which have obscured the horizon" for the year 1891 as in the years previous.

In March the management made its first report for many years, and a study of its contents, by the stockholders was not conducive of a pleasant frame of mind, in fact was but the prologue of disaster to follow, for in June the eastern management allowed the mine drafts to go to protest, and on Monday, June 24, the mine was attached by the creditors and the realty and personal property were in the hands of the sheriff; but work at the mine was continued by the creditors under the management of Cap. Johnson Vivian, who has had charge of the mine for several years, until about the 1st of December when it was closed down and placed in charge of Mr. Graham Pope.

In the January term of the circuit court, Judge Haire rendered the following judgments against the company: Small judgments, $76,924.96; J. H. Seager, $15,378.76; Daniel L. Denmon, $106,351.28.

Owing to the legal complications no authentic information of the condition of the mine can be obtained.

The product for the year was 1,215,734 lbs.

QUINCY MINE.

The "Old Reliable," as the Quincy is familiarly and admiringly termed by the average Portage Laker, was ready for business bright and early New Year's morning, 1891, with cash and other quick assets to its credit amounting to $742,045.15.

January run scored a product of 450 tons 1,845 pounds, against 300 tons 1,075 pounds in January, 1890. This month, too, brought a five-dollar dividend, the 45th since Quincy was a youngster, amounting to $200,000,and making the amount paid shareholders to Feb. 26, 1891, *five million seven hundred and seventy thousand dollars.*

Early in March the directors voted to give 10,000 shares of Quincy treasury stock for the Pewabic mining property.

On Wednesday, April 2, the deed from Mason & Smith conveying the Pewabic property to the Quincy company, was recorded in the county clerk's office, Houghton. The April product, 502 tons 1,125 pounds, brought the total yield from January 1, 1891, up to 1,909 tons 475 pounds. The output for May, 550 tons mineral, exceeded the yield of May, 1890, by nearly 25 tons, and closed the record of the first five months of 1891 with a production of 2,459 tons, or 663 tons increase as compared with the yield of the same period in 1890. In this month, as also in June, a large amount of surface work was in progress, made necessary by the purchase of the Pewabic. The old skip road in the latter was being leveled, and everything put in readiness for big work. The vein rock that was left between the two mines, and supposed to be only from 8 to 15 feet in thickness, proved to be in many places 70 feet thick, and was reported to be very rich in copper.

A branch line was built from the Quincy and Torch Lake railroad to the site proposed for the new rock house, and was nearly completed early in June. The enlargement of No. 2 shaft was commenced in September, 1890, and it was at that time estimated that an entire year would be required to complete it. The work involved the doubling of the size of the shaft from surface to the 40th level—a distance of over 3,000 feet—the building and equipment of a new skip road and some changes in the hoisting machinery, and all without interfering with hoisting over the old roadway. The work progressed without accident, and was completed within five months, instead of requiring a year as first anticipated. The shafts are now uniform in size and the gauge of the skip roads is also uniform, allowing the skips to be used interchangeably. The latter were increased to 67 cubic feet capacity, equal to an increase of from 2| to 3 tons per skip. They are adjusted to counterbalance each other, an important feature in the operation of the mine, since the engines in operation are always hoisting and that with a smaller expenditure of power than formerly. The above and other minor changes, among which were the increasing of the diameter of the drum at No. 2 engine house by 13 inches, and replacing the friction gear with a new tooth gear, were expected to increase the hoisting speed 25 per cent.

For the following further particulars relating to important surface improvements made in 1891, I am indebted to the report of S. B. Harris, Agent:

"A line of four-inch pipes and hydrants was laid, connecting the fire plant at No. 2 with the new work at No. 6. Fourteen double and fifteen single dwelling houses were repaired, or practically rebuilt. A reservoir near the new boiler house was enlarged, and a new one added, making the capacity of both about one million gallons of water.

A stone boiler house 56 by 101 feet was erected and four 6 by 16 feet return tubular boilers placed therein (four or six more are to be added). A stone building 56 by 74 feet for a new direct acting 40 by 84 inch hoisting engine was built, and a stone building 56 by 84 feet built for a new compound condensing 30 by 54 inch steam and 30 by 60 inch Allis air compressor.

At the stamp mill on Torch lake an addition 200 by 40 feet was made to the dock, an extension of 40 feet made to the boiler house, and four new 6 be 16 feet return tubular boilers procured to be placed therein. A new ten million gallon Worthington high duty pumping engine was purchased and placed alongside the other eight million pump in the same building, an extension of 80 feet to the stamp mill building (being 40 feet on each

side) was also made for two new 20 inch cylinder stamps."

June product (569 tons, 1,145 pounds) and the yield for July (570 tons, 600 pounds) made the output for 7 months 3,599 tons, 480 pounds mineral, or an average since January 1, of 514 tons per month.

July 23 the stockholders were again treated to a five dollar dividend, and a total division of $6,020,000 scored to Quincy's credit.

In August the foundation walls for the addition to stamp mill were completed and four new boilers were added to the boiler plant. The product for the month was 570 tons 615 pounds.

In September work on the two additional Ball heads at the stamp was in progress, and it was reported that "when completed the output would be brought up to about 1,000 or 1,200 tons copper per month." The source of this report is not official.

In October 446 feet of drifting was done and at the 41st level, near No.4 shaft, rich block of ground was encountered. At No. 6 (Pewabic) shaft the "water was at the 30th level and the shaft had been reconstructed to the 18th level by the 31st of the month. The new Worthington pump had arrived and eight new boilers, making 25 boilers on the location of 150 horse power each.

In December the farthest opening south was In ground extremely rich in mass and barrel copper, and the lode was reported nearly fifty feet wide.

The output for November was 600 tons, 1,335 pounds; that for December was 502 tons, 1,205 pounds, and the "Old Reliable" finished the greatest twelvemonth its industrial career had witnessed since 1856, (when its first year's*output was 6 tons, 1,462 pounds) by emblazoning on its record:—Product, mineral, for 1891, 6,413 tons, 1,075 pounds. Total product refined copper since 1856, 125,233,906 pounds.

General Summary of Receipts and Expenditures of the Quincy Mining Company from its organization to December 31, 1891.

EXPENDITURES.

For expenditure on location previous to 1856	$42,097 98
For expenditure on Quincy vein, 1858, not now worked	55,000 00
For openings and explorations on 3,800 feet "east" or Pewabic vein extending to Portage lake preparatory to future work	11,500 00
For real estate and permanent improvements on the same, including dwelling houses, stamp mill, machinery, steam engines, railroad, dock warehouse, and other buildings and roads	1,800,851 56
For mining and surface labor, expenses of smelting and marketing copper, and all incidental expenses	14,460,766 93
Balance carried down	6,727,015 54
	$23,097,232 01

RECEIPTS.

From capital stock paid in	$200,000 00
From proceeds copper and silver (125,233,906 lbs. copper)	22,570,958 90
From interest	180,528 77
From profit on sale P. L. & R. Improvement Company stock, and other investments	79,637 16
From sales of real estate, Hancock, Mich.	66,107 18
	$23,097,232 01
By balance brought down, being receipts over expenditures	$6,727,015 54
Deducting dividends declared, Nos. 1 to 46 inclusive	6,020,000 00
Leaving balance	$707,015 54

The annexed

SUMMARY FOR A DECADE

exhibits in concise form such industrial data relative to the Quincy's operations as the management has chosen to publish:

	1891	1890	1889	1888	1887
Average force employed	652 men	484 men	485 men	471 men	447 men
" number of miners	182 "	146 "	145 "	158 "	142 "
" wages of miners on contract per month	$53 40	$52 60	$49 15	$49 60	$48 40
Yield of mineral per fathom of ground broken	835 lbs	961 lbs	842 lbs	842 lbs	976 lbs
Yield of refined copper per fathom of ground broken	685 "	769 "	690 "	690 "	781 "
Total rock mined	276,336 tons	187,244 tons	167,077 tons	165,978 tons	124,289 tons
" " hoisted	269,817 "	168,017 "	123,998 "	123,376 "	96,370 "
" stamp rock treated	263,678 "	165,140 "	117,785 "	117,514 "	94,250 "
Product stamp mineral	8,649,585 lbs	7,262,485 lbs	6,641,785 lbs	7,141,570 lbs	6,092,475 lbs
" masses	4,177,490 "	2,740,365 "	1,178,225 "	621,875 "	651,035 "
" refined copper	10,542,519 "	8,664,253 "	6,405,686 "	6,367,809 "	5,699,762 "
Yield of rock stamped (mineral)	----------	2.82 per cent	2.82 per cent	3.04 per cent	3.23 per cent

	1886	1885	1883	1882	1881
Average force employed	415 men	400 men	453 men	438 men	486 men
" number of miners	140 "	132 "	165 "	152 "	212 "
" wages of miners on contract per month	$45 80	$44 00	$46 02	$48 83	$48 54
Yield of mineral to fathom of ground broken	777 lbs	865 lbs	1,035 lbs	970 lbs	918 lbs
Yield of refined copper per fathom of ground broken	638 "	710 "	850 "	800 "	767 "
Total rock mined	165,618 tons	147,626 tons	117,171 tons	120 377 tons	126,140 tons
" " hoisted	115,608 "	111,402 "	101,415 "	109,751 "	111,131 "
" stamp rock treated	109,702 "	108,181 "	97,100 "	101,327 "	98,869 "
Product stamp mineral	6,748,785 lbs	6,694,125 lbs	6,535,045 lbs	6,508,410 lbs	6,193,190 lbs
" masses	404,715 "	487,680 "	206,105 "	365,820 "	622,295 "
" refined copper	5,923,519 "	5,848,530 "	----------	5,682,663 "	5,702,606 "
Yield of rock stamped (mineral)	3.08 per cent	3.05 per cent	3.36 per cent	3.21 per cent	3.13 per cent

THE PEWABIC MINE,

now called the "North Quincy," which has been for some years the "bone of contention" between the Quincy and Franklin mine managements, adjoins the Quincy on the north and the Franklin on the south.

The mine has been idle for some years, pending decision of court, was sold at public auction by special Master White, January, 1891, for the sum of $710,000, to Smith and Mason, which sale was confirmed by the Supreme Court of the U. S. in May.

The Quincy Mining Company came into possession by turning over to Mason and Smith 10,000 shares of new treasury stock of the Quincy Company, at a nominal valuation of $80 per share.

Construction work was at once begun and the mine put in shape for active operations, but was checked temporarily in April, by fire being discovered in the mine. The fire, however, did not last long, as the miners were again at work underground in a few days (see Quincy).

FRANKLIN MINE.

There was a surplus on hand to the credit of the FRANKLIN, December 81, 1890, amounting to $650,918.54. The mine entered upon the new year with the prestige of having made the largest product in 1890 ever recorded in its history—3,411 tons, 1,204 pounds of copper mineral, over one-quarter of which was the output of the last three months of the year.

The east branch to which this phenomenal yield was locally attributed was reported in January, 1891, to be extending in size and improving in quality with every blast, "a bonanza fully equal in every way to the same branch in the Quincy." The January product, however,

was only 204 tons, 890 pounds, as against 451 tons in December, 1890, and 201 tons in January, 1890, and the yield of each of the succeeding months did not pan out in a manner to strengthen faith in the prophets of the press whose predictions relating to the "East Branch" had been so encouraging at the start.

The mine was unfortunately visited by fire twice during the year. March 18 everything combustible about the hoisting plant was burned except the roof of one of the boiler houses, and hoisting was delayed about three weeks. Hoisting was resumed in April, the delay being much shorter than was at first expected; but on the 8th a fire broke out in the Pewabic, filling the Franklin with smoke and compelling a suspension of all operations for a week. On September 8, No. 3 shaft and rock house were partly destroyed by fire, stopping the output at that shaft for eight days. These three fires caused a decline in the output of rock for the year of about 15,000 tons, or that much less than it would have been, had there been no fires.

In May the quality of the rock hoisted from the mine was excellent, and everything about the surface was in good condition. A dividend was declared in June of $2.00 per share, or $80,000, payable July 6. For the five months ending May 31, the production footed up 1,009¾ tons, against 1,014 tons for the same period in 1890, and the output in June, 203 tons, 110 pounds, brought the yield of the half year up to 1,213 tons, 765 pounds, The products reported for July and August averaged a little over 200 tons each.

In September a cross-cut east from the 27th level encountered the Allouez conglomerate, and found it looking so favorable as to "promise a new lease of life to the old mine." It was struck about 520 feet from the regular Franklin workings. Nothing is said, however, about the developments on the conglomerate, in the report for 1891. And about the close of December it was currently reported that the new vein had not shown anything of value. As the Allouez belt has an extent of about 2,800 feet on 4he Franklin property, at surface, was cut at a point over 2,400 feet "from grass," exhibited in the little opening done "a showing of copper that was certainly very promising," and will not pass out of the limits of Franklin's quarter section until it reaches a depth of between 4,000 and 5,000 feet, it is not unlikely that the shrewd management of the commonly reported to be nearly played out Franklin, may have reasons for their reticence other than the poverty of the Allouez belt.

The following summary of results in 1891, and comparison with like date in 1890 and 1881 will perhaps be of interest:

	1891.	1890.	1881.
Sinking shafts	294 feet.	259 feet	349 feet.
Sinking winzes	26 feet.	73 feet	281 2-5 feet.
Drifting	2,466 7-10 feet	2,513 6-10 feet	2,535 feet.
Ground broken	8,414 fathoms.	12,229 fathoms.	6,750¼ fathoms.
Number tons rock hoisted	175,978.	188,355.	146,260.
Number tons rock rejected	40,400.	43,960.	32,932
Number tons rock stamped	135,578	144,393.	113,328
Yield mineral per fathom broken	619.63 lbs.	556.31	375 lbs.
Yield copper per fathom broken	513.41 lbs.	461.	311 lbs.
Yield mineral per ton rock hoisted	29.62 lbs.	36.12.	22.07 lbs.
Yield copper per ton rock hoisted	24.83 lbs.	29.93	18.31 lbs.
Yield mineral per ton rock stamped	38.45 lbs.	47.11.	28.48 lbs.
Yield copper per ton rock stamped	31.86 lbs.	39.33.	
Total mineral produced	5,213,642 lbs.	6,803,155.	3,228,270 lbs.
Total copper produced	4,319,840 lbs.	5,638,112.	2,678,797.
Total cost per ton rock hoisted	$1.77.	$1.90	$2.82.
Per cent of copper in mineral	82.085.	82.875	82.97

Below is the official statement of

ASSETS AND LIABILITIES DECEMBER 31, 1891.

Assets.

Cash and accounts receivable		$79,098 56
Copper account (amount unsold estimated 10½ cents)		694,231 02
Supplies at mine		66,836 11
Bills receivable		41,435 82
		$881,601 51

Liabilities.

Drafts outstanding	$3,300 32	
Liabilities at mine	29,509 28	
Accounts and bills payable (smelting and freight bills, etc.)	17,191 60	
Loan accounts	311,463 25	361,464 45
Surplus December 31, 1891		$520,137 06

THE ARCADIAN MINE.

This mine had not been in operation for ten years until Messrs. North and Cleaves began to work it on tribute to the Arcadian Mining Company. The lease was secured by S. D. North & Son, who accepted the co-operation of S. E. Cleaves & Son, the Portage Lake founders, the latter placing their machinery against the lease. The mine has been newly equipped throughout. A compressor, made by Cleaves & Son, is capable of operating ten drills. In January four Ingersoll-Seargeant drills were in use. At this time there were about 100 tons of rock on the dump, and stamping was commenced—the rock being hauled to the Peninsular stamp mill and there being treated.

The Arcadian occupies N. W. ¼ of S. 20, T. 55 N. of R. 33 W. and is on what is known as the Isle Royal vein. Four shafts and two winzes, the latter capable of being operated as shafts, extend from surface to 1st level, Nos. 3 and 4 shafts and No. 2 winze going down to 2d level. About 26 feet of holing remained to be done in January, after which the drifts would be connected throughout. This wall of rock is in the 2d level between No. 8 shaft and No. 2 winze.

The tributers were at this time working the 1st level, and in the 2d at No. 3 shaft. In No. 4 shaft the openings, below the 1st level, were partly filled with water, and only sufficient water was raised to supply the boilers, but they were to be put to their capacity and the water pumped but as rapidly as possible.

Capt. E. S. Roberts, now of the Mastodon iron mine, and who had charge of the Arcadian when it was closed down 28 years ago is authority for the statement that the ground at the bottom of No. 2 winze, near the wall in the drift, had been partly stoped and found very rich. From the Franklin, going north no mines have been wrought during the past few years until we come to

THE PENINSULA MINE.

This mine is situate in Secs. 7 and 8, T. 55, R. 33 and has a large amount of territory crossed by nearly all of the known veins in the copper country, but thus far none of them have been found very profitable; although the past year has been the most successful since the mine has been a producer.

The product being nearly one-third of the entire product to date. 108,560 tons of rock was hoisted during the year, of which 99,591 tons was stamped, producing 1,095 tons, 1,830 lbs. of mineral, or 1,599,870 lbs. of refined copper—being a little less than ¾ of 1% of the entire amount of rock hoisted, and at a cost, exclusive of eastern expense, of less than 11 cents per pound. This, with the fact that the bottom levels, at the close of the year, were well charged with copper, would seem to warrant the belief, that with extended facilities for the handling of a large amount of rock the Peninsula would be placed among the dividend payers.

The local management, under the superintendence of Capt. W. A. Dunn, seems to have had a hard struggle with the eastern management to keep the mine working. And as from reports, the company will furnish no money, the mine will keep on the “even tenor of its way" only as long as Capt. Dunn can make the copper pay the expenses, which not only include the regular mining expense but that of exploring the balance of the property.

These explorations have been very extensive in the last few years and give a great deal of information as to the formation. The "Calumet Conglomerate" presents the following compilation of these explorations:

"At the 400-foot level, north of No. 2 shaft, a cross-cut was started east in the Allouez or Peninsula vein, at right angles to the trend of the formation. After cross-cutting 1,040 feet, a diamond drill was started at the breast of the cross-cut, in the same direction, and continued for 540 feet further, making in all 1,580 feet of exploration.

"The table given below will show the location of all the stratigraphical layers or ‘veins' encountered. The intermediate spaces not described are “country rock” or the trap common to this section. They found

At 168 ft. an amygdaloid 4 ft. thick.
“ 347 ft. an amygdaloid 5 ft. thick.
” 463 ft. a conglomerate 6 ft. thick.
“ 506 ft. a conglomerate 27 ft. thick.
“ 749 ft. an amygdaloid 10 ft. thick.
“ 814 ft. an amygdaloid 19 ft. thick.
“ 1040 ft. began drill hole.
“ 1175 ft. an epidote 5 ft. thick.
" 1180 ft. an amyg. trap 10 ft. thick.

At 1260 ft. an amyg. trap 10 |t thick.
” 1299 ft. an amygdaloid 3 ft. thick.
" 1340 ft. an amygdaloid 6 ft. thick.
" 1397 ft. a fluccan 5 ft. thick.
“ 1402 ft. Cal. conglom. 6 ft. thick.
“ 1410 ft. an amygdaloid 3 ft. thick.
" 1420 ft. an amygdaloid 16 ft. thick.
" 1440 ft. an amygdaloid 9 ft. thick.
" 1560 end of drill hole.

“Nearly all of these veins carry more or less copper. The Calumet conglomerate was only six feet wide but carried considerable very fine-copper. Several amygdaloid veins were good enough to warrant working if they hold out as good as they appeared at this point of intersection with cross-cut or drill hole.

"Another diamond drill exploration was made for the Pewabic lode. It was started at a point about 325 feet west of the outcrop of the Pewabic lode or about 800 ft. west of the main Peninsula or 'Allouez' lode.

"After passing through 35 feet of alluvial an amygdaloid was found and in order, a blue trap, poor amygdaloid, amygdaloid trap, poor amygdaloid, common trap, at 140 feet an amygdaloid trap, at 220 feet, amygdaloidal trap, copper bearing trap, at 320 feet poor amygdaloid, coarse trap, dense trap, at 425 the Pewabic lode. All the amygdaloids not noted as poor carry more or less copper. The Pewabic at this point was very good.

"Another exploration consisted of a pit sunk on the outcrop of the Calumet conglomerate. About twenty feet back of the vein a diamond drill was started in, at an angle of about 80 degrees and across the formation. At 95 ft. was encountered an amygdaloid 13 feet wide (measured on the angle), at 210 an amygdaloid 12 feet thick, at 222 an amygdaloidal trap 24 feet, at 266 another amygdaloidal trap 40 feet thick, at 360 an amygdaloid 18 feet thick, and at 465 feet the drill was still in trap."

THE TECUMSEH MINE.

January month found this mine drifting south on the Osceola Amygdaloid, which was penetrated some 80 feet. Heretofore the work had been by hammer and drill, but an Ingersoll-Seargent, with a self regulator has been put in operation, the compressor being of a capacity to run five drills, although but one is employed at date of this writing. Before the introduction of the power drill the drift was extended from 18 to 22 feet per month, but now it is calculated it will be run from 75 to 80 feet.

There is an old pit about 500 feet south of the shaft, sunk some 24 years ago, and it was understood that when the drift was extended to that point a shaft was to be raised on the lay of the lode. The rock crossing from the drift was very promising looking and argued well for a good yield of copper as depth was attained.

The vertical shaft on the Kearsarge lode was sunk 74 feet, when a crosscut was started east. At a distance of about 16 feet from the shaft a belt of amygdaloid about 16 feet wide was struck, which at first was supposed to be the Kearsarge. This cross-cut was stopped after being extended about 30 feet. A cross-cut west was then started, and was raised some twenty feet as it continued along the top of the rock for a distance of 58 feet, when the regular Kearsarge lode was encountered,

which was very promising in appearance and carried a little copper.

Work in June was progressing favorably, but nothing very striking had been discovered either on the Osceola or Kearsarge lode. The drift on the Osceola was at this time in south about 400 feet, and it was expected another 100 feet would carry it to the shaft, or old pit. mentioned above. It was the intention to clean out the pit and continue the shaft down in the hope of catching the copper corning south from the Osceola. In mining this south drift a branch showing much copper was encountered. In July the north shaft was unwatered to a depth of about 70 feet. A pump, boiler and hoisting engine were also erected. The shaft was then down some 100 feet.

On the Kearsarge amygdaloid after drifting south a considerable distance a cross-cut was started east, which early in September was in about 120 feet. In this distance four amygdaloid belts were encountered. The last and easternmost, was about 20 feet wide, but the signs of copper were few and far between.

Very early in December development work on the Tecumseh property was reported abandoned, but work was still in progress (at the 1st level of the old shaft sunk on the Osceola amygdaloid) in the middle of that month, and the drift at that time had reached a point between 700 and 800 feet south. The lode looked well but "carried very little copper."

THE OSCEOLA MINE.

The outlook in the initiatory stages of the openings by shaft, at the beginning of 1891 was not encouraging. Where encountered, in sinking No. 3 shaft, it was " fairly good for copper," but for a great part of the depth from the 26th to the 28th level the shaft, owing to the well-known tortuous character of the lode, was carried through the hanging-wall trap and necessitated the breaking of much dead (unproductive) ground. No. 5 in sinking from the 18th level fell into the same unfortunate trap and continued in it for two lifts, but the outlook brightened at, or about the 20th level. The shaft emerged into the lode and continued there for the next 100 feet, the lode being, as Superintendent Daniel! remarks in his annual report "unusually wide,"—"showing more than the average of copper, and carrying more barrel work than we generally encounter." The occurrence of an exceptionally large proportion of “barrel" copper in the Osceola amygdaloid is regarded as "almost an assurance of a good run of ground."

In January the drifts going south were in good paying ground, continued to appear equally promising in February. In March the lode became bunchy and changeable, sometimes showing rich and again lean for copper in rapid succession.

The product for May was 300 tons, making the total production for the first five months of the year 1,600 tons of mineral, as against 1,142 tons for the corresponding period of 1890. In July the yield was 305 tons mineral as compared with 230 tons in July, 1890; in September it dropped to 302¼ tons, jumping again in November to 350¼ tons, and December closed the year with an output which made the mineral product of 1891 larger than that of any other year in the history of the mine, while the mine was looking better "as stated by its directors" than at any time in the past.

No sinking was done in No. 6 shaft (Opeeche) during the year. The year's record shows an average of a little over 316¼ tons mineral per month, or a total product of 7,590.903 pounds, which at 86.20 per cent gave 6,543,358 pounds of refined copper, exceeding the product of any previous year by more than 620 tons.

From the superintendent's report are gathered the following data relative to the mining operations for the past year: The rock hoisted from the mine amounted to 272,781 tons, rock handled equaled 15,155 cubic fathoms of ground broken, the yield was 432 pounds of ingot copper per fathom, 24 pounds per ton of rock. The openings were extended by shafts, winzes and levels nearly 7,000 feet, footing up in exact figures ,as under:

Shafts	539.2 feet
Winzes	269.2 “
Levels	6,119.9 “
	6,928.3 feet

Drifts and winzes for pillars constituted nearly one-third of the opening work—"more than usual," the superintendent says, "but necessary to .avoid breaking poor ground and to support the hanging-wall."

The depths of the shafts, and the sinking for 1891 appear in the following:

Shafts.	Sunk.	Depth from surface.
No. 1		1,387.1 feet, 18 feet below 15th level.
No. 2	203.8 feet	2,072.7 feet, 8 feet below 23d level.
No. 3		2,663.3 feet, 10 feet below 28th level.
No. 4		2,115.0 feet, 10 feet below 24th level.
No. 5	332.4 feet	1,868.4 feet, 21st level.

Extensions of openings on the several levels were made as follows:

10th level	40.7 feet	20th level	656.4 feet
14th “	593.3 “	22d “	181.5 “
15th “	357.4 “	24th “	347.6 “
16th “	122.7 “	25th “	387.6 “
17th “	943.7 “	26th “	483.6 “
18th “	1,002.2 “	27th “	447.6 “
19th “	535.6 “	28th “	20.0 “

Fairly good stoping ground was encountered in drifting the 17th, 20th and 22d levels in the vicinity of No. 2 shaft.

From No. 3 shaft the 25th, 26th, 27th and 28th levels were drifted, both north and south, and though the openings did not show up ground equal to the best in the mine, yet much of it was thought good enough to stope. "The bunchy ground north of shaft was more continuously productive, and rather better south."

North of No. 4 shaft the 24th level was drifted till communication was effected with the same level from No. 3 shaft. South of No. 4 shaft the 10th, 17th, 18th,

19th, 20th, 22d and 24th levels were drifted 1,560.2 feet. Connection was established at the 17th level, between No. 4 and No. 5 shafts, and a nearly continuous run of copper ground was found between the shafts. There were indications of the same run of copper ground at the other openings. The occurrence of poor bars of ground was, however, not unanticipated, for the superintendent says, "the character of the lode assures them." "But," he adds encouragingly, "in the openings south of No. 4 shaft we find more than the usual amount of stoping ground and of full average quality."

Drifting was done north and south of No. 5 shaft at the following levels:

At 14th level, 593.3 feet; 15th level. 357.4 feet; 16th level, 122.7 feet; 17th level, 520.2 feet; 18th level, 728.2 feet; 19th level, 428.3 feet, and 20th level, 225.7 feet. Considerable stoping was done in all these levels during the year, as is indicated by the excellent map accompanying the company's annual report, and a full average yield of copper was the gratifying result. The Opeechee openings of the mine in and about No. 5 shaft, were in good working shape at the close of the year, and at least one-third of the product was coming from that source.

THE RECEIPTS AND EXPENSES

of all kinds from September 25, 1873, to January 1, 1892, have been as follows:

Receipts.

From capital stock, 50,000 shares at $25 a share full paid	$1,250,000 00
" sales of copper, 62,470,347 pounds at 15.18 cents per pound	9,484,729 34
" " silver to date	35,754 79
" interest receipts "	37,690 15
" 360 shares Hancock & Calumet R. R. stock sold	36,000 00
" 250 " " " " " on hand	25,000 00
Total receipts	$10,869,174 28

Expenses.

Running expenses prior to 1891	$6,940,693 20	
" " during 1891	606,638 15	
		$7,547,331 53
Construction expense prior to 1891	$844,746 18	
" " during 1891	55,226 77	
		899,972 95
Real estate		582,396 20
Dividends prior to 1891	$1,447,500 00	
" during 1891	150,000 00	
		1,597,500 00
Exploratory work		15,466 81
Total expenses		$10,642,667 31
Balance of receipts, Jan. 1, 1892		$226,506 97

DETAILS OF MINING AND OTHER EXPENSE

cover an expenditure at mine of $554,387.42, as follows:

Mining Expense.

Shaft sinking, 539.2 feet at $16 05 per foot		$8,657 90
Winze " 1,336.3 " " 7 43 "		9,931 65
Drifts, 7,316.7 " " 6 32 "		46,270 55
Stoping, 13,753.7 fathoms at 10.96 per fathom		150,779 41
Tramming		56,849 45
Supplies, fuel and labor for engines	$43,017 47	
Mining superintendence and company account labor	19,904 10	
Timbering, labor, materials and supplies	10,935 53	
Blacksmith, machinist, and carpenter labor	5,565 56	
Extra work	6,288 72	
	$395,010 51	
Less profit on supplies	60,216 00	
		$334,794 51

Other Expenses.

Stamping	$84,211 83	
Transportation	36,317 67	
Rock house	29,084 88	
Office labor, supplies, etc.	5,820 91	
Incidental expense, including taxes	5,812 99	
Surface labor, supplies, etc.	3,117 86	
		164,366 14
Total running expenses		$499,160 65

Construction Costs.

Stamp mill (No. 5 head)	$40,089 83	
No. 3 pump	594 95	
No. 4 engine	724 00	
No. 4 rock house	711 25	
No. 5 engine	2,138 27	
No. 5 rock house	2,311 80	
New compressor	2,009 71	
New change house	518 67	
Lime house	156 31	
Machine shop	562 72	
Dwelling houses at mine	5,379 26	
Total construction cost		55,226 77
Total expended at mine		$554,887 42

Summary.

Rock stamped	234,325 tons	
Product of mineral	7,590,903 lbs.	
Product of refined copper	6,543,358 lbs.	
Yield of refined copper per ton of stamp rock	27.92 lbs.	
Yield of refined copper per cubic fathom of ground broken	432 lbs.	
Yield of mineral per cubic fathom of ground broken	501 lbs.	
Percentage of mineral in stamp rock	1.62 per cent	
Percentage of refined copper in stamp rock	1.40 per cent	
Cost per ton of rock hoisted	$1.83	
Cost per ton of rock stamped	$2.13	
Refined copper, cost per pound at mine		7.63 cts.
Cost of smelting, freight, and all other expenses of hauling copper		1.64 cts.
Cost per pound for the year, of refined copper excluding construction		9.27 cts.
Cost per pound for the year for construction		84 cts.
Total cost per pound		10.11 cts.

The following comparison will show the mining and financial results of the four years' work ending December 81, 1891, and offer a clear exhibit of the industrial progress made by the Osceola since the development of the southern part of its property was entered upon.

FINANCIAL RESULTS.

	1891.	1890.	1889.	1888.
Gross receipts	$819,751 38	$828,993	$542,991	$621,950
Expenses and construction	661,864 92	595,119	487,930	502,781
Net income	$157,886 46	$233,874	$55,061	$119,169
Dividends	150,000 00	225,000	50,000	150,000
Surplus	$7,886,46	$8,874	$5,061	* $30,831

*Deficit.

MINING RESULTS.

	1891.	1890.	1889.	1888.
Mineral products, lbs.	7,590,903	6,169,686	5,262,997	4,833,543
Fine copper, lbs.	6,543,358	5,294,792	4,334,127	4,134,320
Per cent copper in mineral	86.20	85.82	86.15	85.53
Yield fine copper per ton, lbs.	27.92	28.08	25.82	22.59
Mineral in stamp rock, per cent.	1.62	1.68	1.50	1.32
Refined copper in stamp rock, per cent.	1.40	1.44	1.29	1.13
Cost per ton of rock stamped	$2 13	$2 39	$2 21	$2 21
Total cost of copper per pound	10.11 cts.	11.24 cts.	10.05 cts.	11.61 cts.

THE CALUMET AND HECLA.

The history of the CALUMET AND HECLA is but a repetition of the years gone before; one of "generous income and vast expenditures." As in the past improvements and experiments are on the "grand scale."

An absence of a few months makes the visitor wonder, can it be the same mine. Old trestle roads and wooden pump rods, that formerly obscured the view, have gone; old shaft houses and rock houses are disappearing, and the new combined shaft and rock houses are taking their places, and when all are completed the Calumet and Hecla will have a line of eleven monster buildings, 25x40

feet, built straight up from the ground, and three stories high, extending over two miles in length. The combined rock and shaft house was, as the consulting engineer, Mr. Leavitt, says, "a mere temporary expedient," but under the supervision of Supt, Whiting they seem to have come to stay.

The difference between the two systems is mainly that in the old, the rock was conveyed from several shafts by trestle roads, an endless rope system to one or more centrally located rock houses, from whence the rock was conveyed to the mill by rail, whereas in the combination rock house the rock is dumped almost directly into the crushers and thence into the cars. The old “gear house" has been converted into an electric station. This plant will be one of the finest in the northwest, and will consist of an electric power pumping as well as lighting plant.

There are at present three Brush dynamos for lighting purposes, two arc and one incandescent, and two Brush generators for the pumping system.

The pole line is being completed. There will be about 100 poles, set 95 feet apart, extending along the entire line of shaft houses. They are being-set so that their tops are on a regular grade, and will present a fine sight.

A test of the dynamos, motor and pump, was made in October and proved satisfactory, and the pump is now being placed in the Hecla branch. This work is being performed by contract by the Brush Electric Company, under the charge of Mr. F. N. Bosson, electric engineer.

At the Red Jacket shaft, which reached a depth of 2,463 feet early in the year, sinking was suspended pending the completion of the new hoisting plant. This shaft, when completed will attain a depth of about 5,000 feet and will have a capacity four times that of the old shafts. In the meantime connections are being made with No. 4 shaft, Calumet, as follows: the first cross-cut, which was connected with the shaft late in 1890. is at a depth of 2,106 feet, has a length of about 1,570 feet, and intersects No. 4 at the 36th level. The second cross-cut at a depth of 2,296 feet will intersect the lode at the 39th level, while third cross-cut at a depth of 2,463 feet is being pushed to connect at the 42d level. From each level three openings are being made at the shaft, the main entrance being on the east side of the shaft, while on the north and south sides openings are made which curve until they meet the main or east drift at a distance of about 180 feet from the shaft. The machinery at this shaft will probably be not only the finest in the world, but will present elements of novelty that will well repay any person interested in mining machinery the cost of a visit of inspection. The twin engines—the "Minong" and "Siscowit," are about completed, and the "Mesnard" and "Pontiac" are well underway. Each engine is double and of the triple expansion type. It will be some time before they go into commission. In the meantime a double compound auxiliary will be used as a hoisting engine. Some idea of the size of these engines may be gained from the weight of some of their parts: Engine bed, 76,107 pounds; main, pedestal bed-plate, 150,722 pounds; end piece for bedplate, 19,466 pounds; cylinders, 25,500 pounds; engine beam (steel), 64,920 pounds. The system to be here introduced differs from that in use at the other shafts, as no large hoisting drums will be employed, but instead what is known as General Manager Whiting's endless rope system will be inaugurated.

The several shafts and openings are showing their average percentage of copper. North of No. 5, Calumet, the rich ground is lengthening, while at the south end of No 12, South Hecla, the lode is rather narrow and poor. Sinking and drifting have been vigorously pushed, so that the openings, President Agassiz says, "are in advance of the stoping by sixteen or eighteen years," No. 4, Calumet, having reached the 45th level, or within 800 feet of a mile. The work of walling off the levels from the shafts as fast as they are exhausted, to reduce the risk of fire, has been continued. At No. 2, Hecla, the experiment is being made at several levels of running cross-cuts on the footwall, the rock from which is used to fill the stopes.

At the stamp mills, at Lake Linden, work is in progress to extend the Hecla mill and place four new heads in this department, which will give the company two mills of 11 heads each, or 22 heads, capable of treating about 5,000 tons daily.

The new pumping engine, "Michigan," was completed in April, and is the largest pumping engine in the Upper Peninsula. The following description is taken from the P. L. Mining Gazette: "It is designed to have a capacity of 60,000,000 gallons every 24 hours. The engine, which is a triple expansion pumping engine, has steam cylinders 18, 28¾ and 48 inches diameter, by 90-inch stroke, and is capable of lifting about 1,400 gallons at every revolution. Its height from base to summit is 56 feet. The foundation for the Michigan and its consort, the Winnipeg, which will be erected in the same building at some future date, contains 912,000 bricks, 3,000 barrels of imported Portland cement and 800 tons of granite capstones. The stand pipe is of iron, 65 feet in height and eight feet in diameter. An overflow pipe, 2 feet in diameter, runs to within 5 feet of the top of the stand pipe. The diameter of the fly-wheel is 25 feet and its weight about 30 tons. Steel shaft manufactured by Fried. Krupp. The well, into which the water runs from the lake through a conduit valve 6 feet In diameter, is 26x36 feet and 10 feet deep.

A new sand wheel has been added to the Calumet branch and a duplicate Is being added to the Hecla. These wheels are 50 feet in diameter and are designed to have a lifting capacity of 30,000,000 gallons of water and 3,000 tons of sand every 24 hours.

No particular changes have been made during the year at the smelting works situated at Lake Linden; but the company has made a material change in its "tactics" by erecting a branch smelting works near Buffalo, N. Y., "preferring, as President Agassiz says, 'to increase the company's smelting plant where the market for coal and

other supplies has greater advantages than at Torch Lake.'" The Torch Lake Times of January, 1892 has the following concerning the new departure:

"Why the Calumet and Hecla Mining Company should have erected new smelting works at Buffalo shortly after the erection of the works at Groverton is not generally known; but let the reason be what it may, it means a loss to Lake Linden and a corresponding gain to the city of Buffalo, which (judging from the Courier published In that city, a copy of which has been kindly sent us by a friend) the press there are quick to realize. After stating that other places than Buffalo would have made a good deal more noise over the possession of such a plant as the Buffalo Smelting Works than that place had done goes on to state:

"About a year ago the Calumet and Hecla Mining Company, proprietors of the biggest and richest copper mines on the face of the earth, bought about fifteen acres of land on the Niagara river, north of Hamilton-street, Black Rock. Last April the work of erecting buildings for an emense smelting and refining works was begun. The enterprise has been pushed so rapidly that little remains to be done before a large number of men will be employed in the plant. There are already erected two refining buildings, 88x140 feet in size, and 25 feet high to the eaves, which have nine refining furnaces; a blister furnace building, 50x55 feet; a blast furnace building, a machine shop, blacksmith shop, and a boiler house all in one, 55x120 feet in size, a part of which is four stories high; a carpenter shop and. laboratory; a coal pocket 360 feet long, provided with an elevated track for dump cars, and having a storage capacity of 3.000 tons; a mineral store house, a frame building situated on the southerly side of the plant, and about 100x100 feet. Besides these there are a charcoal house, an elevated conveyor for taking fuel to the blast furnace buildings from the coal pocket, a fire brick shed, a barn, and an ice house, and a neat and substantial office building. About 1,000 feet of dockage has already been constructed, and considerable more will be built. Dredging is still being done. One dredge has been In operation continually for months, and much of the expense Incurred has been in dumping the material brought up by the dredge on the land where the buildings stand, as the ground was previously too low for building purposes. A foundation is now being laid for a large shipping platform. The plant will be the second in the United States in its capacity of refining copper."

It appears the Courier reporter found Mr. Patch very reticent, the latter stated, that in giving the dimensions, etc., of the buildings he had broken the usual custom of not giving any information in connection with the works and as to the number of men to be employed, the quantity of mineral stored there, for publication, and which all the employés were forbidden to do, and to prevent any outsider gaining admission to the works, a fence or wall was being built. The reporter estimated that the mineral stored at the works was about 4,000 tons. When the vessels arrive, the mineral is hoisted by an immense crane, a track being laid from the dock for conveying the mineral to the store-house. The reporter closes his article with the following, which will naturally make the people of Lake Linden and Groverton feel bad:

"It is expected there will be a steady increase in the amount of labor employed in the new smelting works from the start. It is probable that copper wire will be manufactured after a time, as well as copper plate and tubing, and that separate works for these products will be erected. The company will have at least 100 men on its pay rools this winter. It is believed the works will employ within a year or two, not less than 1,000 men."

The product for the year cannot be given authoritatively, as the company decided in October not to publish any monthly reports thereafter, so the amount has been estimated as nearly as possible. The output for the year was about 45,600 tons of mineral, or about 60,000.000 pounds of refined copper.

The largest one day's output was 181 tons, 315 pounds, on June 26.

THE TAMARACK MINE.

The report of the Tamarack Mining Company for the fiscal year ending June 80, 1891, is replete with Interesting details respecting the mining operations and financial results of the fiscal year, as well as the general results attending the carrying on of this great copper-producing enterprise since its start. It offers more reliable information to the gatherer of statistics pertaining to the minutiae of copper mining in the Upper Peninsula of Michigan than is often obtained from either a published official or non-official source. The presentation of facts Is clear, concise, devoid of verbiage, and in admirable consonance with, the splendid acts of performance to which it serves as an afterpiece. Hence such information relative to the doings of the mine in 1890-91, as follows, is largely taken verbatim from the published report, or made use of in a condensed form.

The report of the directors shows that—

The production of mineral was 18,776,153 pounds, which at 74.97 per cent, gave 14,076,957 pounds refined copper, from which was realized the gross sum of	$1,971,919 28
Interest receipts	36,857 64
	$2,008,776 92

The costs were—

Running expenses at mine	$728,115 88	
Smelting, transportation and all other expenses of handling copper	213,921 24	
Total running expenses		8942,037 12
Showing a mining profit of		$1,066,739 80
Deduct dividends paid during the year		750,000 00
		8316,739 80
Received from sale of 10,000 shares of treasury stock	$1,000,000 00	
(The proceeds to be applied to sinking two additional shafts on section 11; to buying and paying for timber lands, and procuring other needed additions to the company's plant.)		
Expended for the purposes above stated from Jan. 1, 1889, to June 30, 1890	$450,313 03	
Expended for like purposes during year ending June 30, 1891	340,430 71	
	790,743 74	
Balance yet available	$209,256 26	
Balance of assets, exclusive of the above, June 30, 1890	498,059 50	
		707,315 76
Making balance of assets, June 30, 1891		$1,024,055 56

The directors call attention to the fact that the mining profit $1,066,739.80 exceeded the dividends paid by $316,739.80, which very nearly met the cost of the extraordinary construction for the year, and reduced the surplus by only $23,690.91 during the year. They estimate the cost of sinking Nos. 3 and 4 shafts, on Sec. 11, at $125,000 for 1892; say that outside of this the other construction expense will be small, and calculate that if the price of copper holds at 12 cents, the company will be able to maintain its regular rate of dividends and pay for all construction expenses out of the earnings of the year (1892). "The mine," they continue, "increases its output little by little each month, and we have every reason to look for a somewhat larger product for the current fiscal year."

The detailed statement of

ASSETS AND LIABILITIES

is as follows:

Assets.

Cash on hand at mine	$1,495 18
Bills receivable at Boston, and Hancock and Calumet R. R. bonds	284,540 59
Two hundred and fifty shares H. & C. R. R. stock	25,000 00
Accounts receivable at mine	37,377 16
Accounts receivable at Boston	53,614 81
Supplies at mine	69,536 24
Wood and timber land	151,462 48
Copper on hand and cash in bank at Boston	601,095 72
Total cash assets	$1,224,122 18

Liabilities.

Unpaid dividends	$355 00	
Drafts outstanding	23,536 05	
Accounts payable at mine	90,675 57	
Accounts payable at Boston	85,500 00	
Total liabilities		$200,066 62
Balance of assets as above		$1,024,055 56

STATEMENT OF RECEIPTS AND EXPENSES OF ALL KINDS FROM 1882 TO JULY 1, 1891, SUMMARIZED SHOWS:

Receipts.

From capital stock	$1,520,000 00
From 51,055,261 pounds copper at 12.91 cents	6,589,611 86
From interest	52,225 86
From 350 shares H. & C. R. R. stock	35,000 00
Two hundred and fifty shares H. & C. R. R. stock on hand	25,000 00
Total receipts	$8,221,837 72

Expenditures.

Running expenses		$3,565,502 98
Construction expense prior to July 1, 1890	$730,999 14	
Construction expense during 1890-91	162,759 74	
No. 2 shaft	200,873 15	
Nos. 3 and 4 shafts, and expenditures on section 11	267,647 15	
		1,362,279 18
Dividends Nos. 1 to 13, inclusive		2,070,000 00
Real estate		200,000 00
Total expenditures		$7,197,782 16
Balance of receipts July 1, 1891		$1,024,055 56

The total expenditures at mine for 1890-91 were $1,068,546.59. embracing in detail:

UNDERGROUND EXPENSE.

Shaft sinking, $4,122.00; winze sinking, $7,694.80; drifts, $50,793.90; stoping, $157,265.59; tramming, $71,130.72; timbering, labor, materials, and supplies, $96,260,36; extra work, $7,623.68; supplies, labor, fuel, etc., for air drills, $59,453.74; supplies, fuel and labor for engines, $61,608.76; mining superintendence and company account, labor, $47,180.60; blacksmith, machinist and carpenter labor, $8,931.42.

Total underground expense	$572,065 57
Less profit on supplies	49,231 50
Net underground expense	$522,834 07

OTHER EXPENSES.

Rock house, $39,792.37; surface labor, supplies, etc., $11,474.91; office labor, supplies, etc., $13,031.12; transportation, $46,888.26; stamping, $87,086.39: incidental expenses, $8,150.61; taxes, less rents collected, $8,858.15; aggregate, $205,281.81: total running expense, $728.115.88.

CONSTRUCTION COSTS.

No. 2 engine and shaft equipment, $12,313.69; No. 2 shaft and rock house, $4,460.24; dwelling houses, $28,309.24; machine shop, $500; water works, $24,494.79; Allis compressor. $31,836.01; No. 1 engine and shaft equipment, $690.05; stamp-mill, dwellings, etc., $53,457.90; tin shop, $310.65; new office, $51.15; barn addition, $580.96; No. 1 auxiliary boiler, $4,741.17; oil house, $57.90; pipe house, $827,43; repairing damages caused by fires, $2,128.56; No. 2 shaft, $19,493.57.

Aggregate construction expenditures at mine proper		$182,253 31
Expenditures on Section 11.		
Dwelling houses	$990 37	
No. 3 shaft	52,760 13	
No. 3 engine and shaft equipment	32,894 20	
No. 4 shaft	50,098 03	
	158,177 40	
No. 4 shaft and engine equipment	21,434 67	
Total construction expenses		$340,430 71

From the reports of the superintendent and clerk is taken the appended

SUMMARY.

Rock handled including that broken in shafts, cross-cuts, etc.	330,339 tons
Rock taken from conglomerate workings	361,523 "
Cubic fathoms conglomerate broken	16,751
Rock stamped	282,987 tons
Product of mineral	18,776,153 lbs.
Percentage of refined copper in mineral	74.97 %
Product of refined copper	14,076,957 lbs.
Yield of refined copper per cubic fathom of ground broken	840 lbs
Yield of refined copper per ton of rock stamped	49.74 lbs.
Yield of mineral per cubic fathom of ground broken	1,121 lbs.
Percentage of mineral in stamp rock	3.32 %
Percentage of refined copper in stamp rock	2.49 %
Refined copper, cost per pound at mine	5.17 cts.
Cost of smelting, freight and all other expenses of handling copper	1.52 cts.
Cost per pound of refined copper for the year excluding construction	6.69 cts.
Cost per pound for the year for construction	2.42 cts.
Total cost per pound	9.11 cts.

Opening work for the year, not including Nos. 3 and 4 shafts, 6,310.7 feet.

Sinking for the year and depth of shafts at date of report:

Shaft.	Sunk.	Depth from surface.
No. 1	88 feet	2,963.9 feet
No. 2	73 "	3,015.2 "
No. 3	692 "	1,211.0 "
No. 4	575 "	1,029.0 "
Cost of sinking per foot (shafts)		$25.60
Cost of sinking per foot (winzes)		11.23

Drifting for the year, on conglomerate:

Level.	Feet.	
10th	198.0	
11th	439.5	
12th	1,156.0	
13th	1,360.3	
14th	313.0	
		3,466.8 feet.
Cost of drifting per foot		$9.29½
Stoping for the year		13,747.59 fms.
Cost of stoping per fathom		$11.44

Superintendent Daniell in concluding his report speaks encouragingly of the future prospects of the mine. He says: "The mine is now in good working shape, equipment complete, and prospects, as far as we can judge, as good as at any time. The lean ground, previously noted, continues to follow down about the crossing. Going north this gradually breaks up, and we have but little left that cannot be profitably taken out, although in doing so we reduce the average of the whole. Both ends of the mine are rich, and the deepest point reached is as good as anything we have. The Osceola amygdaloid we have not drifted on as yet. In sinking and cross-cutting through it, we find it retaining its characteristics, and, at some points, showing quite rich, sufficiently so to warrant development later. Am happy to say that our construction work is for the immediate future, of small proportions. The new air compressor figures largely in the year's accounts. This is now in service and ample for our requirements. Dam and water-works have been completed with five heads running. The pumps, notwithstanding the dry weather has cut off all the water from the hill, keep us fully supplied. We have put in 26 dwellings during the year, six of the houses at the stamp mill. In this direction our requirements will still be moderate. At section 11, for Nos. 3 and 4 shafts, we are preparing to put in pumps to be run by electricity, which should save much fuel. The electric company guarantees results."

North of the Calumet and west of the Centennial is the

TAMARACK. JR.

The mine comprises the E. ½ of the S. E. ¼ and the S. E. ¼ of the N. E. ¼ of S. 11, T. 56, R. 33, being 120 acres, or three "forties," lying north and south, with the No. 1 shaft located a little northeast of the center of the south forty.

This shaft, which is vertical, struck the Calumet conglomerate in 1890, at a depth of 2,450 feet, and found it to be about 8 feet in width and carrying somewhat more than 3 per cent of copper. The shaft was continued downward and in January a cross-cut from the bottom of the shaft pierced the vein and found it to be 12 feet wide, 7 feet carrying "good" copper, better even than where the shaft cut the vein. Drifting was at once commenced north and south. In April the shaft had been sunk to the 2d level, 60 feet below the 1st. While at the 1st level the south drift was found to be the richer yet the north drift contained copper all through.

During the summer and fall No. 1 was sunk to the 4th level and crosscuts made to the vein at the several levels and the mine was looking well in all the openings. In November two cages were put in No. 1 shaft and production was virtually commenced. By the 1st of January, 1892, the cross-cut at the 4th level was in something over 100 feet. The 3d level had been drifted about 80 feet both north and south of shaft, while at the 2d level the drifts had been opened some 300 feet north and some 80 feet south of shaft. The lode north .of shaft at 2d level showed some rich rock, the breast of the drift looking well and the winzes sinking through good stoping ground. So with the close of the year the prospects for the Tamarack, Jr. were very bright, and should the No. 2 shaft, located some 1,200 feet of No. 1, strike the lode in as rich ground as No. 1. a successful future is assured to this mine.

NOTE.—Since writing the above the No, 2 has struck the lode but as yet the rock carries but little copper.

CENTENNIAL MINE

The Centennial began the work of 1891 with a cash balance January 1, of	$195,849 95
Received from sales of copper during year, 350,281 pounds at 10.544 cents	36,933 99
Received from interest	2,172 97
	$234,956 91
The cash expenditures, of which a detailed statement is annexed, were	$209,263 44
The balance of cash on hand, December 31, 1891, was	25,693 47
	$234,956 91

The work of putting the stamp mill in shape for active operation, building rock house at No. 6 shaft, addition to No. 4 rock house, additions for boiler house at stamp mill and for air compressor at No. 6 hoisting-engine house, and trestle and tram road from Nos. 4 and 6 shafts to stamp mill, together with the extension of the openings in the mine, occupied the attention of the Centennial management exclusively for the first seven months of the year. Much interest was felt, both on the lake and at the east, in the developments that were progressing underground. The year being one of recurring hope and despondency to the officers and stockholders as the work progressed. The prospects at Nos. 4 and 6, alternating "good, bad and indifferent," while at No. 3, which was being sunk as rapidly as possible to strike the

shoot of copper going north of the No. 5 Calumet and in which the Tamarack Jr. is working, was mostly in barren ground.

Agent Vivian tells us in his annual report: "No. 3 shaft is 2,740 feet deep. If the line drawn by Mr. F. Klepetke, mining engineer, as the supposed dip of the shoot of copper going north of the Calumet No. 5 shaft is correct, and it continues to run in that line through our property, we shall reach it at a depth of about 3,250 feet. The lode in this opening has varied in size during the past year, from ten feet to only a few inches in width. *For the last two months the average width is not over six inches*. From time to time it has shown some copper, *but on the whole nothing of value has been found."*

Concerning the underground developments in other parts of the Centennial, the following extracts from the report of the agent will furnish more reliable intelligence than can be obtained from any other source:

"No. 4 shaft is down to the 11th level. The lode at this point is from 8 to 9 feet in width, and has produced some good stamp rock for the last 80 feet sunk. But the copper-bearing portion of it *is too narrow to pay to slope*. The lode exposed in the 10th and 11th levels south of this shaft has not yielded the copper in stoping that we expected it would, while openings were being made. Therefore, with the present low price of copper, *it will not pay to work.*

"No. 6 shaft has been sunk from a point 30 feet below the 3d level, to 42 feet below the 5th level. The lode in this opening *for the entire distance is small and poor*. As stated in my last animal report, the productive ground dipped out of the shaft north, 30 feet above the 2d level, and it seems to continue to dip very rapidly in that direction. Therefore it became necessary to save the expense of opening up a large amount of barren ground, to reach the shoot of copper from No. 6, to sink another or No. 7 shaft north, which was started in July last, 750 feet north of No. 6 shaft. *The lode at this point. No. 7, which is down to the first level, is small and unproductive.*

"The 5th level from No. 6 shaft has been opened north 115 feet, *all of which is in poor ground*. There is a distance of about 50 feet more to be opened before the productive ground will be reached. In the 4th level, for a distance of 175 feet in length at the extreme end of this opening north of No. 6 shaft, the lode has been more productive than at any point in the mine, and there seems to be some good ground going down in the bottom of this level which to all appearance will be found at a deeper point much more productive than what has been found in the levels above.

"In the openings made in the 1st, 2d and 3d levels north of this shaft some good copper ground was often met with, and scarcely ever was the lode found to be entirely barren at these points, which led us to believe that by handling about 250 tons of rock per day we could make it pay to work; but, *unfortunately, the ground exposed did not yield the copper we expected, and with the low price for our product and the limited amount of ground we had to work in we found it impossible to make it remunerative*. There is doubtless a run of copper ground in this part of the property, if it were extensively opened, that will pay to work; and I fully believe that at a deeper level, some rich ground will be met with and worked at a profit, with any reasonable price for copper. Therefore I would advise extending the 4th and 5th levels north of No. 6 shaft to prove the value of the lode in this part of the property as soon as possible."

No man who knows Superintendent Vivian will doubt for a moment that the above is a perfectly honest, truthful description of Centennial's prospects, as viewed during the year, and at its close, by one thoroughly competent to judge of the mine's developments, and perfectly fearless in the expression of his candid opinion . It is not a flattering picture, but that very circumstance should lend weight to the advice expressed in the report relative to the extension of openings north of No. 6, as well as to proving up the Osceola amygdaloid, where Mr. Vivian says "the prospects for opening tip a paying mine are very favorable indeed."

SUMMARY FROM FINANCIAL STATEMENTS.

Total expenditures at mine to December 31, 1891	$439,458 91
Cash on hand at mine December 31, 1891	15 79
Balance due merchants December 31, 1891	12,483 99
Balance due men 1891	10,140 38
Assets (in cash, copper, supplies, etc.) December 31, 1891	70,431 06
Liabilities (drafts, bills payable and due men and merchants)	46,055 35
Balance assets over liabilities	24,375 71
Valuation of machinery, tools, buildings, etc, not included in above account or assets	119,250 00
Expended for new machinery since December 1, 1888	$38,036 16
Cost of sinking in 1891 per foot	16 53
Cost of drifting in 1891 per foot	11 19
Cost of stoping in 1891 per fathom	12 53
Cost of stamping in 1891 per ton	51.20 cts.
Cost of tramming in 1891 per ton	04.25 cts.
Cost of rock house expense per ton	12.68 cts.
Number tons of rock stamped	28,531
Production of mineral copper	777,635 lbs.
Per cent of mineral in rock stamped	$1\frac{363}{1000}$ per cent
Production of ingot copper	531,983 lbs.
Per cent of ingot copper in ton of rock stamped	$\frac{373}{1000}$ per cent.
Per cent of ingot copper in mineral smelted	68.414 per cent.

THE WOLVERINE MINE

This property lies just south of the Kearsarge, the north boundary of the former and the south boundary of the latter joining. Some years ago the mine was opened with local capital, but early in the eighties was forced to suspend operations, owing to an insufficient supply of that indispensible means of success in any enterprise, and the then ruling low price of copper, and shortly after passed into the hands of its creditors. During the time that the property was worked a yield of about 1,900,000 pounds of ingot copper was produced. In the summer of 1889 the company was reorganized, and is now known as the Wolverine Copper Mining Company. The capital stock was fixed at 60,000 shares.

In the fall for 1890 new outfits of machine shops and blacksmith tools were purchased, the old tools having entirely vanished.

The stamp mill is a compact structure, containing a single Ball head, 8-inch shaft and 15-inch cylinder, capable of stamping 200 tons of Kearsarge amygdaloid per day.

There are two shafts in the lode. At No. 1 they were in February driving a drift north on the 2d level, the last ten or fifteen feet being in copper. At No, 2 the 2d level was in 450 feet south, 30 feet of which was in very rich ground, where the vein appeared to be about 12 feet wide. No stoping had yet been done. One hundred feet in length had been opened on the 3d level, south of No. 2, and in the 5th at the bottom of No. 2, the drift was showing fairly well in copper. Five drills were working night and day shifts. In May the mine was reported looking good, and the south end was showing a fine outlook for copper. In July an assessment of 50 cents per share was called, payable August 1, 1891, and a financial statement showed a net of $474.60. In August No. 3 shaft had attained a depth of 90 feet, and had a fine showing of copper.

No. 1 shaft in October was down to the 4th level, and looking well. No. 2 shaft had reached the 6th and No. 3 the second level. The output for the month (October) was 70 tons mineral, a big improvement over the output of September, which was only 49 tons.

In November a three-ton mass of copper was taken out and No. 1 shaft was sunk nearly to the 6th level. Up to December 15 the outlook continued favorable, and the run of mass and barrel copper ground from No. 2 to the north of No. 8 shaft showed no falling off in extent or quality.

The shares of the Wolverine were listed on the Boston Stock Exchange in September, and, the following is the sworn statement made by the company to the exchange authorities previous to the listing:

Capital $1,590,000; par value of shares, $25; 60,000 shares; $10.50 paid on each share; amount expended for mill and surface improvements prior to July 28, 1890, $75,000; amount expended on mill, underground, and surface improvements since July 28, 1890, $75,000; production of ingot copper to September 1, 1,868,511 pounds; financial statement July 31, 1891:

Assets.

Cash in bank in New York		$8,859 00
Due on account of assessment No. 1, payable August 1, 1891		21,237 50
On hand at mine, cash and supplies		5,110 93
		$35,207 43

Liabilities.

Mine drafts in transit	$5,751 99	
Indebtedness at mine	4,639 17	
Loans	8,500 00	18,891 16
Net available surplus July 31, 1891		$16,316 27

KEARSARGE MINE.

This mine showed a balance of assets January 1, 1891, of $144,757.81. Reports of the outlook in the lower levels continued to be as favorable as for some months previous, and ample stoping ground was ready for the drilling machines for a long time ahead. The product, however, was only 61 tons of mineral, against 70 tons for December and 86 tons for January, 1890.

In February hoisting was going on from, the 1st, 2d, 3d and 4th levels, at Nos. 1 and 2 shafts, and from the 11th and 12th levels at No. 2, while the latter shaft was sinking to the 14th level.

Drifting south was under way in the 12th and 13th levels, and the 11th level was being extended north of No. 2.

In March the 18th level was in about 300 feet south of No. 2 and the breast showed a fine coppery lode. A stope on the level was turning out a good deal of splendid copper rock. No. 2 is the main shaft, and in March had reached a depth of 1,400 feet, and was sinking about 48 feet per month. No. 1 shaft had not been sunk below the 600-foot level. Drifting was progressing on the 13th level north and south from No. 2; on the 12th level south from No. 9, and on the 3d level north from No. 2. Stoping was going on at the 11th, 12th and 13th levels south, of No. 2, and at the 2d, 3d and 4th levels north of same.

In April No. 2 shaft reached the 14th level and the outlook at the bottom, was said to be "most encouraging, being quite rich in copper." A product of 86 tons mineral was reported against 82 tons in March, and 86 tons in April, 1890, making 309 tons for the first four months, against 334½ tons for the same period in 1890—a decrease of 25½ tons.

May witnessed the breaking of ground for the erection of a new hoisting plant, a "dry" or change house, 36x60, and a number of dwelling houses for employés. The 14th level was showing up some fine stoping ground, and the product of the month was 86 tons mineral.

The July product was 85 tons, an increase of 1.5 tons over July, 1890, and the yield for the seven months footed up 567 tons mineral, a decrease of eight tons as compared with the product for the same months in 1890.

In August the new 26x48 Corliss hoisting engine was ready to start, and the shaft (No. 2) was down nearly 1,500 feet. The products for August and September were respectively 90¼ and 95½ tons mineral.

The output for nine months—754 tons—had caught up to the yield of the first three quarters of 1890 and beaten it by 17 tons. Good reports continued to come from the mine during the last quarter, and the year's work showed a product of 2,108,812 pounds mineral, which at 81.91 per cent gave 1,727,390 pounds of refined copper, for which there was realized

the gross sum of	$213,790 51
From sales of silver	706 73
From interest receipts	3,617 60
	$218,114 84

The costs have been:

Running expenses at mine	$152,724 69	
Smelting, transportation, and other expenses	28,581 40	
Expended in mine plant	17,788 22	
		199,094 31
Total net income for year		19,020 53
Balance of assets, January 1, 1891		144,757 31
Balance of assets, January 1, 1892		$163,777 84

The assets consist of:

Cash in bank at Boston and copper on hand since sold	$106,392 30	
Cash on hand at mine	40 34	
Supplies " "	3,421 17	
Fuel " "	1,093 33	
Accounts receivable at mine	1,143 78	
" " " Boston	47,169 67	
250 shares Hancock & Calumet Railroad stock	25,000 00	
Total assets		184,260 59

The liabilities are:

Drafts outstanding	$4,037 54	
Accounts payable at mine	16,445 21	
Total liabilities		20,482 75
Balance of assets as above		$163,777 84

The following summary will show the result of operations, and the items of cost entering into the production and marketing of a pound of copper, at the Kearsage, in 1891, as compared with results in 1890:

SUMMARY.

	1891.	1890.
Rock stamped	81,424 tons	60,619 tons
Product of mineral	2,108,812 lbs.	1,928,315 lbs.
" " refined copper	1,727,390 "	1,598,525 "
Yield of refined copper per ton of stamp rock	21.21 "	26.37 "
" " " " " cubic fathom of ground broken	333 "	387 "
Yield of mineral per cubic fathom of ground broken	407 "	467 "
Percentage of mineral in stamp rock	1.29%	1.59%
" " refined copper in stamp rock	1.06%	1.32%

	1891.	1890.
Cost per ton of rock hoisted	$1 63	$1 85
" " " " stamped	$1 88	$2 26
Refined copper, cost per pound at mine	8.84 cts.	8.64 cts.
Cost of smelting, freight, and all other expenses of handling copper	1.65 "	1.83 "
Cost per pound of refined copper for the year, excluding construction	10.49 cts.	10.47 cts.
Cost per pound for the year for construction	1.03 "	0.21 "
Total cost per pound	11.52 cts.	10.68 cts.
Price per pound realized	12.38 "	15.08 "
Profit per pound	0.86 cts.	4.40 cts.

KEWEENAW DISTRICT.

THE ALLOUEZ MINE.

The annual report of the directors of the Allouez for 1890 showed a balance of assets over liabilities of $21,470.87 with which to enter upon the work of 1891.

The receipts and expenditures for the past year were as follows:

Receipts.

1,241,423 lbs. copper @ 12.06 cents		$149,756 26
Assessments Nos. 22 and 23		77,553 00
		$227,309 26

Expenditures.

Running expenses at mine	$197,754 41	
Construction account	5,257 60	
	$203,012 01	
Smelting, freight, interest and other expenses	23,581 95	
Total running expenses for 1891		226,593 96
Balance of receipts for 1891		$715 30
The surplus from 1890 was	$19,018 37	
Balance due on assessments	2,452 00	
		21,470 37
Making the net surplus Dec. 31, 1891 as shown in the accompanying statement of assets and liabilities.		$22,185 67

The result of the year's business was necessarily disappointing. In January the mine returned a product of 116 tons mineral, as compared with 120 tons the month, previous. The expected increase of product to follow the purchase and erection of the new air compressor, did not occur, and the work in February not only showed no better result as regards improvement in tirade of rock, but the mine was visited on the 13th by a disastrous fire which destroyed the rock house and its entire equipment, entailed a loss variously estimated at from $15,000 to $25,000, and caused a complete suspension of production. Superintendent Smith's estimate of the loss was $15,000, based upon the belief that a considerable part of the equipment in the ruins would be fit for further use, with slight repairs. The loss was covered in part by an insurance of $8,000. On Tuesday, February 17, in answer to a telegram from Mr. Smith, recommending that the rock house be rebuilt, the good miners retained in the company's employ, and underground work steadily prosecuted, that the mine might be well opened in advance of the mill, orders were received from the eastern office to proceed to rebuild and equip the burned structure as soon as the insurance was adjusted, and on Thursday, February 19, a force of men began clearing away the debris and preparing the site for a new building. The work of getting out the square timber for the new building was at once begun, the contract let to McCurdy Bros., of Houghton, who began work March 2, and the rebuilt rock house, with its entire equipment in place, started to work May 15, a little less than three months after the fire, though the long timber used in its construction was standing in the forest when the disaster occurred.

The mine reported no product in February, March, April or May, but the work of extending openings, stoping and preparing rock for treatment, was steadily continued, so that there was an abundant supply of conglomerate ready to rush through rock crushers, stamps and washers as soon as the mine was in shape to resume surface operations. In March six drills were employed, five in drifting and one in sinking No. 1 shaft. In April six additional machines were started stoping, thus making a force of twelve drills employed on drifts and stopes in the latter month.

June 25 one head of stamps was closed down from scarcity of water, but the product for the month was 120 tons mineral. Rock stamped, about 12,500 tons, indicating a yield of about 1 per cent.

July 16, lack of water compelled both mine and mill to shut down for a week, when two heads were again started. A like suspension was reported August 3, and another September 11. But the product, despite the water famine, was for July 67 tons, 1,685 pounds; August, 56 tons, 1,880 pounds; September, 63 tons, mineral; making a total product from January 1 to September 80, of 423 tons, 1,565 pounds mineral.

The resumption of regular work at the mill did not begin till October 1, after which date the supply of water became abundant, and the mill worked to its full capacity.

The following details of mining work done during the year are taken from Superintendent Smith's report to the treasurer.

"No. 1 shaft has been sunk 137.8 feet to the 14th level, skip road completed, and rock hoisted from that point for some months past. Drifting from this shaft has all been done to the south as follows: The 6th level 152.7 feet, the 7th level 138.9 feet, the 8th level 120.5 feet, the 10th level 140 feet, the 12th level 147.3 feet, and the 13th

level 96.1 feet. Stoping was prosecuted more or less in all these levels and with varying results.

"'No. 2 shaft, now down to the 18th-level, has not been sunk any. deeper the past year. The several levels have been extended south as follows: The 14th level 819 feet, the 15th level 90 feel the 16th level 35.7 feet, the 17th level 170.7 feet, the 18th level 64.8 feet. North of shaft the 16th level has been extended 29.4 feet, and the 18th level 121.2 feet. Stoping was done in all these levels except the 18th north. The rock broken has been fairly charged with copper, most of it a better grade than, that obtained from stopes tributary to No. 1 shaft. As you well know, the 18th level north has been opened, hoping to again meet workable ground in this part of the lode, which from, the 7th down to the 12th levels in the same relative position was found quite productive. But the undertaking has been a complete failure as regards hoped for results:

"Openings and ground broken during the year were:

Sinking shafts	137.8 feet.
Drifting	1,388.9 "
Stoping	8,838 cubic fathoms.

"The whole amount of rock handled during the year was 115,698 tons. Of this we selected and stowed away in the mine 13,062 tons; hoisted to surface and transported to rock house, 102,636 tons; selected and discarded there, 6,472 tons, showing a total rejected of 19,534 tons, equal to 17 per cent. We sent to mill and stamped 96,164 tons, which yielded 1,728,509 pounds of mineral, or 1,241,423 pounds of refined copper, giving 71.82 per cent refined copper contained in mineral or 12.92 pounds of refined copper per ton of rock stamped, a material decrease in yield per ton of rock when compared with previous year, when the yield, although not large, was 14.51 pounds per ton."

In addition to the losses occasioned by too much fire and too little water, there were two other causes which contributed to make the results of the year's work "very disappointing." The yield of refined copper per ton of rock stamped was 1.59 pounds less than in 1890, amounting to a loss of of $18,432. The price of copper declined, also, so that the average sales for the year were 2.67 cents per pound less than in the previous year—or equivalent, on the output marketed, to $33,146.

PHŒNIX MINE.

No mining work was done on this property in 1891. It was reported during the year that the Clark-Bigelow syndicate were about to get control of the mine, and if successful in doing so, would put the west vein, which is thought very favorably of by miners, in connection with the mill by railroad. Under the late manage merit rock was hauled from this west vein, by horse, and over two miles to mill,—a specimen brick of a kind of management that has prevented not only the Phœnix, but many another naturally meritorious copper mine from earning fame as a producer, and not as a dissipater of wealth.

The Clark-Bigelow syndicate did not effect the negotiation for the control of the property, and the Phœnix is still in the ash business at the same old stand.

ARNOLD MINE.

The adit which was driving south toward the ashbed on one of the great fissure veins which exist on this property was in January, 1891, rich in copper. From information obtained from, the late Samuel W. Hill, shortly before his death, it is learned that drifting and stoping, from Hill's old shaft, was extended some distance north of the ashbed, and in that vicinity considerable copper, was in early days, taken, out. One mass, Mr. Hill mentioned, weighed 17 tons.

April 10 the company issued a circular announcing an assessment of 25 cents per share, payable April 15, for continuing exploration and development begun last year.

In May reports from the mine were decidedly favorable, and the showing of stamp copper on the ashbed, when opened on the east side of Jacob's creek, was very promising, good copper rock being encountered the entire distance opened. The outlook was considered so encouraging, that preparations were at this time being made to go deeper, and it was decided to sink another shaft on the course of the ashbed.

The drift on the vein in June was in from the face of the bluff between 200 and 800 feet. The drift on the ashbed was in from "Jacob's" creek about 60 feet. Here the lode was some ten to twelve feet wide and carried considerable heavy copper.

The amount of copper taken out in August was very encouraging to the local management.

The new shaft in October was down about 120 feet deep, and the showing for mineral continued to hold remarkably well.

Toward the close of December the shaft had reached a depth of about 200 feet, and a drift was started about five feet from, the bottom. The ashbed was showing up well in heavy copper. The mine suspended operations at the end of the year to avoid expense during the winter, and with the expectation of resuming work in the spring.

THE CENTRAL MINE.

Among the copper mines of the Lake Supperior region the CENTRAL may well be styled, "The last of the Mohicans." It is the sole survivor of all the fissure vein mines which once made Keweenaw county a beehive of Industry. It began the campaign of 1891 with a surplus of assets, in cash, loans, copper, merchandise and supplies, amounting to $210,993.88, produced 1,313,197 pounds of copper during the year at a cost of $195,415.61, and sold it at $12\frac{7}{000}$ per pound—

Making		157,945 36
Add interest received		1,676 58
		$159,621 94
Total expenses as above		195,415 61
Showing a deficiency in 1891 of		$35,793 67
The surplus for 1890 after deducting dividend of $20,000, paid Feb. 2, 1891, was	$190,993 88	
Add amount credited real estate for stumpage	4,500 89	195,494 77
Making net surplus Deuember 31, 1891 of as shown in the statement of assets and liabilities, in the annual report.		$159,701 10

The deficit is accounted, for by the unusually large expenses, small product and low price realized for it, which was nearly three cents per pound less than that of the previous year.

The large amount of exploratory and development work, undertaken with the hope of finding more productive ground, is assigned as the cause of the increase in expenses.

The long drift toward the “Northwestern" struck the lode early in. June, and the openings, failing to find anything of value, were discontinued. The heading of the drift was at this time pointing toward another amygdaloid belt which on or near the surface showed considerable value. The main workings of the mine were looking poor.

The developments on the "Central" vein in that portion under the "slide," by which, as noted In the annual report for 1890, it was shifted 220 feet to the west of old workings above, failed to disclose any "pay ground" in either the 30th, 31st or 32d levels. The vein was of fair size and very regular but seemed to have been, impoverished by the disturbance in the formation/

Though, nearly all copper taken, out of the mine during the year was from the portion of the vein above the "slide," yet the management were not inclined to believe that the part below the "slide" would prove to be barren in all places, and at the close of 1891 were still extending the 31st and 32d levels Into entirely unproved ground.

The extreme southerly workings at the 29th level, above the "slide," disclosed an apparently new body of ore which in March last was reported to extend upward above the line of the 28th level. It was hoped that the 30th level, when extended far enough would reach the run of good ground encountered in the 29th level, and that it would continue in depth.

The report of the agent contains the following details of the year's operations, which will be of interest:

GROUND BROKEN.

Sinking in shafts, 345 1/2 feet, average cost	$17 94
Drifting in vein and cross-cuts, 3,340 1/2 feet, average cost	6 35
Stoping on vein, 2,616 6/6 cubic fathoms	13 10

The total amount of ground broken in openings and stopes, exclusive of cross-cuts and drifts in “Northwestern,” is 3,787 cubic fathoms.

PRODUCTION.

	Pounds.
799 bbls. stamp copper, weighing	1,253,625
188 hhds. barrel copper, weighing	316,590
86 masses copper, weighing	108,605
Total	1,678,820
or 839 830/2000 tons.	

EXPENDITURES AT MINE.

Mining and surface expenses		$158,604 36
Stamp mill expenses		16,238 01
Taxes		2,110 97
		$176,953 34
Less rents received		4,361 01
Total expenses		$172,592 33

Agent Dunstan calls attention to the fact that a larger amount of opening was done in 1871 than in any previous year, also a great amount of cross-cutting. And remarks, in concluding his report: "On the whole, we have more copper in sight than we had at the beginning of the year, and if we can find the vein good under the conglomerate, the mine will be in excellent condition.”

SUMMARY OF RECEIPTS AND EXPENDITURES OF CENTRAL MINING COMPANY FROM ITS ORGANIZATION TO DECEMBER 31, 1891.

Receipts.

Capital stock paid in		$100,000 00
Copper sold, including silver		9,202,381 16
Profit on timber sold		79,011 75
Total receipts		$9,381,392 91

Expenditures.

Net expenditures for mining operations, buildings and machinery, smelting and marketing copper, and incidental expenses	$7,241,340 53	
Net cost of “Madison,” “Northwestern” and “Eagle River” lands	10,351 28	
Total expenditures		7,251,691 81
Balance of receipts		$2,129,701 10
Deduct dividends paid		1,970,000 00
Net surplus December 31, 1891		$159,701 10

THE COPPER FALLS,

Early in January a shortage of water was felt at this mine, there being an insufficient supply for milling purposes, and owing to this cause seventeen men were discharged toward the end of the month. The product for the first month of the year was, however, encouraging, having been 88 tons, 240 pounds, an increase over the yield for December, 1890. The rock, most of which was coming from the new openings in the ashbed, east of the Owl Creek vein, was reported to average a little over one per cent, a most cheering improvement in the outlook, for the persistent management of the mine, when viewed in the light of the too truthful state of my predecessor, Mr. C. D. Lawton, in his report for 1890, "Of late years,” says he, "the average percentage of copper obtained from the rock been exceedingly low, lower than that of any other mine on the lake. It used to be estimated at one per cent. If it were one per cent the Copper Falls would pay. * * * * Of late years only about two-thirds of the lode has been found to be worth stoping, and this even, has given only twelve or thirteen pounds of refined copper to the ton of rock, equal to about sixty-five ten thousandths per cent."

In February there was an increase, rather than a diminishment in the supply of water at the stamp mill. There was reported to be “almost enough on the 20th to supply the mill and keep two heads running." No further trouble from lack of water was then anticipated, nor was any reported during the year by the local press, though there was not enough water at any time to keep the three heads of stamps running and supply the mill.

Notwithstanding this drawback the "poor" ashbed had panned out 650 tons of mineral by the first of September, an average yield of over 81 tons per month, and returned a product of 730 tons of refined copper for the year.

Product of Michigan Copper 1891.

Name of Mine.	County.	Refined copper.	Total product to date.	
		Pounds.	Tons.	Pounds.
Adventure	Ontonagon	5,600	602	1,521
Allouez	Keweenaw	1,241,423	12,752	999
Arcadian	Houghton			
Arnold	Keweenaw			
Atlantic	Houghton	3,653,671	27,426	718
Calumet and Hecla	Houghton	63,586,620	368,241	293
Central	Houghton	1,313,191	23,504	197
Centennial	Keweenaw	531,983	1,285	974
Copper Falls	Keweenaw	1,460,000	11,817	449
Franklin	Houghton	4 319,840	36,720	81
Huron	Houghton	1,215,734	12,128	440
Knowlton	Ontonagon	7,129	239	258
Kearsarge	Houghton	1,727,390	3,047	570
Mass	Ontonagon	30,114	2,531	1,844
National	Ontonagon	103,884	5,802	1,947
Osceola	Houghton	6,543,358	31,231	1,603
Peninsula	Houghton	1,599,670	3,265	1,908
Quincy	Houghton	10,542,519	62,446	930
Ridge	Ontonagon	43,049	2,962	1,517
Tamarack	Houghton	16,161,312	29,758	1,254
Tamarack, Jr.	Houghton			
Wolverine	Houghton	312,112	1,089	623

Total value of Michigan copper production in 1891, at 12 9–10 cents per pound, the average price for the year, in N. Y.=$14,757,418.11

Average price per pound of lake copper in New York.

Year	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
	22¼	19⅛	25¾	32⅞	46⅞	36¼	31¾	23⅛	23⅝	23⅝	20⅝	22⅝	33	29	23¼	22½
Year	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891
	21	18⅝	16½	17⅛	20⅛	18⅛	18½	15⅞	13⅞	11⅛	11	11¼	16⅜	13⅝	15¾	12 9-10

Average price for each month in the year 1891 was as follows:

Jan. cts.	Feb. cts.	Mar. cts.	Apr. cts.	May. cts.	June. cts.	July. cts.	Aug. cts.	Sept. cts.	Oct. cts.	Nov. cts.	Dec. cts.	Year. cts.
14¾	14½	14	13¾	13¼	13	13	12¼	12½	12¼	11	10⅝	12 9-10

Production, consumption and stocks of copper in the United States in 1891.

Source.	Pounds.		Pounds.
Lake Superior	114,388,596		
Arizona	39,699,520	Production	286,138,356
Montana	113,200,640	Stocks on hand Jan. 1	109,959,360
New Mexico	1,599,360	Imports of pigs, bars, etc.	3,200,960
California	3,749,760		
Colorado	7,000,000		
Utah	1,700,160	Total available supply	399,298,676
Other sources	4,800,320	Deduct exports	109,599,680
		Deduct consumption	210,819,840
Production	286,138,356	Supply on hand Dec. 31	78,479,156

Principal copper supplies of the world. †

(In English tons of fine copper.)

Countries.	1890.	1889.	Countries.	1890.	1889.
	Tons.	Tons.		Tons.	Tons.
Algeria	120	160	Spain and Portugal:		
Argentine Republic	150	190	Rio Tinto	* 30,000	29,500
Australia	7,500	8,300	Tharsis	* 11,000	* 11,000
Austria	1,210	1,225	Mason & Barry	* 5,600	* 5,250
Bolivia	500	* 1,200	Sevilla	810	1,350
Canada	3,050	2,500	Portugueza	* 1,200	1,200
Chili	26,120	24,250	Other mines	* 4,425	* 6,500
Cape of Good Hope:					
Cape Copper Co	5,000	5,600		53,035	54,800
Namaqua Cop. Co	1,450	* 2,100			
England	* 1,000	905	United States:		
Germany:			Lake Superior	44,450	38,769
Mansfield	15,800	15,506	Montana	49,560	46,518
Other German	2,000	* 1,850	Arazona	15,945	14,419
Hungary	* 300	300	Other states	6,370	6,068
Italy	3,000	* 3,500			
Japan	15,000	15,000		116,325	105,774
Mexico:					
Boleo Co	3,450	3,280	Venezuela:		
Other Mexican	875	500	New Quebrada	5,640	5,563
Newfoundland:					
Betts Cove	735	1,115	Total	270,485	261,650
Tilt Cove	1,000	1,500			
Norway:					
Vigsnaes	925	1,007	Average prices ‡		
Other Norwegian	* 450	350	Chili bars	£54 1s.	£49 10s. 6p.
Peru	150	375			
Russia	4,800	4,070			
Sweden	800	830			

* Estimated. † Compiledby Henry R. Merton & Co. London. ‡ On the first of each month.

Statistics of copper in Europe.

(Compiled by Henry R. Merton & Co.)

	Oct. 31, 1891.	Nov. 30.			
		1891.	1890.	1889.	1888.
	Tons.	Tons.	Tons.	Tons.	Tons.
Stocks in England and France:					
Liverpool and Swansea, Chili bars	23,247	26,473	16,375	22,887	27,285
Liverpool and Swansea, Chili ingots	144	81	229	99	.....
Liverpool and Swansea, Chili ores and regulus (fine)	25	441	242	81	.....
Liverpool and Swansea, other stuff (fine) and English copper	9,127	8,157	12,796	27,963	17,748
London (including landing)	9,120	9,747	7,054	5,493	4,741
Havre, Bordeaux, Rouen and Dunkirk, Chili bars	4,804	2,270	14,726	30,623	28,891
Havre, Bordeaux, Rouen and Dunkirk, other copper	7,648	7,051	8,968	8,738	10,405
	54,115	54,220	60,390	95,884	89,070
Advised from Chili by mail and cable, fine coppor	4,200	* 3,100	4,000	3,600	4,800
Advised from Australia by mail and cable, fine copper	1,500	400	1,050	500	1,950
	59,815	57,720	65,440	99,984	95,820
Afloat from Liverpool to Continent					2,086
	59,815	57,720	65,440	99,984	97,906

Price of Chili bars and G. M. B's., per ton. £46 5s. £44 12s. 6d. £55 7s. 6d. £50 2s. 6d. £77 10s.

*Charters for second half of November estimated at 1,200 tons.

United States copper imports.

Year.	Bars, ingots and pigs.		Old, fit only for re-manufacture.		Fine copper contained in ores.		Regulus and black copper.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Lbs.		Lbs.		Lbs.		Lbs.	
1867	1,635,953	$287,831	569,732	$81,930		$936,271		
1868	61,394	6,935	318,705	42,652	3,496,994	197,203		
1869	13,212	2,143	290,780	34,820	24,950,604	448,487		
1870	5,157	418	255,386	31,931	1,934,875	134,786		
1871	3,316	491	369,633	45,672	411,315	42,453	489	$60
1872	2,638,589	578,995	1,144,142	178,536	584,878	69,017	4,247	1,088
1873	9,697,608	1,984,122	1,413,040	255,711	702,086	80,132	1,444,239	279,631
1874	713,935	134,336	733,326	137,087	606,266	70,633	28,880	5,397
1875	58,475	10,741	396,320	55,564	1,337,104	161,903	12,518	2,076
1876	5,281	788	239,987	35,545	538,972	68,922	8,584	1 613
1877	230	30	219,443	28,608	76,637	9,756	1,874	260
1878	1[1]		198,749	25,585	87,039	11,785		
1879	2,515	352	112,642	11,997	51,959	6,199		
1880	1,242,103	206,121	695,255	91,234	1,165,283	173,712	2,201,394	337,163
1881	219,802	36,168	541,074	63,383	1,077,217	124,477	402,640	51,633
1882	6,200	896	508,901	59,629	1,473,109	147,416	224,052	30,013
1883			320,495	36,166	1,115,326	113,339		
1884	(b) 542	107	149,701	12,099	2,204,070	219,957	2,036	204
1885	814	172	81,312	6,658	3,665,729	343,793	285,322	20,807
1886	276	24	37,149	2,407	4,530,400	341,558	1,960	98
1887	212	40	39,357	2,374	3,896,192	194,785	27,650	1,396
1888	1,787	299	37,629	2,535	4,850,812	351,477	4,971	324
1889	3,160	522	19,912	1,176	3,772,338	274,649	60,525	4,244
1890	5,189	859	284,789	26,473	3,448,237	241,732	221,838	15,688

In this table the figures are for the fiscal years ending June 30, from, 1867 to 1885, inclusive, and for calendar years ending December, 1886 forward.

Copper exported from the United States.

† Years.	Ore.		Pigs, bars, sheets and old.		Value of manufactured.	Total value.
	Quantity.	Value.	Quantity.	Value.		
	Cwts., of 112 lbs.		Pounds.			
1867	87,731	$317,791	*4,637,867	$303,048	$171,062	$791,901
1868	92,612	442,921	1,350,806	327,287	152,201	922,409
1869	121,418	237,424	1,134,960	233,982	121,342	592,698
1870	* 19,198	537,505	2,214,658	385,815	118,926	1,042,246
1871	* 54,445	727,213	581,650	133,020	55,198	915,431
1872	35,564	101,752	267,868	64,844	121,139	287,735
1873	45,252	170,365	38,958	10,423	78,288	259,076
1874	13,326	110,450	503,160	123,457	233,301	467,208
1875	* 51,305	729,578	5,123,470	1,042,536	43,152	1,815,266
1876	15,304	84,471	14,304,160	* 3,098,395	343,544	3,526,410
1877	21,432	109,451	13,461,553	2,718,213	195,730	3,023,394
1878	32,947	169,020	11,297,876	2,102,455	217,446	2,488,921
1879	23,070	102,152	17,2.0,739	2,751,153	79,900	2,933,205
1880	21,623	55,763	4,206,258	667,242	126,213	849,218
1881	9,958	51,499	4,865,407	786,860	38,036	876,395
1882	25,936	89,515	3,340,531	565,235	93,646	748,456
1883	112,923	943,771	8,221,363	1,293,947	110,286	2,348,004
1884	386,140	2,930,895	17,044,766	2,527,829	137,135	5,595,859
1885	432,300	4,739,601	44,731,858	5,339,887	107,536	10,187,024
1886	417,520	2,341,164	19,553,421	1,968,772	76,386	4,386,322
1887	501,280	2,774,464	12,471,393	1,247,928	92,064	4,114,456
1888	794,960	6,779,294	31,706,527	4,906,805	211,141	11,897,240
1889	916,720	8,228,206	16,813,410	1,917,581	86,764	10,230,551
1890	483,180	4,413,067	10,971,899	1,365,379	139,919	5,918,395

* Evidently errors in quantities. † Fiscal years ending June 30, from 1867 to 1885, inclusive; calendar years subsequently. —*N. Y. Engineering and Mining Journal.*

Table showing details of copper production of Michigan.

Name of mine.	Location in county of.	No. vertical shafts sunk.	No. feet sunk in shafts and winzes.	No. feet drifted.	No. fathoms stoped.	No. fathoms broken in openings and stopes.	Rock hoisted, tons.	Rock stamped, tons.	Mineral produced, pounds.	Product of refined copper, pounds.	Yield of ore in refined copper.	Yield of refined copper per ton stamped.
Adventure	Ontonagon	....	....	....	....	....	....	....	....	5,600	....	....
Allouez	Keweenaw	203	137	1,388	9,431	8,838	102,636	96,164	1,728,500	1,241,423	....	12
Atlantic	Houghton	420	180.	4,505	19,884	20,591	303,618	297,030	5,080,700	3,653,671	177	12
Calumet & Hecla	Houghton	....	....	....	....	....	....	....	....	63,586,620	....	....
Central	Keweenaw	100	345	3,349	2,616	3,787	....	23,946	1,678,820	1,313,197	347	18
Centennial	Houghton	....	1,230	2,437	1,750	....	....	28,531	777,635	531,985	....	....
Copper Falls	Keweenaw	....	....	....	....	....	....	....	....	1,460,000	....	....
Franklin	Houghton	....	320	2,495	8,414	8,414	175,978	135,578	5,213,642	4,319,840	513	31
Huron	Houghton	....	....	....	....	....	....	....	....	1,215,734	....	....
Koolton	....	....	....	....	....	....	....	....	....	7,120	....	....
Kearsarge	Houghton	....	537	2,232	....	5,185	93,332	81,424	2,108,812	1,727,200	333	21
Mass	Ontonagon	....	....	....	....	....	....	....	....	38,487	30,114	....	....
National	Ontonagon	....	....	....	....	....	....	....	....	130,370	103,884	....	....
Osceola	Houghton	....	808	6,119	....	15,155	272,781	234,325	7,590,903	6,543,338	432	27
Peninsula	Houghton	179	228	516	5,779	....	108,560	90,591	2,191,830	1,599,670	....	16
Quincy	Houghton	632	600	5,882	....	15,352	269,817	203,678	12,827,075	10,542,519	685	30
Ridge	Ontonagon	....	....	....	....	....	....	....	....	43,049	....	....
Tamarack	Houghton	....	....	....	....	....	....	....	....	16,161,312	....	....
Wolverine	Houghton	....	....	....	....	....	....	....	....	302,112	....	....

IRON

GOGEBIC IRON RANGE.

The Gogebic Iron Range, located in the extreme western portion of the Upper Peninsula, is the youngest factor in the varied mineral resources of the State, but in extent and value by no means the least.

The general good quality of the ore and the comparative ease with which many of the larger mines were opened has led to wonderful developments in the seven years that mining operations have been conducted on this range.

The general features, historical and otherwise, of the Gogebic range. have been very clearly outlined by my predecessor in his several reports. Since his examination of the district, however, continued developments have added materially to our knowledge of the detail of the ore occurrence; all of which tends to strengthen faith in the stability of the ore deposits, and that they are likely to be wrought for many years and to great depths.

From the Montreal river which forms the boundary line between Michigan and Wisconsin, eastward to the Black river, a distance of eight and one half miles, the iron formation is extremely regular, being on the northern slope of a gently undulating ridge, the main elevation and general slope of which is granitic. Lying on this granite with a thickness of three or four hundred feet is a variagated slate, on which a belt of fragmental quartzite from 60 to 80 feet thick is superimposed, the economic limits of which do not as yet exceed four hundred feet. Overlying this are varying belts of slates, iron carbonates, and quartzite, to the copper trap, a distance approximating one mile.

The average dip of these rocks is about 60° to the north and trend about 15° north of east.

From the valley of the Black river eastward the character of the range, so far as the relative position of the component rocks is concerned, appears greatly altered, the prominent ridge of granite, slate and quartzite is apparently wanting. It has probably been faulted in some direction, or has been reduced by erosion and covered with drift for a long distance along the trend of the formation.

The position of the merchantable ore, which to the west of Black river occurs in the immediate vicinity of the fragmental quartzite, is found relatively one mile further north, being within three or four hundred feet of the trap belt.

The country lying between this ore and the line of the foot wall extending east from Black river, is occupied by mixed ore alternating with belts of slates and ferruginous quartzite and occasional ridges of greenstone, evidently of eruptive origin. Some exploration has been done in these various belts of mixed ore, but nothing of value found in paying quantities.

A distinguishing feature of the Gogebic formation is the dykes which are thrust through the with considerable frequency, and which in many cases have much to do with the concentrating of the ore in workable quantities. In general these dykes, of varying thickness up to one hundred feet run at nearly right angle to the dip of the formation, and pitching east at 15° to 20°. The variation from this is in the pitch, the dyke sometimes rolling to form a basin as in the Pabst mine, and sometimes gently undulating with an approximate level for some distance, as seen in the Palms, Anvil and Eureka.

The dykes have, been recently encountered in the Newport mine, whose angle of pitch is about 80°, and which intersects at a high angle a large dyke in ordinary position, which is the bottom of the present workings of that mine. Dykes are also found in the Mikado, Sparta, and Comet mines having a very high angle of pitch.

In most cases the ore is found in a trough formed by the intersection of a dyke and a quartzite footwall, or some parallel belt of hard quartzite rock.

It was formerly supposed by many that the ore did not exist under the larger dykes, but developments have proved this supposition to be erroneous, as at the Ashland mine the ore is being mined from beneath the fourth large dyke, and at the Norrie the ore is found by the diamond drill in undiminished quantities at a depth of fifteen hundred feet and below numerous dykes, while at the Palms the principal workings are beneath what was thought to be the "basal" dyke, and explorations have determined that large bodies of ore exist under this same dyke at the Anvil and Eureka mines.

It frequently happens that large blocks of barren ground occur between the dyke and the upper portion of an underlying body of ore, and to this no doubt is attributable the idea that no ore would be found beneath the dyke, though at the Norrie mine the ore is in immediate contact with the dyke both above and below.

The permanence of the ore bodies being now so well established, many of the mines are equiping themselves with machinery to operate at great depths. The main hoisting plant of the Ashland consists of five 10-foot drums. This mine is also furnished with the only Cornish pump on the .range, having a fifteen inch column with nine feet stroke.

Larger hoisting and compressing plants are being erected at the Norrie. The Colby is also in line, having recently erected a plant of twelve feet first motion, drums, operating balance cages which they are working in the new vertical shafts.

The practice of electric lighting in the mines seems to have come to stay, the Ashland mine being completely lighted by their own plant, the Norrie and Aurora mines are lighted from the Ironwood central station, and the Colby, Palms and Anvil from the Bessemer central station.

At present the expense is primarily somewhat more than that attending the use of candles. But the abundance of light around the shafts, along the tramways, and at the stopes and headings, enables the work to be performed more advantageously and safely than by the dim light of candles. In close places the air is not vitiated and the men feel more free to exert themselves. It is a question, if these advantages do not more than compensate for the extra cost.

There are yet many properties on the range which are undeveloped, sufficient work not having been done to prove them to any considerable depth. It is more than likely, however, that when a revival of the iron market occurs, sufficient capital will be provided to thoroughly test the greater number.

Such of the mines as I had the pleasure of visiting, under the skillful guidance of Mine Inspector Boss, appear to be wrought by a system that would seem to insure the winning of at least 85 per cent of the merchantable ore, and at the same time, the safety of the men is of prime consideration, but the absence of means for getting the men to and from their work rapidly and comfortably was painfully noticeable. The mines being from four hundred to eight hundred feet deep, the use of ladders deprives the companies of at least two hours labor per day of each man employed at these depths. This is a large item of expense and cannot long be ignored by managers.

The past year being one of general depression in the iron industry, the product of the mines has been somewhat limited, but the work of development has been pushed forward to such an extent that a majority of the properties now being worked are in excellent condition for putting out large quantities of ore at a reasonably low percentage of cost should the occasion demand.

The following is a brief description of the several mines and explorations:

THE ASHLAND MINE.

The ASHLAND mine, located at Ironwood and the first mine on the Gogebic range on the Michigan side of the Montreal river, is owned in fee by the Ayers estate, and in 1891 was operated under a lease held by Hayes Bros, of California, under the superintendency of Mr. J. H. Taylor.

The ore mined is a soft hematite, running 63.50 in metallic iron, and the deposit has an average width of 85 feet. It has eight shafts numbered from the west. Nos. 1 and 2 are idle at present. The others have attained a depth of 670, 440, 650, 765; 737, and 677 feet respectively. The total amount of sinking during the year was 976.8 feet.

The surface equipment of this mine is complete. A battery of eight boilers of 80 horse power each, supplies the steam for hoisting and the air compressors, while four 10-foot drums and two 6-foot drums do the hoisting, and two 4-foot Rochesters are used for sinking and timbering.

As before stated this mine is thoroughly lighted by an electric plant owned by the company. Most of the ore is being taken from the sixth and seventh levels and the eighth level is being opened. While the diamond drill has proved the ore at several points beneath the fifth dyke.

The lessees employed 550 men in 1891 and produced and shipped 266,961 tons of ore.

THE NORRIE MINE.

This mine is operated by the Metropolitan Iron & Land Company, and adjoins the Ashland on the east, and in conjunction with the North Norrie comprises the S. ½ of S. E. ¼ of S. 22, and W. ½ of S. W. ¼, S. 23, T. 47 N., R. 46 W. S. S. Curry is president of the company, and the main office is in Milwaukee.

The following description of the mine given by Mine Inspector James Knight, of the Norway Current, August 22. 1891, is so complete and so nearly in accordance with what I saw on my visit in January, 1892, that I give it almost complete:

"For the first time in about a year and a half, the reporter of The Current, visited the underground workings of the Norrie. To give an extended description of the many changes since then and the improved condition of the mine as a producer would require more time and space than are at our disposal, so we shall merely attempt to outline the present condition of the property. As will perhaps be remembered by some of our readers, the Norrie proper covers 80 acres of land and the ore comes in from the west and crosses the half mile, going out into the East Norrie, on the east line. There are eight working shafts, all either in or on the foot-wall and all carried down at about the same angle as the wall, viz., 60°, and all fitted up with skip-roads. No. 1 which is next the Ashland mine on the west, is down to the 7th level but is not opened out below the 4th. No. 2, the next shaft east, is down about 45 feet below the 7th but the 6th level has not been opened up. No. 3 is down about 50 feet below the 7th level and is opened up as far down as that level. No. 5 has not been sunk deeper than the 5th level but connections have been made below it. No. 5 has been sunk 47 feet below the 6th level and is opened up to that level. No. 6 has been sunk to the 8th

level and as the bottom is pretty well in the footwall a cross-cut is now being driven to the north to strike the ore. No. 7 is down about 20 feet below the sixth, and No. 8 is down to the 7th level. Those of the shafts which are sunk a part of a level, were being sunk last winter and the work was suspended to await an improvement in the iron business, but it is probable that they will be finished, and perhaps an additional level sunk during the coming winter. With the exception of the extreme ends, the mine may be said to have caved to the fifth level and the ore in the caved pillars and backs is being systematically and, we believe, economically taken out. Some changes seem to have been made in the manner of doing this since our last visit, and the present system seems to be something of an improvement, in that it permits cleaner and surer work, and eliminates several elements of danger. The running of the ore in crushed pillars has been virtually done away with and timber strong enough to permit the taking out of the ore, but of smaller size than the room-timber, is used. The method in outline is this: The original footwall drift is opened up after a cave, the location of a pillar having been found, a crosscut is driven through it to the hanging wall and securely timbered. Next the hanging, what may be termed a slice is cut out and timbered with square sets and this slice, perhaps two, three or four sets wide is carried up until it reaches the hanging or as nearly as deemed advisable to the level above. This completed, another cut nearer the footwall is made in the same way and this work continued until the footwall is reached. The object seems to be to take the ore next the hanging first leaving the caved ground if it grows too heavy for the light timber to settle against the crushed pillar and thus keep the remaining ore next the footwall. We shall show by a series of cuts at a later day the work as it is being prosecuted. In speaking of the shafts which are opened, we have of course reference to those where stations are cut out, drifts driven and rooms cut out and mined or being cut out. At the time of our last visit one of the westerly shafts had been sunk through a dyke which had come in from the Ashland mine to the west, had struck No. 1 shaft at the third level and had extended about half the length of the mine, dipping to the south and pitching to the east in the same general course as the ore body and cutting it out. At this time, although there were perhaps, millions of tons of ore above the dyke the question of what might be under it was an unsolved problem, hence the sinking of the shaft and the driving of a cross-cut which was about fifteen feet in ore at the time of our visit. Since then many thousands of tons of ore have been mined below this dyke, the work extending nearly the whole length of the mine, and another smaller dyke has come in and ore has been mined and is being mined below that. The first dyke, as before stated, came in about the third level of No. 1, and pitched until it reached about to the fifth level at the center of the mine. At the sixth level dyke rock was again met and the level driven through it from shaft No. 3 to shaft No. 5. As noted before the general course of these dykes is very regular but their upper surfaces are very uneven. For instance, in going up with a stope of ore, when the point is reached where the hanging wall should be cut by the dyke and the ore cut out, the dyke will fall back on its upper edge and the ore make into the hanging for a long distance, so flat that it is necessary to lay down tracks on top of the dyke and tram the ore out of the vein proper. At one of these places where the ore was being trammed out a distance of (we think) nine sets, we asked our guide (our brother Will) where the hanging was, and received, as nearly as we can remember, the following answer: "D—d if I know, it may be up somewhere above us or we may have cut through it, but we're going to follow this ore if we never find the hanging." All these circumstances go to show that there is but one Norrie and its possibilities are unlimited. The output of the mine will not be as great this year as for 1890, it will perhaps not fall short of 600,000 tons and it seemed to us that not more than half the available places were being wrought. About 70,000 tons is yet in stock, and the working force is about 950 men."

Five hundred and fifty feet north of No. 8 shaft is a shaft known as the North Norrie. It is a 4-compartment vertical, shaft, 18x22 inside. A cross-cut was being driven from No. 8 shaft, 4th level, and another will be driven at 6th level, to connect with the North Norrie shaft. Two similar shafts will be sunk 700 feet east and west respectively from the initial shaft known as the Curry. The shaft is operated by 3 boilers and 40-drill air compressor, and four 12-foot hoisting drums.

The shipments of the season amounted to 756,774 tons.

The deep drill hole at the Norrie sunk for the purpose of testing the formation is located 982 feet north of the footwall, and cut the footwall at a vertical depth of 1,498 feet. The following is a record of the various strata passed through:

Surface	3 feet	Ore and quartz	200 feet
Black slates	163 "	Ore	8 "
Mixed ore and quartz	59 "	Quartz	2 "
Lean ore	28 "	Ore	6 "
Dyke	34 "	Mixed ore and quartz	16 "
Ore and quartz	100 "	Ore	41 "
Dyke	55 "	Dyke	92 "
Hard ore	5 "	Ore	95 "
Quartz and ore	368 "	Dyke	8 "
Dyke	18 "	Ore	28 "
Quartz and ore	82 "	Footwall	2 "
Dyke	87 "	Total	1500 feet

AURORA.

The operations at the aurora mine have hitherto been carried on in a body of ore overlying the lenses worked by the Norrie and East Norrie, and the ore in the Aurora occurs mainly along the footwall. It is of variable width, and is a harder ore generally, than that, found in other properties east and west. This hardness makes an unusual amount of blasting necessary, and adds to the difficulty of mining operations, as the timbering where put in close to the ore attacked by blast is frequently blown out, and even when repaired is liable to be less fitted for the purpose intended than when originally put in. The diamond drill has proved the continuance of the wonderful Norrie lens under this property.

The shipments for the season of 1891 were 83,552 tons.

At the election of the board of directors, held at Cleveland in January the following gentlemen were chosen; C. L. Colby, E. A. Abbott, J. L.,,. Colby, Colgate Hoyt, L. H. Severance, A. C. Dickerman and C. H. Ropes. Mr. C. L, Colby was elected president, Mr. E. H. Abbott vice president and secretary; and J. L. Colby treasurer. It was voted to remove the general offices and headquarters of the company to Milwaukee.

Capt. Nat. Hibbert resigned his position as superintendent in the latter part of January and was succeeded by Capt. Geo. Brewer, who has been, in the emyloy of the company for some years.

THE PABST MINE.

The PABST mine, controlled by the Metropolitan Iron & Land Co., is under the charge of Capt. Wm. Trebilcock, and both the so-called north and south veins are being wrought, the vein on the hanging proving the-more productive. Exploring been carried on on the south vein with the expectation of striking the Aurora lens, but I have not yet heard the result.

The season's output was 130,328 tons,

THE NORTH PABST MINE.

Explorations at the NORTH PABST have been carried on with more or less persistency since the early days of mining on the Gogebic range, and in March, 1891, one shaft had reached a depth of 410 feet and going through a dyke, following the drill hole, which struck a good ore body, at a depth of 520 feet, early in the previous winter. Two power drills were at work. In May the shaft was bottomed in mixed ore that was steadily improving in character, and Capt. J. S. Buddle, who is in charge of the work, felt confident that at a depth of 25 feet further clean ore would be encountered.

By the middle of October the shaft was down about 550 feet and was still bedded in mixed ore and quartz, and a cross-cut was started and run to; the south some 65 feet. It was expected that this cross-cut would strike the main body of ore at a distance of 250 feet from the starting point.

In November the company was incorporated with a capital stock of $200,000, divided into 40,000 shares of $5 each, and it was determined to furnish the mine with a new hoisting plant at once.

THE MOUNT HOPE.

The MOUNT HOPE, now known as the Newport, lies east of the Pabst mine and is the old Iron King. This mine has been more or less under the cloud covering the "Burton properties." Most of the work heretofore had been done on the north vein but latterly the south vein has been the principal producer. Originally this mine, probably owing to the legal complications, was worked in a very slovenly manner; but under the present efficient management improvements of a very marked nature are the order.

During the season this mine shipped 105,607 tons, which is credited to the Mount Hope.

The work is under the superintendency of Mason W. Burt.

THE BONNIE.

The BONNIE is still a non-producer, although some explorations have been going on during the year.

THE FIRST NATIONAL OR DAVIS.

On this property, where work had been carried on by the Metropolitan Land & Iron Co., for over two years prior to the beginning of 1891, all operations were stopped early in that year, though during the season of 1890 they had struck and taken out of a small vein several hundred tons of manganese ore pronounced as fine as was ever shipped from the Lake Superior country. The vein was not opened to any great extent, but continued sinking till they struck h dyke and after penetrating the latter 70 feet, pulled out. The pumps were removed, but an early resumption of work looked for at the close-down.

At a foreclosure sale of the properties of the Bessemer Consolidated Iron Company, held in October, 1891, the first national, Iron King, Bourne, Blue and Valley, the old Burton properties, were bid in for $50,000 by G. D. Van Dyke, of Milwaukee, attorney for W. W. Wright, trustee for the American Loan and Trust Company.

THE GENEVA MINE.

The GENEVA, lying north of the First National, as yet but an exploration, is very favorably situated and has every prospect of success. The company have pushed the work forward as fast as their rivals for the ownership of the property will permit, and have a shaft bottomed in a good soft ore.

The mine is in charge of Capt. Jas. Nicholson.

THE ROYAL.

The ROYAL, which adjoins the Geneva on the east, and comprises the S. E. ¼ of S. 18, T. 47, R. 46, is the old Blue Jacket, also one of the "Burton group," and was old at public sale in October, and the prospects of renewed activity the corning spring are favorable.

THE RUBY.

All work at the RUBY, which joins the Royal on the east, was abandoned early in the season. For what reason I am unable to ascertain.

THE LOWELL.

formerly the Ironton, is the W. ½ S. E. ¼, S. 17, T. 47, R. 46.

The original work near the Ruby was abandoned during the year, and work has been concentrated near the east line of the property, in sinking a good shaft and in explorations. It did not ship any ore during the season. Joining the Lowell on the east is

THE FEDERAL MINE.

In January this mine was shipping three cars of ore daily to Black River Falls, Wisconsin, and employed a force of 50 men.

No. 1 shaft was sinking from the 225 foot level to a depth of 325 feet and was down 275 feet.

A new compressor and other machinery were to be added to the surface equipment.

In September the mine was shipping eight cars of ore every day, and the mine had been opened by a drift for a length of 400 feet, and it averages from eight to thirty feet in width.

In October it was determined to test the depth of the vein by sinking a diamond drill to a depth of at least 300 feet from the bottom of No. 1 shaft, which will involve the sinking of a hole 600 feet deep from the surface.

The shipments of the FEDERAL for the season of 1891 were 6,778 tons.

THE JACK POT.

The JACK POT comprises the west half and the BENJAMIN the east half of what was known as the Valley mine. The fee is in Mr. J. M. Longyear, and explorations are being made under options. The JACK POT is being operated on the footwall and the Benjamin on the hanging wall.

The Benjamin cut ore at the depth of 180 feet from surface, and sinking was going on in the beginning of the year, with the intention of dropping the shaft 100 feet further. Development work was the feature of the year's business, and only 1,200 tons of ore were shipped.

THE COLBY.

In the beginning of 1891, the management of the COLBY was bending all its energies to put the mine in shape to take its place among the front ranks of the producers. New shafts were being sunk in the "hanging" 600 feet from the footwall, on the north side of the vein which dips at an angle of 60°. The shafts are vertical and are expected to reach the ore at a depth of 1,000 feet. Cross-cuts to the vein have been made from points affording the most convenient connection with the levels already opened. The new shafts are from 700 to 1,000 feet apart.

From 900 to 1,000 tons of ore per day were being added to the stockpiles in January; 650 men were employed, and predictions were made that the season of '91 and '92 would again see the Colby in such shape as to be able to "scoop" any record of a Gogebic mine, just as it did in the season of '86 and '87, when it was the Gulliver among the Lilliputians of the range.

In March, however, the outlook was less bright, the dullness of the iron market having caused the discharge of 150 men, and only about 400 men were retained in the company's service, which number was no greater at the close of the year's business.

In September Capt. Dickinson resigned and was succeeded by Mr. W. J. Olcott as superintendent.

The following account of a brief trip over the property, taken by the editor of the Bessemer Pick and Axe, in company with Capt. W. W. Gray, will serve to give some idea of the extent of the development work going on at the Colby mine in December, 1891:

"At No. 6 shaft one cage is now in steady operation, but will work to better advantage, and consequently with still greater satisfaction, when the present preparations are completed, and the second one attached. By this arrangement each cage will serve as a balance for the other, so that only the net weight of the ore will have to be lifted, admitting of much more rapid and economical hoisting. An extensive bottom is being prepared for the stockpile that is already beginning to grow at a rapid rate. The grade is also being prepared for the railroad spur, which will form a loop around the stockpile, running up on one side and allowing the cars to be "spotted," or dropped to position on the other side, where can be located a steam shovel if needed. At No. 7 the shaft house is up and no time will be lost in getting the cages into operation. The same arrangement of cages is planned here as at No. 6, and they will be operated by the same hoisting plant. Here the ground is also being cleared and leveled preparatory to the stocking of the ore which will soon begin to be raised. No. 8 shaft is the old "south 15," from, which a considerable amount of rich ore was taken in the earlier days, but which was practically abandoned by Mr. Sellwood on the supposition that the deposit was exhausted—as indeed the pocket near the surface was. Under the present management, however, the shaft has been sunk down, through the dyke, and at a depth of some-thing over 400 feet the real deposit of ore that constitutes the mine is being opened up. This shaft follows down the incline of the footwall and is operated with a skip instead of a cage. The engine house which contains the hoists for this and No. 9 has recently been enlarged to make room for a second air compressor, which is so connected with the one nearer the west end of the property that either one can. on occasion be used temporarily for the entire mine. No. 9 is the newest shaft, but is now down to a depth of 340 feet. Like Nos. 6 and 7, it is located well over in the hanging, goes down vertically and will be supplied with cages. At a depth of 295 feet a cross-cut has been started in towards the vein and this will constitute the first level."

Shipments of the season of 1891, 39,065 tons.

THE PALMS.

The palms mine, which lies directly east of the Colby, and is described as the N. W. ¼ of S. 14, T. 47, R. 46, has the same general features as at the Colby and Anvil, the principal mining now being beneath what was called the "basal dyke" and a capping of rock some forty feet thick. From the appearance of the ore in the bottom, the palms promises to be one of the large producers during the coining year.

The mine is under the efficient management of Capt. J. P. Christopher. The output for the year was 32,237 tons.

THE ANVIL.

Regular shipments of ore were begun at the ANVIL mine May 2, to the Ashland furnace, and about five or six cars per day were the average shipment.

In June a fire at the mine destroyed one of the shaft houses and set fire to the timbering in the shaft. The shaft was the one tapping the rich, deposit discovered some years ago, and its loss crippled the mine considerably.

In July development work was going on but no shipping was being done, but in September the complaint of Superintendent Bennett was the scarcity of cars on the M. L. S. & W. "If we don't get some cars in a few days," said he, "we will not be able to find room for our men. As it is all the underground levels and rooms are filling up on us, and we must get cars before long."

The location of this mine is Bessemer, S. 14, T. 47, R. 46 W. The average width of the deposit mined is 50 feet. In 1891 the number of feet sunk in shaft was 280; in winzes, 400. The depth of the several shafts at the close of 1891 was, No. 1, 258 feet; No. 2, 331 feet; No. 3, 333 feet; No. 4, 306 feet; No. 5, 196 feet. Tons of ore mined in 1891, 25,000. Tons of ore shipped, 5,000. Number of men employed, 50. Superintendent, D. A. Bennett; H. Siegrist, clerk.

THE EUREKA.

The EUREKA mine, formerly known as the Dangler, had in January, 1891, two shafts in operation, and two store were sinking, and in preparation for next year's work.

In May the company had 10,000 tons of ore on the dump at No. 1 shaft, and the pile was growing at the rate of about 200 tons per day. Cross-cutting was in progress at No. 2, with good prospects of soon being in readiness to begin hoisting ore.

In September the mine, though not shipping any, still continued to send up ore from both shafts, but principally such as was necessarily taken out in the progress of development work.

In October the test of the depth of a newly discovered deposit at the EUREKA had to be abandoned temporarily, owing to the breaking of the drill rod, leaving the bit and about 200 feet of the rod beyond reach. The drill was still sinking in the ore, having penetrated the body about 140 feet when the accident occurred. It was intended to sink until the footwall was reached, but the test made was very satisfactory, despite the mishap. The working shaft was at the time down 360 feet, and was to be pushed, down into the deposit as rapidly as possible.

The shipment of the EUREKA for the season of 1891 was 13,907 tons.

THE EAST DANGLER.

The EAST DANGLER is as yet nothing more than an exploration, although at a depth of 300 feet a fissure of good ore was struck in a cross-cut at nine-feet from the shaft.

THE UNITED.

The UNITED, composed of the old Rhinelander and the east half of the Miner & Wells option, is still an exploration, having a small vein of ore. It is worked through one 7x10 foot shaft, which is equipped with a new Reynolds upright boiler and No. 7 Cameron pump in addition to the old plant. Capt. Thomas Waters has charge.

THE MIKADO.

The MIKADO during the early part of January was being worked by a party who were said to be “doing barely enough work to hold their claims," but in the latter part of the month the property was attached by the sheriff on labor claims. Later the property fell into the hands of Detroit parties, under the management of W. P. O'Brien.

A shaft has been sunk to a depth of 310 feet. At a depth of 190 feet a cross-cut encountered a vein of merchantable ore eight feet thick. At 250 feet deep a cross-cut exposed a vein, of ore 11 feet in thickness. At the bottom of the shaft the cross-cut exposed two veins of excellent ore eight feet in thickness with three feet of ferruginous quartzite between them.

THE SPARTA.

The SPARTA, formerly known as the CHICAGO, is one of the most promising options on the Gogebic range, and is situated north of Sunday Lake. Location, N. ½ of N. W. ¼ S. 9, T. 47, R. 45.

In January they were opening a 15-foot vein, struck at a depth of 190 in November, 1890. The vein was then opened for a distance of 250 feet, and the dump in January showed about 500 tons of good ore. The mine has a finely timbered two-compartment shaft, and a good plant of machinery, and in May the shaft bottomed entirely in ore.

In November a new find was struck north of the old explorations, a cross-cut going through 35 feet of fine ore, and a new hoisting plant of 4-foot Bullock drums was put in about that time. Mr. Putnam, the general

manager of the company, reported his mine constantly improving, and in the latter part of the month they struck a vein in the west drift, into which it penetrated 26 feet and was still being pushed ahead in clean ore. The new hoisting plant was in. satisfactory operation toward the last of November, and the outlook in both, the east and west drifts betokened excellent future prospects for the Sparta.

The shipment for the season, was 5,000 tons. Number of men employed, 40; nature of ore, soft hematite; per cent iron, 60 to 65; silica, 6: phosphorus, .115.

THE BROTHERTON.

The BROTHERTON ended the work of 1890 with a record of 92,000 tons of ore, and at the opening of 1891 everything indicated that it would beat that record and easily write; “100,000 tons" on its banner on New Year's day, 1892.

In January 200 men were employed, 450 tons were being raised every day, and three shafts had either been or were about to be started sinking from the 200 to the 300-foot level. But in April, compelled by the same causes which operated at other mines, the Brotherton greatly reduced its working force by discharging 75 of its 200 employés, and though its shipments continued up to late in the season to be about 500 tons per day, its total shipment amounted to only 46,574 tons—but little over half the number of tons shipped in 1890.

THE CROWN POINT.

At the CROWN POINT they were still extending the cross-cut south from the bottom of the old No. 1 shaft, at a depth of 95 feet. The cross-cut in 190 feet, breasted in mixed ore; it was to be continued from 200 to 300 feet further, unless the vein was struck sooner. Prospects in March were good. Capt. R. J. Bawden is in charge.

THE SUNDAY LAKE.

The SUNDAY LAKE is owned by Geo. M. Wakefield and others, and held under an option by Ferdinand Schlesinger, of Milwaukee, Wis. The ore raised is the highest in metallic iron of any Gogebic ore, and in January, 1891, in was coming from the mine at the rate of 400 tons daily.

In March a new vein of ore was struck, north of any of the former workings, which was considered a great find and expected to put the mine in the list of big shippers of the Gogebic range.

The mine is opened from surface by two shafts. No. 1,400 feet deep and No. 2, 450 feet. The following is an official statement of work done in 1891:

No. feet shaft sunk in 1891	238⅔
No. “ winzes “	495½
No. “ drifted in 1891	2,048
No. tons iron mined in 1891	72,014
No. “ “ shipped “	64,902
No. men employed	165

Location of mine, Wakefield; superintendent, John McLeod; main office, Milwaukee, Wis.

THE JOLIET.

The JOLIET mine, located at Wakefield, Mich., was operated in 1891 under an option held by F. Schlesinger of Milwaukee. The only work done was exploratory, and no shipments were made. One shaft was sunk to a depth of 165 feet. The property is under the general management of Mr. P. F. Cole, and Mr. John McLeod is superintendent at the mine.

THE IRON CHIEF.

The IRON CHIEF, which was originally operated by Moore & Benjamin, and produced some ore in 1887, fell into the control of the Schlesinger syndicate about the close of 1890, and in February, 1891, the work of unwatering the old workings was in progress preparatory to resuming mining operations.

THE COMET.

The COMET, formerly known as the ECLIPSE, is a comparatively old mine on the East Wakefield range. It is owned by the Penokee and Gogebic Development Co., and under charge of Capt. Pent. Mitchell, and consists of 80 acres in S. ½ of S. W. ¼ of S. 11, T. 47 N., R. 45 W.

Ore was struck in July, 1890, and a fine body has been brought to light since that time.

In January about 60 feet of water was pumped out of No. 3 shaft. When the shaft was forked out a power drill was to be started at the bottom. A cross-cut from the 235-foot level was then to be commenced, and the shafts deepened to give sump room for water, which in this mine is so abundant as to be very troublesome.

In the middle of January about 2,000 tons were in stock, of the same general character as that found in the Sunday Lake and Brotherton on the west.

In September and for sometime previous the Comet was sending out about 25 cars of ore per day, and there were some 15,000 tons of ore in the stockpile. No ore was then being raised for sale at the ruling prices, and the only reason for the sale and shipment of that in stock was, Capt. Mitchell explained, "that the stockpile was in the way."

THE COMMERCIAL.

The COMMERCIAL option joins the Comet on the east and was again undergoing exploration about 700 feet east of the old shaft in 1891. Work was commenced in May on the foundation for an engine house, and in November explorations with the diamond drill were going on in the bottom of the old shaft which had been sunk to the ledge sometime before and abandoned.

MARQUETTE IRON RANGE.

THE IMPERIAL MINE.

At the IMPERIAL mine in January a new shaft 8x12 feet, and 470 west of the west pit was commenced. It was sunk on the foot wall, with the dip of the vein 36 degrees, and when a depth of 50 feet was attained they were to begin to mine out the ore. In the west pit everything has hitherto been done on the open pit system to a depth of 240 feet, and from that point the sinking of a shaft was commenced. In the east pit the shaft in January was down 60 feet below the bottom of the pit. They are all bottomed in the ore which has become materially harder, so much so that in the greater portion of the mine, power drilling will have to be substituted for hand drilling which has met all requirements hitherto, as the ore was very soft. The hard hematite runs from 54 to 56 per cent in metallic iron. There were in January 14,000 tons in stock and about 35,000 tons was ready for shipment by the opening of navigation.

The mine is the old Wetmore and has the southeast ¼ of section 25, town 47 north, range 29 west. This mine employed in January one hundred and fifty men, and in March nearly two-thirds of the force were discharged.

In June the mine was closed down to await an improvement in the market Lake shipments from the Imperial in August were suspended, leaving some 15,000 tons of ore in stock at the mine.

THE MICHIGAMME.

About the middle of April, 1891, the MICHIGAMME mine closed down, in consequence of the unpromising state of the ore market. The pumps were taken out and the mine was allowed to fill with water. The crushers and separators were kept in operation, however, as then there was an amount of ore in the waste piles, to furnish material for some months.

In the latter part of November the magnetic concentrators were still in operation. But the freight rate of 60 cents per ton to lake port (Marquette) offered little inducement for the shipment of high phosphorus ore.

THE CHAMPION MINE.

The opening months of 1891 found the company that operates this great mine making preparations for doubling the mine's compressor plant, and reinforcing its hoisting plant. The contract for the new compressors was in the hands of E. P. Allis & Co., of Milwaukee, in January and early in March it was reported that they were due at the mine and would be set up as soon as they arrived. But up to the last of October only three carloads of the new machinery had arrived—a portion of the expected plant, and it was announced that the whole would not be on the ground for some time thereafter. The compressors hitherto in use have a stated capacity of 30 drills but have been actually driving 45. while there is work enough for 60. The air cylinders of the new machines are to be 28x48 inches each, and steam cylinders 36x48 inches and 40x48 inches.

When the improvements in the hoisting plant were completed the management expected to secure a more economical service in that branch of the mine work. The plant used up to the time of which I write was adapted to the economical hoisting of a ton of ore per skip from a depth of 1,000 feet, but in practice was hoisting 2 tons from a depth of over 1,000 feet. The new drums will be much larger and will hoist from Nos. 3, 4, 5 and 6 shafts. The old plant will be remodeled and used for hoisting from the other shafts which have not yet preached a great depth.

The company began shipping ore early in May notwithstanding the fact that-they had then 60,000 tons of the product of 1890 lying in Lake Erie ports, representing a cost of $240,000, and not a ton of which was sold.

The location is already connected with the outer world by three railroads and a fourth-—the Huron Bay—was making rapid headway during the slimmer of '91 toward Champion, employing a construction force of 1,500 men and was expected to be ready for business in the summer of 1892. Its advent was looked forward to with great local interest, as it was reported the new road would be a competitor for carrying Champion ore and would cut the prevailing freight tariff square in two.

But one discovery of note was made during the year's operations—-that of a new lens of ore near No. 1. shaft. For the following particulars concerning the new find, as well as of the general outlook at the mine at the close of 1891, I am indebted to the Ishpeming Iron Ore:

"At No. 1 shaft, at the east end on the Champion mine, they have encountered a new lens of ore that is particularly rich, it giving from 69 to 70 per cent in metallic iron and is low as to phosphorus. It is not thought that it is a very large deposit, but it is acceptable nevertheless. It is dark, lusterless ore, and specimens of it would be good things to have at the World's Fair for free distribution amongst those who desire to learn of the purest ores of this country. They would compare favorably with the ores of any region under the sun. The ore was encountered between the third and fourth levels of the shaft, the latter having been started in the foot wall. The shaft is an old one having been sunk many years ago, and abandoned because the deposits were supposed to have been carried, by their pitch, farther west.

"The Champion possesses one of the most tenacious veins in this field. It has been opened upon for a great length, and as to depth it exceeds any mine in the Marquette district. The bottom shows well in fine stopes of ore, and everything in and about the property is in excellent condition."

The depth to which the openings by shaft had been carried up to the end of 1891 was as follows: No. 1,

209½ feet; No. 2. 351 feet; No, 3, 1,007 feet; No. 4, 1,102 feet; No. 5, 1,087 feet; Main (or No. 6), 821 feet. Number of feet shaft sunk in 1891, 419½; number of feet winzes sunk in 1891, $431^{7}/_{12}$.

Number of men employed in 1891, 566; number of tons iron mined in 1891, 196,357; number of tons iron shipped in 1891, 133,418. Nature of ore, magnetic and specular.

Location of mine. Beacon, Mich., superintendent, W. Fitch; agent, A. Kidder, Marquette, Mich.

THE HORTENSE.

The HORTENSE (North Champion) property is owned in fee by the M. H. & O. R. R. Co., and held under a lease by the Hortense Mining Co. No work was done in 1891.

THE REPUBLIC.

The REPUBLIC company in May put two of its lake carriers in the Ashland ore trade which was thought to mean a very material curtailment of season's product. Heretofore the company had had use for its entire fleet and had at times found it necessary to secure the service of "tramp" vessels.

In July the mine was greatly damaged by fire, by which two men lost their lives. The unwatering of the No. 4 shaft in December, on the Republic property, purchased from the West Republic Company, was under way and diamond drilling was commenced. Several holes were to be put in across the formation, and towards the big green stone bluff rising so prominently at this point.

The product for the year was 191,000 tons, being a considerable reduction from the product of 1890, owing to the accident.

The property of the REPUBLIC REDUCTION Co. consisting of a lease from the Republic Iron Company, a mill and machinery was disposed of at a foreclosure sale in December, the mortgage being in favor of Dalliba, Corrigan & Company of Cleveland, Ohio. Nothing in the way of ore reduction was done the past season. The old dump pile proved to be very refractory when put into the crushers. Production was attended by too much cost and then the material was not nearly as rich as was anticipated. At one point there was a few tons of ore in the pile, but this was not sufficient to give a profit and other portions of the pile were practically unproductive. The reduction of the dump piles of the Republic can be said to be at an end. The ore is not there.

THE RIVERSIDE.

The RIVERSIDE Mining Company reported very good news from the mine in January. This came on the heels of an assessment, and those who paid up were gratified to learn that they were likely to receive adequate returns for the outlay. In January 26 men were working in the mine. The vein is fifteen feet wide and is being worked out full width. Indications of a large ore body are abundant.

In April 2,000 shares of the capital stock were offered for sale for the purpose of raising funds to push the development of the mine.

In November a new shaft house was building at the mine, work preparatory to the resumption of sinking was about finished and the force of. miners was put at work in the shaft. In December the new compressor was started up, sinking in the new shaft resumed and shipments of ore were being made from the mine to the Weston furnace at Manistique.

THE HUMBOLDT MINE.

At this mine in September all work was stopped, the pumps removed and the mine allowed to fill. An assessment of three dollars per share was called. There is lots of good ore there, and it can be mined, profitably, and no doubt will be before long.

In December it was reported, that the Humboldt expected to resume operations the first of the new year, that a small force of men would be employed for a time, and if the ore could be marketed at a fair price an increase would be made accordingly.

THE EDWARDS MINE.

An exploring party renewed operations in September at the abandoned EDWARDS mine, the oldest mining property at Humboldt. It was currently reported that they found ore in quantities.

NEW FOXDALE.

The directors of the NEW FOXDALE company levied an assessment of ten cents per share in May, payable in five monthly installments of two cents each, the first installment becoming due June 1. The purpose of the assessment was to raise working capital to develop the property. All paid the assessment should have yielded $6,000.

There is no doubt that there is ore on the property, which is on the E. ½ of N. E. ¼ of S. 10, T. 47, R. 29, W., it having been located by diamond drill, and a test pit uncovered the ore 14 feet from surface.

Active operations were resumed May 13, under the management of Capt. Buzzo, of the Salisbury mine, and a gang of men were put to work sinking the shaft. New machinery was ordered and was expected soon to arrive.

The land is owned by Don M. Dickinson of Detroit, and leased by Ishpeming gentlemen.

Toward the last of August ore was struck at a point a few feet west of the Humboldt mine. The ore is a continuation of the Humboldt ores going west, is a black magnetite and known to exist in quite a large body.

In, October the showing at the Foxdale was considered very promising. The shaft was down 65 feet and all the way in clear, hard specular ore.

Considerable work was in progress in December, but although some fine ore was coming out of the mine, it was not considered sufficiently clean to be called first-class. Capt. Buzzo did not then expect to find a clean product until greater depth was attained. At a depth of about 135 feet the shaft was expected to reach a point in line between the diamond drill holes, where the good ore there cut ought to be found.

THE SAMPSON.

At the SAMPSON mine after sinking a shaft for a distance of 315 feet in the hardest kind of jasper, and driving a cross-cut 68 feet, the ore, found, some time before with the diamond drill, was reached in July.

The shaft followed the foot, the cross-cut being towards the hanging. From the boring the thickness of the ore is judged at 16 feet.

The point at which the cross-cut finds the ore is 50 feet west of the drill hole, it being deemed advisable to go to that side in order to prevent accident from ground that might come away from above, as overhead are the old workings from which considerable trouble has resulted. The ore in the Sampson, where cut by the drill, is a non-Bessemer, very high in iron, and one that should find a ready market at fair price in ordinary seasons.

In November a vein of fair ore was penetrated on the two hundred foot level and the miners had worked into the cross-cut some thirty feet, the vein improving as they progressed. The outlook for the mine then quite flattering.

VOLUNTEER MINE

A new outfit of machinery put Into operation during; the past year, consisting of two Kendall boilers of 150 horse power, drums eight feet in diameter and six feet length of face. The compressor is a Band Duplex, with air cylinders 20x48 inches. This compressor was formerly in use at the Champion mine, but being too small for use there, was remodeled, made as good as new in every respect and transferred to the Volunteer. A ponderous steam engine from the E. P. Allis works was also added. In the middle of August, 1891, four hundred men were employed at this mine. Early In December it was looking well at all points, and in the east the ore had. improved much in quality.

The location of this mine is Palmer, Richmond township, Marquette, Co., Michigan. Nature of ore, hematite; per cent iron, 60; per cent silica, 5; per cent phosphorus, .085, Main office, Detroit, Mich., Address, Palmer, Mich.

Number of shafts.	Depth.
1	300 feet
2	500 "
3	400 "
4	400 "

Average width of ore deposit	20 feet
Number feet shaft sunk in 1891	250 "
Number feet winzes shaft sunk in 1891	100 "
Number tons iron mined in 1891	150,000
Number tons iron shipped in 1891	92,699
Number men employed	400
Cost per ton mining	$1.60

Superintendent, Thomas Watters.

AMERICAN MINE.

At the AMERICAN mine in July they had reached the swell on the lowest level which shows in the next one above, the pitch of the ore having carried it westward some distance from its location on higher levels.

The management reported the property as looking well and had good reasons for expecting a considerable gain in future product,

CAMBRIA MINE.

Water at the CAMBRIA mine in April was rapidly rising in the shafts and the pumps were working full capacity. The underground force was laid off. Mr. A. W. Maitland, general manager of the Cambria, Lily and Lucy mines, reported these properties in September to be operating in a quiet manner. But little ore had been sold, and the company did not favor the plan of piling it upon the docks at Cleveland, or other Lake Erie ports, until a sale had been effected. The drain, which Is nearly a mile in length, was said in October to be nearing completion. And as soon as the electric railway was started up the mine water was to be utilized for furnishing power to run the boilers in the company's power house, Mr. Powell Stackhouse, of Philadelphia, late vice president of the Cambria Iron Works of Johnstown, Pa., has been appointed president of that company to fill the vacancy caused by the death of Mr. Townsend. Mr. Stackhouse is also president of the Penn Iron Company.

DEXTER MINE.

The DEXTER consolidated mine Is located on the E. ½ of N. W. ¼ and W. ½ of N. E. ¼ S. 3, T. 47 N., R 28 W. In the month of January a new deposit of hematite was discovered 200 feet east of the "Dexter" shaft.

In May the drift had gone four feet Into a soft brown limonite ore after going through 40 feet of mixed hard ore and jasper.

Its yield for the year was about 8,000 tons of limonite and manganiferous ore, containing 56 per cent iron, .105 phos.

It employs about 25 men. The cost per ton mining was $2.50, and the cost per ton of transportation to lake port was 60 cents. The Dexter Is opened by two shafts, the "Dey" shaft, 150 feet and the " Dexter," 425 feet deep.

There was 125 feet of sinking done in 1891, of which 75 feet were sunk in shaft: and 50 feet in winzes. The season's shipments were 5,500 tons.

I am indebted, to Geo. R. Persons, clerk of the company, for courtesy in furnishing the above facts.

WHEAT MINE.

At the WHEAT mine in February a winze was being sunk from the lower levels in the south vein through the ore. The ore Is of a Bessemer grade showing .031 In phosphorus. Both veins in the property have been well opened and in February were still breasted in ore, the vein averaging over 20 feet in width.

Thomas Prout, Superintendent of the Wheat Mining Co., furnishes the following statement concerning the mine and its operations in 1891:

Fee owner, A. H. Wick; lessees, Wheat Mining Co.; Superintendent, Thomas Prout; location of mine, Cascade range, S. E. ¼ S. 29, T. 47, R. 25; nature of ore, hematite; per cent iron, .59; per cent silica, .12; per cent phosphorus, .065; main office, Cleveland, Ohio; address, J. B. Zerbst, Cleveland.

No. of Shaft.	Depth.
1 (Pit)	70 feet
2 (Shaft)	76 "
3 "	262 "
Average width of ore deposit	25 "
No. feet shafts sunk in 1891	47 "
No. " winzes " "	40 "
No. fathoms stoped "	1,795⅛ fathoms
No. tons iron mined in 1891	4,000 tons
No. " " shipped "	4,000 "
No. men employed	25

SWANZEY MINE.

At the SWANZEY mine of the Escanaba Land and Iron Company, everything in June was progressing favorably. The ore deposit was looking well and a considerable stock pile had been mined. Shipments were soon to commence from the latter. In August the existence of a vein of first class Bessemer ore 68 feet in width, below the working of the Swanzey was ascertained. In January, 1892, the company were meeting with much encouragement in their operations. They were developing a fine deposit of ore, and reported a sale of ore for this year's delivery at a price considerably in advance of that which ruled for the year 1891.

The company possesses several hundred acres of land favorably located, and look to the discovery of other mines after the one now being wrought is well under way.

CHESHIRE MINE.

The CHESHIRE mine is near the Swanzey on the Chicago & Northwestern railway. It is now the property of the Escanaba Land and Mining Co., who are prosecuting active work at the mine. Capt. Joseph Cornish resigned his office and Capt. John Carmichal, lately with the Milwaukee mine at Negaunee, was directing affairs at the mine in May.

THE FITCH MINE.

Mining operations at the FITCH, located west of the Saginaw, on S. E. ¼ of the N. E. ¼ S. 24, T. 47, R. 28, were suspended in October, and doubt was expressed as to whether the mine would again be wrought, the deposit having so narrowed down as to render its profitable working a matter of doubt except under favorable circumstances, not looked for, in the future. Shipment in 1891, 15,093 tons.

The mine is owned by the Iron Cliffs Co., and operated by Pickands, Mather & Co., Cleveland, Ohio.

IRON VALLEY MINE.

The following description of the IRON VALLEY mine, character of deposit, and work done in 1891, is taken mainly from the columns of the Ishpeming Democrat:

The shaft at the Iron Valley mine reached the ore early in October, 1891. This shaft Is situated 600 feet east of the west line of the company's land, which is the east boundary line of the city limits of Ishpeming, and 250 feet south of their north line. This body of ore evidently does not appear nearer to the surface than 60 feet, and is overlaid with about 24 feet of soft schistose rock, about four feet of green, rock very much of a soapstone nature quite heavily charged with iron, the lower part of which is stained with the ore and strongly resembles a rich paint rock. Underneath this is about two feet of jasper and greenish quartz, and then the clean hematite. The ore dips at an angle of about 50 degrees to the south and west. The north side of the shaft is down about five feet in the clean ore which is of a very superior quality. The first four feet is a hard hematite, perfectly clean, and under this a soft blue hematite. A sample from four feet of the ore was analyzed by S. A. Mitz and showed the following result: Metallic iron, 62.05; phosphorus, .075. In October the shaft was 53 feet deep and it was intended to sink it to a depth of 75 feet when a drift was to be started west towards the diorite. The diorite to the east and west is about 400 feet distant, the present shaft being down In the middle of the valley. The drill hole that discovered this body of ore was a lucky one for if it had been a little further north it would have missed the ore entirely. The track which was put in two years ago will be turned down into the valley at once and from present appearances Iron Valley ore will be shipped again in 1892.

The development at the bottom of the shaft Indicates a body of hard hematite, such as was shipped from No. 2 shaft in the old. workings, rather than a soft blue ore. The diamond drill did not cut any of this ore as it lies about 12 feet south, of where the diamond drill ran. This was a very superior quality of ore, many of the samples taken running as high as 66 and 67 per cent in metallic iron. On the side hill only bunches and pockets of this

ore were found, all on the surface; but the present indications are that the shaft has discovered the main body. This hard hematite now covers almost the entire bottom of the shaft. The diamond drill hole bottomed in some very hard matter, and as the stock of diamonds was exhausted the company thought it best to sink a shaft to reveal what was hidden. At this time, December, 1891, the Iron Valley shaft is down over one hundred feet and still going deeper. A drift will shortly be driven in towards the hanging wall where ore is expected to be found.

MITCHELL AND WINTHROP.

These properties are both worked by the Winthrop Iron Co. The fee owner of the Mitchell is the Pittsburg & Lake Angeline Iron Co., while the fee of the Winthrop is in the Winthrop Iron Co. and both mines are under the local superintendency of Mr. C. F. Fairbarn, to whose courtesy I am indebted for much of the following particulars relative to properties and the operations on them in 1891.

The ore mined is a hematite running 63.50 per cent iron, 4.95 per cent silica, and .120 per cent phosphorus. The average width of the ore deposit is fifty feet on the Mitchell end of the property and 40 feet on the Winthrop.

The Mitchell began sinking a new shaft in the early part of 1891, and in February it reached a depth of 46 feet. In April a new ore lens was struck in the foot wall, that bade fair to develop into something of much value. The ore was of excellent quality and indications pointed to a large deposit.

In June the new shaft had been holed through to a depth of 370 feet, but had not been squared up for this distance. The showing of ore was good and about 7,000 tons per month were being raised. With the new shaft down this amount can be very materially increased.

The openings by shaft at the close of 1891 were shafts "A," 510 feet, and "B," 500 feet deep, and the sinking for the year aggregated 560 feet; 68,615 tons of ore were mined, all of which was shipped to Cleveland at a cost of $1.45 per ton.

The Winthrop is located two miles south of Ishpeming on S. W. ¼ of S. 21, T. 47, R. 27.

The openings during 1891 by shaft amounted to 195 feet, by winze to 80 feet, and the several shafts were, at the end of the year, respectively of the following depths: No. 1, 420 feet; No. 2, 230 feet; No. 8. 95 feet; No. 4, 520 feet.

There was mined from the Winthrop for the year, 68,920 tons of ore, and shipped 58,428 tons. The force employed at the mines was 160 men, and the aggregate shipment of ore from both amounted to 122,043 tons of ore.

LAKE ANGELINE MINE.

The official report of Thos, Walters, Supt. of THE LAKE ANGELINE mine, states that the number of feet sunk during 1891 was 650; shaft sinking, 150 feet; winze sinking 500 feet. Five hundred men were employed, 250,000 tons of ore was mined, and 242,000 tons shipped, for the season. The cost per ton of milling was $2.00, and cost of transportation to lake port 55 cents per ton.

In January the company were engaged, in developing a deposit of blue ore at the end of their property near the lake. The deposit presents a perplexing condition of things, the ore first taking a pitch of about 50 degrees and then making quite flat. The vein has been drifted upon for about 800 feet and no change downward as yet. A diamond drill was placed at the new shaft to further test the ore. The vein was cut 26 ft. thick when they encountered jasper on the north, and on the south 40 feet of ore was encountered. The company decided toward the close of October to remove the water from the shallow arm of Lake Angeline, that occupies land owned by them.

In the latter part of December the work of opening the first level in the east, or new end of the mine was in progress. Prospects of its adding considerable to the old workings were considered bright.

THE LAKE SUPERIOR MINE.

The diamond drill and the sinking of the new shaft on section 16 were doing important development work on this property in the closing days of 1890 and beginning of 1891, and by the middle of February had shown up a greater extent of ore than was anticipated. The shaft was then 350 feet deep and a cross-cut was under way to the east workings. The ore is a Bessemer, 62 per cent, and contains no phosphorus. In October the company was filling in that portion of the north end of Lake Angeline that adjoins their property. A fire did considerable damage to the cage shaft early in December and stopped the hoisting of ore for about a month, but by the middle of January, 1892, the mine was cleared of water, the damage repaired, and everything in readiness for active mining.

The Lake Superior finds all grades of iron ore, Bessemer and non-Bessemer, on its extensive estate. Five hundred and twenty-five feet of shaft sinking was done in 1891, and the depth of the several shafts worked was as follows at the end of the year:

No. 2 shaft	720 feet
No. 3 "	520 "
No. 6 "	844 "
No. 7 "	880 "
Sec. 16 "	430 "
Cage "	513 "
Lake "	440 "
East shaft, section 21	81 "
West " " "	20 "

Total number tons ore shipped in 1891, 318,288; average number of men employed 830. Main office, Boston, Mass.; address, Ishpeming, Mich.

THE BARNUM MINE.

The BARNUM MINE, the property of the Iron Cliff Company, was closed down in March. It was one of the oldest openings worked, being first commenced, here in 1868. Since that time it has produced about 815,000 tons of good quality ore. Its lenses have been wrought to nearly their full limit, and there is little to expect in the way of a profit for future operations, certainly not at the prices offered for ore during 1891.

CLEVELAND-CLIFFS IRON COMPANY.

In May, 1891, occurred a most important event in the mining world of which Ishpeming is the center, viz: The organization, of the Cleveland-Cliffs Iron Company. The new organization was effected under the mining law of the state of West Virginia, and the new company is in fact, though not in law, a consolidation of the Cleveland Iron Mining with the Iron Cliffs Company. The new organization issued its stock, at a par value of $100 per share and agreed to exchange the same for stock of the Cleveland and Iron Cliffs Companies upon a basis which is explicitly set forth in the following circular:

To the stockholders of: the Cleveland Iron Mining Company, and to the holders of trustee certificates for Iron Cliffs Company stock:

GENTLEMEN—The trustees holding the legal title to the 14,500 shares of the capital stock of the Iron Cliffs Company purchased by syndicate in February, 1890 (which syndicate all the stockholders of the Cleveland Iron Mining Company were offered an opportunity to join), under the powers conferred upon them by the trust and subscription agreements, and with the approval of the subscribers owning a majority interest therein, and also with the consent of those owning a large majority of the stock of the Cleveland Iron Mining Company, have perfected the following plan for the combination of the two companies, which plan has greater advantages than a consolidation under the Michigan law.

A corporation is now being organized under the laws of the state of West Virginia, to be known as the Cleveland Cliffs Iron Company, with a capital of $5,000,000 divided into 50,000 shares of $100 each. The stock of the Iron Cliffs Company, held by the trustees, will be transferred to the new company and one and one-fourth shares of its stock, full paid, and. non-assessable, will be issued in exchange for each share of the Iron Cliffs stock, to be distributed among the holders of trustee cirtificates; that is to say the Iron Cliffs stock will be exchanged on a basis of $125 per share for the stock of the new company at par, being a total valuation of $2,500,000 for the entire stock of the Iron Cliffs Company.

Stockholders owning a large majority of the stock of the Cleveland Iron Mining Company have already agreed to transfer their stock to the treasury of the new company, on a basis of $20 a share, and to receive in exchange therefor the stock of the new company at par; that is to say, for each, five shares of the stock of the Cleveland Iron Mining Company so transferred, one share of the new stock, full paid and nonassessable, will be issued, making a total valuation of $2,000,000 for the entire stock of the Cleveland Iron Mining Company. An opportunity is hereby given to all other stockholders of the Cleveland Iron Mining Company to exchange their stock for the stock of the new company on precisely the same terms.

The Cleveland Iron Mining Company and the Iron Cliffs Company will not be dissolved, but as the stock of each will be owned by the new company, its capital stock will represent the stock of the two constituent companies transferred to its treasury, and the respective values of $125 per share for the Iron Cliffs and $20 per share for the Cleveland are adopted as equitable, for the reason that they were market values of those stocks at the elate when the purchase of the Iron Cliffs stock was made. Such, an arrangement will insure the joint and harmonious working of the contiguous properties of the two constituent companies, and will inure to their mutual advantage in many ways, chiefly in the saving of administrative expenses, in the elimination of competition, in advantage in purchasing supplies and in transactions with railroads and other transportation companies; a large corporation, in these days of consolidations, having more power and influence than a small one.

For your information we would state that the Iron Cliffs Company has four producing mines, and also a large undeveloped acreage in the mineral belt, and in the year 1890, it produced from its mines 295,000 toes of iron ore, and from its furnaces 25,000 tons of charcoal pig iron and made a net profit.

The acquisition of the entire capital stocks of the two companies by the new company will require $1,500,000 of its stock at par, thus leaving unissued $500,000 in its treasury, which will enable it to acquire other property and engage in other enterprises, favorable opportunities having already presented themselves.

In addition to these advantages, the new company will have much more liberal corporate powers, and greater facilities than are now possessed by either of the constituent companies, and it is therefore expected that its stock can be made more valuable and profitable than that of either of the other companies under their present organization; and that through its cash receipts obtained from dividends on the stock in its treasury, and from its other earnings and resources, a surplus can be accumulated which will enable it to pay a regular quarterly dividend on its stock, thus giving it a stable value in the market, independent of any temporary depression in the iron trade.

As it would not be equitable to make this exchange of stock at the above figures after the stock of the new company has enhanced in value, this opportunity for transfer will not be held open later than May 25, 1891.

E. R. PERKINS,
J. H. WADE, JR.,
WM. G. MATHER,
Trustees.

In August the Cleveland-Cliffs Iron Company began sinking a sand shaft north of the city of Ishpeming where explorations with the diamond drill had been going on for about a year previous, with the purpose of determining what portion of the land did not bear iron ore, so that the company might sell or lease the same, and it was anticipated that the finding of a paying deposit of ore

might hinder the growth of the city in that direction for some years.

By the middle of October the miners had reached the ledge with the stand-pipe in the northern part of the city at a depth of 67 feet, and bored 80 feet in hematite formation, and the prospect was considered, good for the opening of a mine there.

The company in October made their lands subject to option for the purpose of exploration,—the options to run for 90 days and obtainable at a cost of $50.00. The minimum royalty to be paid by parties taking an option, or lease, is $2,000 for the first two years, and after the first two years $4,000 a year, whether any ore is shipped or not. Option holders and lessees are to pay 30, 40 and 50 cents per ton royalty, according to the units of iron and the amount of phosphorus the ore contains. About 50,000 acres of mineral lands were thus thrown open to adventurous and enterprising explorers, but the opinion was not infrequently expressed that the options to be had were so weighted down, with iron-clad conditions that they would not stimulate the enterprise of iron hunters to any great extent.

About the last of November the foundation for a new engine house at the Lake shaft was completed and inclosed and the work of preparing the place for the new machinery was to be finished, so that the plant would be in position in February, 1892. It will be a good one and capable of handling a large amount of ore.

At the Cleveland Hematite in October, 1891, the stockpile that was there in the spring was still a feature of the landscape and somewhat increased in size.

The shipment of ore for the season of 1891 was as follows:

Cleveland	221,788 tons
Iron Cliffs	278,270 "
Total	500,058 tons

THE NEW YORK IRON MINE,

This mine is in the last stages of its existence as a producer. The vein dips rapidly into the Cleveland property on the south, and the Iron Cliffs property on the west. "When the lines are readied the life of the New York is at an end," was the language used by the Ishpeming Democrat in speaking of the prospects of the mine early in January, 1891, "That such a fate is certain has been revealed by the diamond drill. There has been spent in. diamond drilling the sum of $16,500, and aside from this is the cost of two long drifts across the property, which can therefore be said to be thoroughly tested. Nothing has been discovered."

The total production of the New York from 1861 to 1890 was 1,068,149 tons. The New York may therefore be classed among the big mines, but in that role it is now "a thing of the past."

In December there were only 36 men employed all told. There was nothing new to report relative to the underground condition of the mine. The deposit was getting nearer and nearer to the Cleveland Cliffs lands, and the days of the New York were drawing to a close. About 1,400 tons per month was the output and the company had not shipped a pound for nearly two years past.

EAST NEW YORK IRON COMPANY.

The EAST NEW YORK IRON COMPANY holds an entire quarter section, comprising the S. W. ¼ of S. 3, T. 47 R. 27. The mine is located within the limits of the city of Ishpeming, north of the Cleveland mine and east of the New York. The season of 1891 was the fourth since the mine became a shipper. The first year's shipments were very small, amounting to 13,694 tons. The second year there were shipped 29,739 tons, and the the third year 36,431 tons.

The ore is a soft hematite and it lies under the Jasper Knob which forms so prominent a feature of the landscape near the east side railway tracks. The stockpile in February contained about 10,000 tons, of ore running 61.50 in iron and .050 in phosphorus. The shafts are south of the Jasper Knob, and are 500 feet apart on a nearly east and west line.

During the past year the 200 foot level was opened up from No. 1 shaft, and showed one body of ore 250 feet long and 25 feet wide. The mining is all done through No. 1 shaft and mostly from the 200 foot level, except some work on pillars in the 100 foot level. The surface equipment of the mine consists of two 50 inch by 16 feet boilers, two 42 inch drums and a compressor with a capacity of five drills. The Worthington 12x8½x10 pump is on the 200 foot level at No. 1 shaft. A No. 8 Knowles does duty at the 150 foot level of No. 2 shaft. Both pumps are operated by steam carried down the shaft in lagged pipes. A new shaft house was built at No. 1 last year, giving one pocket each at the shafts. These pockets have a total capacity of 200 tons. A coal trestle was erected with a capacity of 1,200 tons. A barn and office were also built. The mine employed, including surface and underground, a force of 100 men. Assays of diamond drill core from the bottom of the mine taken December 26, 1891, gave 65.40 in metallic iron, and .038 in phosphorus. All the ore stocked in the fall of 1891 averaged better than 63 per cent metallic iron, which was certainty very good for a hematite. The shipment for 1891 was 50,293 tons.

THE EAST JACKSON MINE,

THE EAST JACKSON MINING COMPANY which conducted explorations, during the year to the east of the old Jackson mine, has encountered a deposit of ore that promises to result in a good mine.

Assays of the ore proved it to be of excellent quality. An assessment was levied January 17, of 25 cents per share for providing adequate means to explore the

different veins which the diamond drill, in the old Pendill and Burt workings, has proved to cross the estate.

A good deal of drifting and cross-cutting was done from the old shaft west, and it was found to have been left in such bad shape by the former operators of the mine that satisfactory work could not be done.

The middle shaft was down 250 feet, bottomed In mixed ore, jasper, soapstone, quartz and paint rock. At the depth of 90 feet a cross-cut 18 feet north into the ore opened up a vein 26 feet wide, and about 1,500 tons were stoped. Ore had not been expected here, the drift having been made only to find a place to locate a diamond drill.

Another lift of 60 feet was sunk when the cross-cut found the ore 12 feet from shaft, and of better quality than on the first level. Sinking and drifting were going on at the rate of 45 to 50 feet per month, all by hand drill, and with a working force of six men.

In May the drift on. third level was in 82 feet from the shaft. The south drift was in 130 feet and was expected to reach the hematite in 20 feet more. The hard ore lies 100 feet south and to this the drift was being driven.

In July a vein of soft ore was struck at a point 100 feet south of the shaft, which it was said would yield high in iron.

The appearance of the new find continued to improve as the work of cross-cutting was in progress. The ore is of high grade and, practically clean. Shipments for 1891, 600 tons.

THE LUCY MINE.

In January, 1891, the LUCY mine "struck it rich" on manganese. The deposit in the bottom of shaft No. 5 was reached in the fall of 1890, and considerable ore was shipped during season of navigation. During the month of January, 500 tons were shipped to the Illinois steel works. The grade of this manganese is exceptionally high, varying from 15 to 23 per cent. This is better than any other known deposit of any magnitude on the range. No. 5 shaft was down 348 feet in January. It was within 100 feet of the ore when the sinking of the shaft was continued by the former owners. No. 3 was down 375 feet and. was bottomed in very good ore. Nos. 3 and 5 shafts are the only ones now operated.

The Lucy mine is owned by the estate of J. P. Pendill, and worked under a lease by the Lucy Mining Company, the management being in charge of Mr. A, Maitland. The ore ruined is hematite, assaying 59.50 per cent iron., 8 per cent silica, and .060 phosphorus. Shipments for 1891, 27,906 tons.

NEGAUNEE MINE.

The shaft at the NEGAUNEE mine in April was about 710 feet deep, of which about 400 was vertical depth and the remainder on the incline of lease. The stock piles was at that time of large proportions. Ship for 1891, 64,218 tons.

PLATT MINE.

A sample of ore taken from the new find at the Platt mine, on the Cascade range, in November gave 65 per cent in metallic iron with a bare trace of phosphorus. In other respects the prospect of the mine is good. In November, Superintendent Lawton reported the mine to be doing exploring work, conducting affairs quietly, and with a view to determining what the property possesses in the way of marketable deposits of ore. In November they were drifting and cross-cutting, and expected to prove up something of value—ore that will be clean, well up in metallic iron, and near the Bessemer limit as to phosphorus.

Mr. J. O. St. Clair is the secretary.

JACKSON MINE.

Nothing particularly new has happened at this, the oldest iron mine on Lake Superior. A diamond drill hole is being bored but as yet nothing of importance has been discovered.

The season's shipments from the mine for the year 1891 were 100,000 tons, leaving from 20,000 to 25,000 tons of ore in stock.

THE BESSIE MINE.

The BESSIE mine is located in the E. ½ of the S. W. ¼ S. 35, T. 48, R. 27, Marquette county. The shaft is about 400 feet east of the west line and near the dividing line of the two 40 acre tracts. In January, 1891, the mine was shipping ten car-loads of ore daily to the Wisconsin Furnace Company in Fond Du Lac. The ore was then hauled to the railroad on sleds, but the company hoped to have railroad connection by spring. The ore is a non-Bessemer running from 59 to 63 per cent in iron. The chief owners are confident that if a market can only be found for the ore, they have a valuable property, as they have great quantities of it and it can be mined very cheaply. In March a skip road was building in, the shaft, and the slow and expensive method of hoisting by buckets was to be soon dispensed with. In June the mine was closed down to await rail connection.

Richard A. Parker, M. E., who made a report on the Bessie property in the fall of 1890, says of the character of the ore and the probable cost per ton of putting it on, the cars inclusive of royalty: "This ore is the easiest reduced of arty of the iron ores of commerce and for that reason, is specially valuable for charcoal pig iron purposes. From its physical properties it seldom, comes in competition with the other ores produced upon this range, and it has its special function as a mixture with other ores, for making cog-wheel iron. While the units of metallic iron in a limonite ore are lower than those of a hematite, even of second grade, a limonite possesses advantages to the furnace operator that should enable it

to hold a preferred position when prices are considered and after it has been thoroughly tested (if quality is maintained) it is certain to be appreciated, and given the standing as a mixing ore, that it is entitled to receive from its chemical and physical Properties. I estimate that the ore should be put upon cars for $1.75 per ton Inclusive of royalty, provided the mine be worked to Its capacity say 75 tons per day, the figures being:

Breaking and tramming, including power, etc.	$0 80
Fuel, hoisting and pumping	20
Surplus	20
Development work (shaft and levels)	20
Superintendent and clerk	10
Royalty	25
	$1 75

THE U. S. GRANT MINE.

March 14, 1891, an assessment of 5 cents per share was levied to continue work on the U. S. Grant property. The shaft was down 140 feet deep and in rock of the same character as the capping of the Negaunee mine which adjoins the Grant on the west. The gentlemen interested in this exploration have been putting about $1,500 per month into the enterprise, and this has been going on for many months. In April the shaft was sunk to a depth of 157 feet and bottomed in mixed ore. The force of six miners under Capt. Broad were drifting south, opening about 6 feet wide by 7 feet high and were in 22 or 23 feet. In May the drift was in 52 feet, July, 140 feet, September, 200 feet. Up to this time (December), they are still drifting for the ore and the ore still persists in keeping out of sight. At the point where ore was encountered by the diamond drill they could undoubtedly find something of value by drifting, but this is so near the line of their neighbor that they do not care to seek there. By so doing it might put them on the track that would lead up to a deposit on their own lands, and this will probably be done in the near future.

I am indebted to Wm, F. Anderson, manager, for the following official statement: Location of mine, W. ½ of N. E. ¼ of S. 5, T. 47, R. 26, next east of Negaunee Iron Company and in the city of Negaunee; fee owners, Arctic Iron Co. and Pioneer Iron. Co.; lessees, U. S. Grant Iron Co.; Manager and Superintendent, William F. Anderson; main office, Negaunee; address, Negaunee, Mich.; nature of ore, none yet mined; will be like Negaunee Iron Co's. ore, soft hematite, Bessemer; number of shafts, one; depth, 210 feet; average width of ore deposit, unknown.

No. feet of shaft sunk in 1891	50
No. winzes " "	none
No. fathoms stoped "	none
No. fathoms ground broken in drifts	395
No. tons iron mined	none
No. men employed	12

THE BUFFALO MINE.

The BUFFALO Is one of the four mines comprising the Schlesinger syndicate's Negaunee group, but while the other three mines are in the large deposit of ore, in the center of the 160 acres, the Buffalo is mining a smaller and entirely separate lens near the center of the northeast forty. Some time ago a drift from the second, or 140 foot, level was started westward. At a distance of about 200 feet from the west shaft, after passing through a slaty formation, it encountered clean ore in which in January it was breasted. The deposit is a new one, and is an additional evidence that the Buffalo and Queen hematites exist in a series of lenses. If not a continuous body, to the westward. The Buffalo Co. began the season with 185,000 tons of ore in stock besides a considerable quantity shipped last season and still lying on Lake Erie docks. Of this quantity a sale of 100,000 tons was effected. The mine, it was predicted, would henceforth rank as one of the biggest producers on the range. Development work was keeping pace with, production In July.

The small deposit west of No. 2 Buffalo shaft, was opened up and its yield and character exceeded anticipations. The mine was being opened out both In depth and longitudinally. Supt. Cole said that the openings were in July three years ahead of the actual mining operations, which were still in the old workings, taking out the pillars so needlessly left by former operators. Up to August 1 the company had shipped 200,000 tons from the opening of navigation. The diamond drill was in October boring towards the deposit then recently found upon the Blue and had something over a hundred feet yet to cut before reaching the ore of that lens.

The product for the season of 1891 was 479,509 gross tons. This represents the amount actually sold.

In December the stockpiles had already started at the different working shafts, and the production of 1891 can be equaled in 1892, providing there is a call for the ore. The mine is in excellent condition. The new deposit at the old Buffalo is proving to be the best portion of the mine. At this place there is a very heavy jasper capping. The ore is soft, running freely, and they adopt the caving system of mining it. In December the north Buffalo was shut down for a while to put in a new skip.

The Queen, Prince of Wales, Buffalo and South Buffalo mines have been operated as one mine during 1891 by the Buffalo mining Co. The fee is in the Breitung estate and others; lessee, Ferdinand Schlesinger; superintendent, J. D. Jeffery; main office and address, Milwaukee, Wis.; location of mine, Negaunee, Mich.; nature of ore, red hematite, 62½ per cent T. F. Cole, general manager.

Depth of shafts as follows:

No. 1	310 feet
No. 2	310 "
No. 3	310 "
No. 4	320 "
No. 5	320 "

Average width in feet of ore deposit	150
No. feet shaft sunk in 1891	316½
No. feet winzes sunk in 1891	4,889¾
No. feet drifts in 1891	7,066
No. tons iron mined in 1891	489,018
No. tons iron shipped in 1891	479,509
No. men employed	676
Cost of transportation per ton to Escanaba	$0 65
" " " " Marquette	45

HAWKEYE MINE.

The work of sinking a shaft on the HAWKEYE—east range—was commenced in August, and was in charge of Mr. John Freeman. The purpose of the owners of the Hawkeye property is to open and mine a body of ore some 80 feet from the surface, the existence of which was proved in 1889 by the diamond drill.

THE BLUE MINE.

The BLUE mine is situated on the East Negaunee range adjoining Queen on the west. During the fall of 1890 five drill holes were put down, two in the foot wall and three in the ore deposit, the top of which is about 400 feet from the surface ranging from the Queen west. The latter holes cover a distance of about 350 feet in length, leaving no doubt that it connects with the Queen on the east, a distance as much farther.

The estimated width of the vein is from 88 to 50 feet, and analyses taken from the core of each of the holes every two feet show that the ore contains about 64 per cent of iron, with barely phosphorus enough to place it outside the Bessemer limit, being substantially of the same quality as the Queen product which is much sought in the market.

On the 31st of October Capt. Samuel Mitchell bought all the mining machinery and appliances belonging to the old Detroit mine, near Ishpeming, and it was removed to the Blue property. Within the following two months the mine was thoroughly equipped, a large working shaft was being put down and every preparation under way to place the mine among the list of large shippers in the spring. It was predicted that 200 men would be employed before the close of 1892.

THE GRAND RAPIDS.

At the GRAND RAPIDS mine very little work was done in 1891. The shipment for the season was 9,362 tons, and early in April, 1892, work was entirely suspended.

THE BARASSA MINE.

The work of sinking a shaft at the BARASSA mine was commenced in January. The Barassa Company owns 80 acres described as the S. ½ of S. E. ¼ of S. 32, T. 48., R. 26. The work up to the last of February was all done on the west forty (except sinking in the shaft at No. 3 hole) and consisted of five drill holes. The first hole was driven 63 feet and abandoned, the pipe being left in it with a view to driving deeper in the future. No. 2 hole was made 200 feet south and about 40 feet west of No. 1, and driven to the capping, a depth of 122 feet where quicksand was encountered. No. 3 was 190 feet west and a little north of No. 2 and struck the ore at 161 feet, and the diamond drill here passed through 84 feet of clean, hard ore.

After this development a hole was commenced near the center of the forty, 440 feet north of No. 3 hole, and sunk 144 feet where it was left bottomed in mixed ore. The fifth hole was 120 feet northwest of No. 3, and was bottomed in clean ore at 161 feet.

Difficulty was met with all through May and June from the quicksand encountered, and lack of power to do the work in hand, but in July some diminution in the difficulties caused by treacherous quicksands, was observable, and a slight increase was noted in the rate of sinking, though Capt. Cornish thought he was doing well to sink eight or nine inches each shift. The working shaft which was sinking to the ore body was successfully carried down through the quicksand and reached stable ground in first part of October. By the first of December the shaft was down 70 feet from the top of timber and about 80 feet from the surface level. Three number 10 pumps were kept busy freeing; the shaft from water, these were being operated at the rate of 100 strokes per minute. This would imply a discharge of about three tons of water per minute that was being discharged,

The difficulties encountered by the plucky adventurer in getting to their field of iron, and the prospects awaiting its development, are thus spoken of in a December (1891) number of the Ishpeming Democrat:

"But for the flattering prospects as shown by these borings the company would have hesitated to have gone to the expense necessary to reach-the deposit. As it was the shareholders often talked of giving up. With the shaft making but an inch a day for much of the time, with constant breakages owing to the heavy strain, it certainly was an enterprise that .needed considerable pluck as well as confidence to carry forward. That the property will repay its owners for all their patience and capital expended is very likely, as the showing of ore indicated by work already done is good. The enterprise bids fair, when developed to be a good thing for the people of the city of Negaunee."

THE LAKE SIDE MINE.

At this mine in January a small force of men were engaged in removing the drilling machinery, which was left standing when, work was stopped preparatory to sinking a shaft. The mine in February let a contract for drilling 600 feet—one hole—on its property near the south edge of the swamp at the lake. This done others were intended to be made. In the hole put down near the water-works building something like 100 feet of good ore was passed through, but at such a depth as to

render sinking a question of grave consideration. It was hoped to find the ore nearer the surface and with this in view a number of holes were to be drilled to this depth.

THE DETROIT MINE.

The DETROIT mine was closed down in September. The pumps were taken out, together with all machinery, pipes, etc., of any value. The mine will probably never be worked again as no considerable amount of merchantable ore can be found. There is probably ore on the forty acres south of the Detroit owned by the Cleveland Iron Mining Company; at least the late workings in the Detroit on the south side of the property indicated the near existence of ore.

Official information received from W. K. Anderson, treasurer, under date of February 23, 1892, is that the company has abandoned mining and ceased doing any business, except that it still owns the real estate,

THE LILLIE MINE.

The main office of the LILLIE mine is at Negaunee, and the property is owned by the Teal Lake Mining Company, and leased by the Lillie Mining Company. The deposit mined, a hematite containing 61 per cent iron, .06 silica, .070 phosphorus. The deposit has been opened by two shafts, No. 1 having a depth 325 feet and No. 2 425 feet. In the season 1891 the the number of tons of iron ore mined was 18,127, and there was shipped 17,105 tons. The number of men employed 80.

THE SAGINAW MINE.

At the beginning of the year there were in stock about 4,000 tons of ore. A new 18x24 inch compressor was added to the equipment, with a capacity of ten drills.

There are two veins in the Saginaw property—the north and the south veins. A drift to the north in the hanging of the south vein cut a fine vein of ore 12 feet in width. This was a new discovery as the north vein was worked in the old workings.

In March the stock pile showed no more than 5,000 tons, but the grade was very high, running iron 68.16, phosphorus .015, silica 1.40. It is a very hard ore. During this month the diamond located a vein of softer .ore (hematite) under the bluff on the west end. On the 5th level, near the west breast of the drift, the miners opened into the hanging, and in eight feet came upon a lode which extends, in line with the first, east as far as the shaft, and its upper margin overlapping the other. Two drills were working westward in this lode. East of the shaft the hanging rises up and the ore lies off flat to the north, and two drills were also working there. Extra pumps were ordered about this time and on their arrival the unwatering of the east mine was commenced.

By the latter part of June the stock pile had grown to about 8,000 tons. The unwatering of the 6th level was completed.

In July all the stopes were stopped, it having been determined to do no mining until the stockpile, amounting to about $30,000 worth of ore, was disposed of.

In August the big Worthington pump was lowered to the sixth level, the entire mine was freed from water and by the early days of September the bottom became visible for the first time since 1884 at which time the mine closed down. New pockets and trestle work were built, besides a stockpile ground and shipping dock—indications that the management expected to find ore somewhere in the mine.

The Saginaw had shipped its stock pile and was preparing to resume mining work in the latter part of November but with the intention of hoisting no more ore than it was thought could be disposed of the following season. In December Mr. T. R. Bargh became superintendent of the property, and found considerable preparatory work before him to get everything moving to his satisfaction. Shipment for 1891, 4,320 tons,

THE ELBA.

The ELBA mine shut down about the middle of November. The property is situated on a forty south of the city of Ishpeming and had worked for two years previous to the shut down at a considerable loss—estimated at the time to be over $30,000.

The shaft had attained a depth of 210 feet, and drifts extended from the bottom north, east, south and west. The longest drift was 130 feet, and all along the line a fine quality of soft ore was encountered but not in sufficient quantity to warrant the cost of mining it. The management was confident, however, that ore existed on the property, and further efforts were to be made to find it with the diamond drill.

MENOMINEE IRON RANGE.

APPLETON MINE.

At the beginning of 1891 the APPLETON shaft was 70 feet deep and bottomed in nearly all clean ore. A blast was put in and from it were hoisted eleven buckets of first class ore and but two buckets of rock, and the owners were very much pleased with the outlook. In April much trouble was met with in the shaft from water, and it became necessary to get another boiler and one larger pump than those which were then in use. Toward the close of April the shaft was about 90 feet deep, and, apparently in or very near the footwall rock; in May it reached the depth of 102 feet, and cross-cutting to the south was begun at once. As soon as the cross-cut was far enough in the ore, drifting east and west was the order. By the last of May the shaft had been securely timbered up, and a new boiler and five power drills were received. In June the cross-cut south from the bottom of the shaft passed through the lens of ore, finding it 11

feet thick, and was being pushed further south in the belief that another good deposit would be found.

In September Capt. John Gatherer took charge of the mining work. At this time it was reported that the ore in the shaft was increasing in extent as the shaft grew deeper, and nearly all the shaft was in ore. Sinking was steadily continued in October, and it was thought probable that by this time the ore struck in the cross-cut to the north had been reached in the shaft.

The PENN IRON COMPANY mines comprise several groups on the Menominee range in the vicinity of Norway, Mich., and are as follows: The East and West Vulcan, the Curry, the Cyclops, the Norway, Briar Hill, besides several explorations, such as the Harrison, Stephenson, etc. They are under the supervision of General Manager, William Kelley. The office of the company is 218 South Fourth street, Philadelphia. Penn.

EAST VULCAN MINE.

The beginning of 1891 found the EAST VULCAN preparing for another season's output. At No. 3 the shaft was about 60 feet below the 400-foot level, and sinking was being done at the rate of from 18 to 20 feet a week. The main (new) shaft was 755 feet from the surface and a pump station was being cut out to the south. To the north a station was being cut out and a large tank put in. At the southeast Vulcan No. 2 shaft was 452 feet deep, a drift being driven east about 320 feet, and a cross-cut south, at the end of this, 90 feet to the ore, had been made. The northeast Vulcan shaft was down 190 feet. At the new shaft the station had been cut out at the 7th level and the ore struck in the north side, and the work of cross-cutting the ore was begun. The cross-cut to the northeast 600 feet from the shaft in the level above had penetrated a fine body of ore. A great deal of opening work was done.

In February the cross-cut from the bottom level of No. 3 shaft was temporarily suspended as the force and the drill used was needed elsewhere. About 90 feet of jasper had been driven through, the whole length of the cross-cut being fully 800 feet. At the northeast Vulcan, in February the station was being cut out and preparations were being made for the sinking of the No. 2 shaft (southeast Vulcan) to the 5th level. In the bottom of the new shaft the ore had been drifted on at this time 250 feet, the drifting being done each way from the shaft. At No. 3 the cross-cut north from the 4th level, struck jasper at a distance of 46 feet, and its course was changed to the west. In March the ore body had been struck at the bottom of the shaft at northeast Vulcan. The stockpile at the main shaft at this time was increasing in size rapidly.

A new cage way was put in at No. 2. In April the drift from the bottom of No. 3, struck the ore at a distance of 125 feet and a cross-cut in the ore, towards the hanging was in 20 feet, and no hanging was yet in sight.

At the 7th level of the new shaft, the drifts had been extended east and west about 415 feet and the ore still held out.

In May a breakdown of the hoisting machinery at southeast Vulcan, caused a week's delay. In June No. 1 East Vulcan, shaft was equipped with a new boiler, and they were mining from 450 to 500 tons per day.

In August No. 2 shaft readied the 5th level, and drifting to the ore body was begun. The station, was being cut out at the bottom and preparations were being made to put in the pump.

In November, at No. 3, the 3d level drift had been, connected with the stopes, and the drift at the bottom of southeast Vulcan was in about 175 feet, and the main shaft had penetrated the ore body at a depth of 85 feet below the 7th level.

An official statement received from Superintendent, Wm. Kelley, furnishes the following interesting data: There were in 1891, three distinct producing pits on the East Vulcan—new shaft, or No. 1; southeast shaft, or No. 2; and No. 3 shaft. The last is non-Bessemer. The others, which produce the bulk of the ore are Bessemer. The northeast shaft is idle, and the old No. 1 is used only for pumping from new shaft. The several shafts at date of Supt. Kelley's statement were of the following depths: New shaft, 830 fest; southeast shaft, 540 feet; No. 3, 500 feet; No. 1 (pump shaft), 500 feet; northeast shaft, depth not given. Two hundred and seventy feet of shafts and 740 feet of winzes were sunk in 1891. The average force was about 320 men. Tons of ore mined, 93,750; tons of ore shipped, 78,370. Mine is owned by "Keweenaw Association (limited)," and leased by Penn Iron Mining Co. Address, Vulcan, Mich.

WEST VULCAN MINE.

The new vertical shaft which was begun at the WEST VULCAN in July, 1890, and which is known as "C" shaft, was down about 400 feet in the early days of January, 1891, or to what is locally called the 6th level of the mine. "The shaft," says Knight's Norway Current, "counting the days actually worked up to January 1st, has been sunk and timbered at the rate of 2 feet and 8 inches per day. This is not record breaking, but in jasper and jasper slates is not bad work. The sinking of "C" shaft to a depth of 1,000 feet and the pumping of so much water was a big undertaking in face of the not very favorable condition of things at the bottom of the mine when the old shaft burned out, and it is hoped that the Penn Co. will be fully rewarded for the outlay. By this we do riot wish to intimate that the West Vulcan was or is, a played-out concern, but that it was and is a question whether the of the ore body will warrant the expenditure, or admit of being mined at a profit. The words of president Stackhouse to the writer soon after the fire, will explain the situation. He said. 'The question is, shall we abandon the property and find later that we have made a mistake when some other company shall have reopened the mine and struck it rich, or shall we spend $100,000

in satisfying ourselves that we had better have left it alone and kept our money."

In February the engines for the pumping plant were being placed. The water had been lowered to the 6th level in No. 2 shaft, and it was the intention to keep it at that point till the new shaft was down. Three of the old steam boilers had been taken out and two new ones of greater capacity put in their place. Late in the month the new shaft was 480 feet deep, and the drift being driven from the 6fch level of the shaft, to intersect the cross-cut connecting the north and south veins, was in 58' feet, or something over a third the distance to the point aimed at. By the last of March the new shaft was 560 feet—60 feet over half the distance to be sunk—and the drift east from the 6th level was in considerably over 100 feet of the 160 required to connect it with the cross-cut from the north to the south vein. Toward the latter part of April the drift reached its destination at a distance of 150 odd feet, and the water was running from the cross-cut and being pumped up the new shaft.

The pipes in No, 2 shaft were undergoing repair, and as soon as they were in serviceable trim the work of "forking" the mine clear of water was begun.

In May the new shaft was sunk 74 feet, and by the middle of June it had reached the depth of considerably over 700 feet, and new ore pockets and trestles had been brought to completion.

At the last of August the shaft was about 950 feet deep, the water was out of the old. workings down to the 10th. level, and some repairing was done in No. 2 shaft, through which the water was being pumped.

In September the new shaft reached a depth of 1,030 feet and was bottomed in the ore in the north vein, and a cross-cut south to the old shaft was commenced about 20 feet from the bottom, leaving that depth for a sump.

This deep shaft was sunk between the north and south veins for the purpose of reopening the south vein on which work was suspended by the burning out of the main shaft in 1890. The north vein, on which work had been carried to a depth of about 300 feet, seemed to have pinched out at that depth, and work on it was abandoned. But on completion of the vertical shaft, and while cleaning up with the intention of cutting out a station preparatory to cross-cutting south, ore was struck in the bottom on the north side of the shaft, which seemed to be the north vein and overran 64 per cent iron.

This discovery was thought to be a pleasant surprise to the company, and it was expected the 11th and 12th level stations would be cut out and a cross-cut then started north to intersect the ore body cut in the sump.

By the middle of November the old workings were almost free of water, and the cross-cut south to the old shaft, at the 11th level of “C” shaft was in 145 feet, while that at the 12th level had advanced about 40 feet. About a month later it was announced in the Norway Current that connections; had been made between "C" shaft in the workings tributary to the old shaft, at the 11th level, and would be made at the 12th level within a few-weeks.

The Current of December 19, 1891, said of the mine: "The Cornish, pump will be in working order to the 10th level of the new shaft at ant early date, and as quickly thereafter as possible two other plunger pumps; will be dropped to the 12th level. The levels of the new shaft being somewhat lower than those of the old shaft the water will all find its way to, and be taken care of in, the new shaft. Some ore has been hoisted through No. 2 (the skip shaft) and the West Vulcan will soon again be numbered among the ore producers. It is not probable that any cross-cutting to the north vein will be done to strike the ore body reached in the sump of the new shaft until the pumps are all in shape to insure the taking care of any water which may be cut in so doing."

In the early days of January, 1892, the pump work in "C" shaft was being pushed with all possible speed.

The shipment of the season, as reported by Wm. Kelley, Manager, was only 597 tons, just enough to show that the West Vulcan had, as it were, finished its preparatory course of training, and was now ready to enter the lists again as a producer.

THE CURRY.

This mine had the largest output for 1891 of the several mines on the range worked by the Penn Iron Company.

In January No. 1 shaft was fitted with new machinery consisting of two 6-foot Lane drums and a Corliss engine, which are used to work two cages. This shaft was sunk during the year from the 4th to the 6th level. The drift west from the 4th level reached rock about 430 feet from that shaft, the drift from the 5th level is in about 300 feet and shows well.

About 375 tons a day was being mined in August, while the stock piles were being loaded and shipped so fast that in September they were exhausted.

New stock docks have been built, so that by spring with the ore in stock and the supply from the mine, the shipments for 1892 promise to be much larger than 1891.

The number of men employed for the year, 230; and the season’s shipment was 100,681 tons.

BRIAR HILL.

At the BRIAR HILL which is also one of the Penn Iron Company's mines, but very little success has been met with during the year, but as Gen. Mgr. Kelly says: “We have spent a great deal of time and money to prove the mine and we propose to spend another year at it."

A vertical shaft was sunk 44 feet through sand to the ledge 153 feet, where a cross-cut was started to the north, which at 75 feet struck ore formation and was continued 61 feet further in the formation, when a drift was driven east 458 feet with an occasional showing of

lean ore. At the end of 1891 the east drift was discontinued, and a drift is being driven west.

ARAGON MINE.

About the middle of January No. 2 shaft at the Aragon was down to the 3d level, and the station cutout and No. 1, which was down to the 4th level, was connected with this level by drift, and cages were put in No. 2 shaft. The openings generally showed very satisfactorily, but considerable trouble was caused by ice in the No. 2 shaft. A winze was sunk at the 4th level west of No. 1 shaft, and a cross-cut from the bottom of it was driven in "Castile" ore.

In March No. 1 shaft had reached the 5th level and No. 2 the 4th level. The pockets in No. 1 for loading the skips were working very satisfactorily. In April a new track was laid on the spur into the mine preparatory to shipping, but the first ore was not shipped until the latter part of May.

During the summer months about 400 tons a day were being mined, more side tracks were laid, more stockpile ground was prepared, and much other surface work was done.

In No. 2 shaft at a depth of 190 feet a cross-cut was driven to meet the one coming from the 2d level of No. 1. This connection greatly improves the ventilation as well as renders it much more safe from fire.

Two new boilers were placed at No. 2 in October, and the shaft reached the 6th level. Stockpile ground was being further increased in size, but not as much as it would have been were it not for the fact that ore was to be shipped all winter by cars to Chicago. The mine is in good condition as regards both ground opened and surface improvements and is without doubt one of the solid institutions of the range.

The official statement as furnished, by Supt, Larsson is as follows:

Location of mine, N. ½ of N. W. ¼, S. 9., T. 39, R. 29 and N. E. ¼ of N. E. ¼, S. 8, T. 39, R. 29, city of Norway, Dickinson county, Mich. The fee of N. ½ of N. W. ¼, S. 9, is owned by Briar Hill Mining Co. The fee of N. E. ¼ of N. E. ¼, S. 8, is owned by S. L. Smith, Seager estate, T. L. Chadbourne and J. A. Hubbell. Nature of ore, blue hematite. Granada, 63 per cent iron, .085 per cent phosphorus; Ingalls, 68 per cent iron, .060 per cent phosphorus; Castile, 66 per cent iron, .015 per cent phosphorus; Aragon, 64 per cent iron and .045 per cent phosphorus.

Average width of ore deposit, in feet	50
No. feet shafts sunk in 1891	478
No. feet winzes " "	953
No. feet drifted "	3,252
No. men employed "	343

Depths of shafts in feet:

No. 1	420
No. 2	520
No. 3	420
No. tons of ore mined in 1891	96,999
No. tons ore shipped in 1891	96,829

THE PERKINS MINE.

The PERKINS mine, which is a continuation of the ore measure of the Norway, had but a small body of ore in the limestone. A very few men were working, the early part of the year. All operations were suspended in June. There may be still a, few thousand tons in the bottom. The ore in stock, about 2,200 tons, will be held over until 1892, or a more favorable market.

THE NORWAY AND CYCLOPS

are owned by the Keweenaw Association, and worked under a lease by the Penn Iron Co.

The Norway is practically worked out, although the bottom of the ore lens has never been reached. Two drill holes were bored from the bottom of the working in 1890, one being at an angle of 45° to the north —across the formation—which showed 36½ feet of slates, limestone and lean ore, and then 26½ feet of rich ore, then limestone. The other hole was bored with the formation 64 feet in lean ore, then in 150 feet of ore high in metallic iron, but also high in phosphorus.

In January the big pumps at the Norway were removed to the West Vulcan and two 12-inch pumps were put in their stead and the mine was allowed to fill to the 4th level. In May there was a cave of ground, from the surface, but as the fall was expected no one was hurt; and as the pillars in the bottom had been mostly taken out, the mine will not be reopened below the 2d level. So the pumps were pulled out and the water rose to the adit level. Considerable ore has been taken from the pillars in the upper levels and from open pits, about 60 tons a day being the product.

At the Cyclops nothing new has been developed. The Cyclops and Black Hill pits have been producing about 60 tons per day. The Black Hill section does not seem to improve any.

The ore at the Norway is both Bessemer and non-Bessemer, while the output of the Cyclops is all Bessemer.

Product for the year:

Norway mined 25,347 tons, shipped 4,089 tons.
Cyclops mined 9,887 tons, shipped 10,599 tons.

Number of men employed at both 70.

The HARRISON EXPLORATION by the Penn Iron Co., on the Harrison property in the city of Norway is fully described by Supt. William Kelley, in a paper read before the American Institute of Mining Engineers, which is given here, with the exception of the plates:

SINKING THROUGH WET GRAVEL AND QUICKSAND NEAR NORWAY, MICH.

(Cleveland Meeting, June, 1891.)

An extensive swamp covers a large part of the town site of Norway and adjacent land. Through this swamp run two parallel ore formations. In the north one is the

Aragon mine. The south one passes into the swamp on the Harrison property. On the edge of the swamp, about 1,000 feet from the Aragon mine, a diamond drill, in the fall of 1889, located the ore-bearing formation and a probable ore-body. To explore further and develop this ore, the Penn Iron Mining Company proposed, in the spring of 1890, to sink a shaft.

The drill had shown the depth of the glacial drift to be more than 80 feet. A test-pit near the location of the proposed shaft had struck, at a depth of 20 feet, an amount of water which a 200 gallon pump was unable to lower. At the Aragon, a few years before, a shaft had been sunk to hard pan with great difficulty and many delays by the usual method of driving laths.

Under the conditions it was decided to sink a caisson—- or drop-shaft. Two 40-horse-power boilers, a Lidgerwood engine with 4-foot drum, and a good derrick were set up; and two No. 10 Knowles pumps, rated at 400 gallons per minute, were brought on the ground. The pumps had been purchased for another purpose, and being brass-lined, were not well suited for the work intended, but they were available,

The dimensions adopted for the top of the shaft were 6 feet by 13 feet inside. To give sufficient space for pumps and working, and to aid the shaft to settle. It was made 4 feet larger each way at the bottom. The shaft was divided, to within 12 feet of the bottom, into three compartments, the middle one uniformly 4 feet wide. This compartment was used for hoisting, a ladder-way and pipes. The pumps were placed one in-each end-compartment. Above the pumps the end-compartments were planked up to be filled with sand to increase the weight. A ventilation-box was put in one corner. The bottom of the shaft was left unobstructed for working purposes, and sufficiently high to allow two additional pumps to be put in under the first.

The bottom pieces, made of oak and constituting what is called the shoe, were 15 inches square, but the bottom inside was beveled off to 6 inches. Above the shoe, white-pine timbers 12 Inches square, framed, in sets, were laid close and bolted together and to the shoe with eight 5-foot bolts. The successive sets were reduced one inch in length and width, until at 48 feet above the bottom their dimensions corresponded with the top. Corner posts, 12 inches square, of unequal lengths, so as to break joints, were bolted to every other side piece and end piece. The bolts being put in from the inside and having the nuts countersunk, were easily unscrewed and recovered when the corner posts were removed. Like the corner posts, side posts were put in, one at each corner of the middle compartment. Twelve-inch dividers were used every five feet.

After the ground had been, leveled the timbers were built up and bolted as far as the derrick and bucket would permit, nearly 30 feet. The seams were then carefully caulked outside, and 3-inch planks in unequal lengths were spiked on, to protect the caulking and timbers and to strengthen the shaft. A shaft of this character Is liable to be pulled apart if riot very strong. Steam-hose was used at first to connect the pipe on the ground, coming from the boilers, with the pipes in the shaft. But afterwards lengths of pipe with double elbows were substituted. Two lines of steam-pipe from the ground to the pumps were necessary, in order that one could be used while the other was being altered in building the shaft up.

The shaft erected, the pumps in place and everything ready, ground inside the shaft was broken Monday morning, June 2, 1890. As the top was dry, the buckets came up fast, and by next morning the shaft had gone down 6 feet. On Friday the fifth day at 15 feet the pumps had to be started. The first week's work resulted in 18 feet sunk. During the first three days of the second week 9 feet more were sunk. It was now evident that both our pumps had to run fast to keep the water out, and if one should break down or the water should increase, we would be drowned out. Therefore before sinking the pumps below the water level, we stopped to get more power.

Two portable boilers, of 35 and 100 horse-power respectively, were bought, delivered and connected, and two No. 10 Cameron pumps without air-chambers were placed 4 feet under the Knowles pumps. During the stop the shaft was built up again as high as possible. We lost thus 15 working days, but started afresh Monday, June 30, with doubled power. Billing the next three days we sank 7 feet. Then, the Knowles pumps gave out. Eight days of sand and gravel had completely worn out the brass linings. It was necessary to take out the linings and. put in larger pistons, which repairs consumed two days.

On Saturday, July 5, we started again, and to the end of the following week we sank 16 feet in 7 working days, during which time everything went well. The pumps were kept busy, three running constantly and the Knowles pumps often making 160 strokes a minute. The quantity of water was estimated at 1,500 gallons a minute. During the week the sand boxes were filled to keep the shaft clown to the bottom of the excavation. The sand and gravel came in under the shoe, and the surface about the shaft settled into a large pit which continually grew larger.

July 12 the shaft was down 50 feet, and it became necessary again to build it higher. This took three days. A drill in the bottom gave us some encouragement, as at 10 feet it struck, something hard. During the next 3 days we sunk 7 feet and found hard pan in a corner of the shaft. At this point the shaft did not settle regularly. Sometimes it would hang, and then it would drop with a great inrush of sand and water, even when the ground was out a foot or more under the shoe. To increase still further the weight of the shaft, 30 tons of rails were laid on the top; and props had to be placed against the shaft at different times to keep it straight. It took 18 days to go through the 14 feet of hard pan; but parts of two days were spent in weighting the shaft and one day with, an accident which bade fair to stop proceedings summarily.

Some difficulty with the water-supply of the boilers cut down the steam pressure so low as to stop the pumps, and before steam was raised again they were completely drowned and could not be reached. An anxious quarter of an hour was passed before first one, then another, and then a third pump, started of their own accord under water.

The ledge was struck August 7, and two days later the slates were exposed all across the shaft. Four days more were spent getting the shaft down 2 feet further into solid rock.

The time spent in sinking may be summarized as follows: Four days sinking 15 feet above water level, 17 days sinking 42 feet through wet gravel and. quicksand, 16 days sinking 14 feet through hardpan 4 days sinking 2 feet in slates, making a total of 41 days sinking 73 feet. To this must be added 6 days required to build, up the shaft, and 2 days weighting shaft with rails, making a total of 49 days, or one day over eight weeks actual working time. In addition to this we lost 12 days in increasing our power and 2 in repairing pumps, making the time consumed 63 days, or ten and a half weeks.

We now, August 14, had the shaft down firmly in the ledge; but the most delicate part of the operation was still to come, namely, stopping the flow of water. Before that could be done, however, many things were necessary.

The rails had to be removed from, the top and the sand from the boxes, the pipes changed, and the shaft built up to the surface. There was now a sink-hole about the shaft, 65 feet in diameter and 20 feet deep, and the top of the shaft was about 6 feet below the original surface level. The shaft was but little out of plumb, the top set having to be raised 2 inches at one end to level it. The corner posts were taken, out, the bolt holes plugged and the shaft caulked on the inside. This work took 8 days.

The next 14 days were spent in sinking 11 feet further into the ledge. It was unsafe to make heavy blasts, and the pumps, after their severe strain with lengthened suctions, were barely equal to their task. The bulk of the water from under the shoe was gathered together by troughs of boards and clay, but still water was falling everywhere.

The work of sealing up the bottom of the drop-shaft was now undertaken. A set, six feet by 13 feet inside, of 12-inch square timber, was carefully placed in line with the top set of the shaft, about 6½ feet below the shoe. This was thoroughly blocked against the rock all around with wedges. Six sets of the same size were placed on top of the first and each bolted to the next. Behind the sets as they were built up, was put a thin layer of clay over the wedges and then concrete of equal parts of sand and Hilton cement. The middle of the top set was about opposite the the bottom of the shoe. Through this set twenty 2-inch holes had been bored. Behind the holes a layer of gravel and broken stone, 4 inches deep, was laid, leaving a free passage for the water. Upon this perforated set were put three other sets of increasing inside dimensions, so that the top set was against and bolted to the drop-shaft. The space behind these sets was filled with concrete as before. This timbering and cementing in such a flood of water was a tedious process and took 18 days.

It was all done and we were ready to plug up the holes when the pumps failed. One had been removed to make room for lowering the timbers. The piston-rod of another broke and a third would not draw. In a few minutes the pumps were flooded and the water gradually rose to its old level. Then followed ten days in recovering the shaft by means of, other pumps. The perforated set could not be cleared of water, as the broken pump was the lowest and the others could not be got down low enough. The first few holes were plugged without difficulty under two feet of water, but the last one defied us for some hours until we used a long plug reaching across the shaft.

The result was entirely satisfactory. The water at once fell to about 200 gallons a minute. After the pumps and side posts had been removed and the interior had been thoroughly caulked, the water was decreased to about 90 gallons. After the shaft had been sunk further and bearers put in, a small station was cut at one end and the water was gathered to a No. 8 Cameron pump. Below this the shaft was sunk with a No. 4 Cameron which now works about an hour and a half a day.

The time taken for sealing up the bottom may be summarized, as follows: Eight days to alter shaft after it rested, 14 days to sink 11 feet in slates, 18 days to timber and cement, 16 days to remove pumps, caulk, and arrange shaft for regular sinking, making a total of 56 days. To this we must add 10 days lost by failure of pumps, making a total of 66 days or eleven weeks.

This makes the total of both periods of the work 129 days or five months. At the end of this time, November 1st, the shaft was 84 feet deep and in shape for sinking in the regular way.

The history of the work after the shaft had been completed was one of failure as regards finding workable bodies of ore. The shaft was sunk to a depth of 225 feet when a cross-cut was started north which reached the Aragon line, a distance of 275 feet. No ore bodies were encountered worth mentioning. A drift was started on a small seam of ore about 100 feet from the shaft. It was driven west about 90 feet. Nothing encouraging being struck, the management concluded to abandon the lease to the fee holders.

EXPLORATIONS NEAR NORWAY.

Exploratory work on S. 6, T. 39, R. 29 has been pushed continuously, but nothing of much importance has been developed as yet. A shaft has been sunk that has produced some very fair ore, but it is not yet deep enough to warrant any predictions.

On S. 8, T. 89, R. 29 some work has been done with the diamond drill. The Mutual Company has been doing considerable diamond drilling on S. 1, T. 39, R. 30. At a

depth of 425 feet a magnetic belt was encountered similar to that at Quinnesec drilled by Dr. Crowell and others.

On. S. 25, T. 40, R. 30, Messrs. Sicard, Wheeler and Husten are making a persistent search for ore, and a diamond drill has made a very encouraging showing. A shaft is being sunk and considerable "test pitting" is in progress.

Capt. Colwell and others are exploring on the S. W. ¼ of S. W. ¼ S. 30, T. 40, R. 29. They have sunk seven pits about 13 feet deep, across the formation for a distance of 200 feet, and all showing ore.

THE QUINNESEC.

The diamond drill exploration on the town site at Quinnesec had reached a depth of nearly 300 ft. in January, 1891, and the drill was then in a block of quarztite. The drill hole was being put down at an angle of 60° and the slates were cut through after drilling about 100 feet. In March the diamonds had ground their way through 72 feet of ore, and it was calculated that, allowing for the dip of the ore formation to the south and the angle at which the drill hole pointed to the north, they had tapped about 55 feet of a lens of ore. It was expected that more holes would be put down to test the deposit, and a test pit was sinking to the north of the first drill hole to locate the ledge.

The forty on which the first drill hole was sunk is under an option from the canal company, held by Dr. Crowell. The hole was within about twelve feet of the line between the canal forty and the Quinnesec town-site. Dr. Crowell also holds an option from Mr. Buell in which it is provided that work within a certain, distance of the Buell line shall be considered on his property. After the first hole was put down a test shaft was begun to the north on the canal forty, and about twenty feet from the line, and a second hole was being put down which was on the town-site. Thus work was in progress on both options. The standpipe was driven 98 feet to the ledge, and the second drill hole at this point was down about 20 feet in the ledge in March. Sinking in the test shaft to the north was still going on and a mixture of ore, quartzite and jasper was coming from the shaft. In April the second drill hole was down about 250 feet and seemed to be in the same ore formation as was encountered in the first hole, but the quality of the ore was thought to be not as good. But the same depth had riot been attained. And it was believed, with apparently good reason, that the second hole would find the ore "all right" at the right depth. In May the second drill hole penetrated a formation showing considerable ore, but the clean ore found in the first had not yet shown up.

The third drill hole was finished in July, having reached a depth of about 500 feet, 70 feet of which was vein matter. And 50 feet of this it was estimated would average about 58 per cent iron, and was low enough in. phosphorus to be reckoned a safe Bessemer ore. A new shaft to reach the ore struck by diamond drill was commenced in September, and is intended to be a two-compartment shaft, each division being 5x8 feet in size with 12 inch dividers, the sets being also of 12 inch square timber. In October, the shaft having reached the ledge at a depth of some forty feet, operations were suspended for a time pending a change in the personnel of the management. Work was resumed before the close of the month, however, and a bent was built over the new shaft and a small hoisting plant brought into use. A power drill, with steam as a motive power, was also introduced, and in November the shaft reached a depth of about 85 feet. In January, 1892 the shaft was down 100 feet and was in black slates.

KEEL RIDGE MINE.

The work of reopening the old KEEL RIDGE was commenced in October, the repairing of the main shaft being the first step in that direction. A comparatively small amount of work was required to put the shaft in good condition, as it is sunk nearly all the way from collar to bottom (280 feet) in jasper.

It has long been a question whether or not other bodies of ore besides those mined may be found on the Keel Ridge property, and the Pewabic Company undertook to clean out the mine, do some exploratory work and put it among the list of producers.

A line of 4-inch pipe was laid in October from the Pewabic mine to the Keel Ridge, a distance of over half a mile, to carry compressed air to run the machinery needed at the beginning of operations. Supt. Brown of the Pewabic has the general supervision of the work, and is assisted by Capt. Win. Benetts.

By October 31 the shaft had been put in good shape to a depth of 80 feet, when water was reached and pumping started up. The shaft is a two-compartment one and affords room for two cages, and pump and ladder way. Pumping was continued steadily through November and December, and the work of repairing went on as fast as the water was lowered. At the end of the first week in December the water had been lowered to about 50 or 60 feet from the bottom of the shaft.

PEWABIC MINE.

At the outset of 1891 the bottom (500-foot level) drift had been extended 285 feet east, and the talk was that It would be driven about 200 feet further. Work was being pushed at the 2d level, but ore was nearly all out of the 1st level. They were driving the bottom, drift at the rate of 40 feet per week. Prom the 21 level about 350 tons per day was being sent up, and the stockpiles showed upwards of 10,000 tons by the middle of the month.

A new saw-mill, capable of sawing all the timber for use in the mine, among the additions to the outfit this month, and a new brick engine house was just nearing completion.

In March about 16,000 tons of ore was stocked, and the pile was increasing at the rate of from 280 to 300 tons per day. At the 3d level a sump room, about 15x50 feet was cut out, and a compound condensing pump was expected to arrive and be set up ere the end of the month. The bottom drift had been driven 445 feet and was advancing about 35 feet weekly. The drift here was about as far east as the work in the level above, and cross-cutting to the ore was to be commenced as soon as the new pump was in place. The new hoisting plant arrived in March, and also the air compressors, but the former could not be put in place till the foundation for it was finished, and the latter were waiting for the new pump to be put in readiness. A force of 325 men were employed at this time.

In April work on the drift east at 3d level was suspended at a point nearly 600 feet from the shaft, and a cross-cut was begun 500 feet from shaft. This cross-cut had been driven about 60 feet by the end of April, and reached the ore body about June 13. At this time about 200 men were employed, all told, a considerably less number than theretofore. Drifting was in progress from the bottom of the winzes sunk from the 2d to 3d level; the new hoisting plant, new pumps and compressor were in place and doing satisfactory work, and the mine had been, since the middle of May, and was still, shipping about 25 cars of ore per day to Escanaba.

Up to the latter part of July 27,000 tons had been shipped, and there was still from 8,000 to 10,000 tons in stock. The output of the mine was at this time about 225 tons daily. There was a feeling of disappointment in the developments made so far, by the cross-cut to the ore from the 3d level. The lens in July was very much smaller than in the level above. But by September 1 the drift east from the bottom of the shaft had shown up some better ground, and the outlook was much improved. A new rope haulage to do the underground tramming was among the improvements put in this month. Its adoption required the employment of 2,300 feet of rope and 1,300 feet of track. Other improvements were the erection of a brick building, 22x40 in size, to be used as a laboratory and for offices, and the purchase of a small mill for use in mixing and pulverizing ores for analysis.

The laboratory is in charge of Mr. E. E. Brewer, well known from his long connection with the Chapin mine.

In October a new shaft was started 2,000 feet east and south of the present shaft. This new shaft is to be sunk to the ledge, when a diamond drill will be used to test the formation, and if a satisfactory show of iron presents itself, the shaft will be continued and made the second working shaft of the mine.

The first week in November this exploring shaft had reached a depth of about 130 feet and was in sandstone. A small hoisting engine had been placed in position to do the hoisting. The drift east from the bottom level of main shaft had reached a point 60 feet beyond the ore body then wrought and was in jasper. Cross-cutting both ways was to be commenced after drifting a few feet further. The shipping of ore ceased at the end of November, the aggregate amount shipped being about 64,507 tons, and the company began stocking its ore. The closing of the shipping season caused a material reduction in the working force. The force in the middle of December was about 250 men. The exploring shaft at that time had been sunk about 150 feet and was still in sandstone.

MILLIE MINE.

No large output was made at this mine during the winter of 1890-91, only a small force was retained and the mine was sunk and opened up to the 400-foot level. Although the Millie continued to mine ore, no water was being pumped from the mine in January and it was not probable that it would be necessary to do pumping for some time. Drifting to the west was being continued and one winze put down which at the depth of 100 feet was expected to open up a large amount of stoping ground.

In June the daily output was from 30 to 40 tons, and about 2,200 tons had been shipped.

In August the operators were working about 40 men, and sending out nearly 100 tons of ore per day. Stoping in the west end was being pushed, and some drifting was done in the east end to reach a body of ore which had been proven up by sinking. In September the mine did not send out much ore owing to the necessity of doing much dead work which should have been done the previous winter.

The drift west from the 4th level of "C" shaft at this time had been driven about 104 feet, and a cross-cut was soon to connect it with a winze which had been carried down in the ore. A winze was also put down to the 4th level. Work at the "B" shaft in September was giving satisfactory results, and the open pit was yielding more or less ore.

The hoisting machinery and the compressors, have been put in shape for future work. The mine is under the supervision of Capt. McGregor. The output for the year was 5,889 tons.

THE WALPOLE,

which adjoins the Chapin on the east, has been energetically explored, but with the exception of a few small lenses of ore nothing has been found. It shipped 3,895 tons during the season but is now shut down.

THE CHAPIN MINE.

Previous to 1889 the Chapin was the champion iron mine in all the world, and it still remains the giant among the iron mines on the Menominee range.

To the practical miner some idea of the remarkable strides made by the Chapin in its struggle to regain the championship, wrested from it by the Norrie in 1889, may be conveyed by the following brief statement of

work done at the mine in 1890, for which I am indebted to the Norway Current of January 17, 1891:

"The amount of opening work for 1890 has just been figured up, and the figures, as we get them from the office are as follows:

No. feet sunk shafts	1,054
No. " " winzes	7,612
No. " drifts and cross-cuts	33,071
Total	41,737

"This makes nearly eight miles of sinking and driving, and it is hardly probable that so much work was done the past year in any other mine in, the world. In these figures, 'slicing' work in taking out the crushed pillars, is not included." The timber shaft was down to the 5th level in January and ready for work to the 4th. In the same month work at "B" shaft was progressing satisfactorily, but at "C" delay and annoyance were caused by the formation of ice, especially at the 6th level where the rope haulage was seriously interfered with. The most disastrous event of the year at this mine was the fire at "C" shaft, which was discovered January 29, at 6:15 o'clock, and by which three miners lost their lives. It was at first reported that eight men were lost and hope for their rescue was abandoned, until the welcome news came that four of the eight men had been saved by the heroic efforts of a few employés, headed by James McNaughton, the mining engineer. The fire originated in the 6th level, and what started it is still a mystery.

On February 10 the mine again resumed operations and everything was moving along almost the old way. No work at "E" shaft was done during February month except the mining of 70 to 80 tons of ore per day in the open pit. Shaft "D" was sinking from the 6th to the 7th level, and shafts "D" and "C" were also being sunk. The work of pumping water below the 7th level at "C " shaft and which accumulated during and after the fire, was finished February 20, and drifting was again in progress at the 8th level immediately thereafter. The underground force at the mine then numbered about 1,000 men. The new hoisting machinery at "D" shaft was in place and nearly ready for duty, and about 700 tons of ore per day were being shipped, there being some 50,000 tons of ore at this time in stock.

March 23 the sale of the mine was concluded to a syndicate represented 'by Messrs. Stetson, Hamilton McK. Twombly and G. H. Kent of New York. The board of directors elected were as follows: Messrs. A. Hanna of Cleveland; Geo. Kent, Hamilton McK. Twombly, William D. Sloan, Francis L. Stetson, Chas. McVeagh, all of New York; Geo. D. VanDyke, Ferdinand Schlesinger and John L. George, of Milwaukee. The capital stock of the company is as before, $2,000,000 divided into 80,000 shares of $25 each,

There was a stockpile of 100,000 tons at the mine on March 28. April month found the Chapin still reducing its working force, and the daily output was figured at 1,200 tons. Early in May mining work was temporarily suspended at shafts "A" and "A 1." Shipping to Escanaba was commenced and the all-rail shipments were continued. The working force in May was about 975 men and the only ore hoisted was coming from "B" and "C" shafts, about 1,000 tons per day. Sinking from "D" shaft was going on and had reached the 7th level. In June shaft "D" was sunk within 60 feet of the 8th level. The average amount of ore hoisted per day in July was 1,800 tons. The output for the season up to July 16 was 145,725 tons.

The drainage level at the mine had been driven about 900 feet up to July 81, and the same month found "C" shaft down to the 9th level. In August the cross-cut from the bottom of "E" shaft passed through about 30 feet of ore, and shaft "D" was finished down to the back of the 8th level. The output and shipments of the mine in August footed close to 80,000 tons of ore. This product was reached with the old equipment and at the same time extensive preparatory and opening work was carried on. In September the cross-cut from the 6th level to the line of the shaft was completed and a raise was made to meet the sink from the 5th level A stone pump house was completed at "D" shaft during the past year, and a foundation was also laid for a stone engine house to contain a hoisting plant consisting of two 24x60-inch engines and two winding spools for fiat ropes. The dimensions of the engine-house are 56x56, and it is located close to the shaft. "D" shaft, at the close of September, was about 20 feet below the 8th level, and was ready for the cage runners.

Supt. Cady closed his connection with the mine October 1 and was succeeded by Mr. T. F. Cole, formerly General Manager of the Schlesinger people.

The daily output in December reached between 1,700 and 1,800 tons. The drainage level was almost completed, with the exception of about 40 feet and this was to be left until the pumps were in place at "D" shaft and ready to take care of the water from the whole mine.

Concerning the pumping plant the Norway Current of Dec. 5, 1891, says: "It will take nine or ten months to get the plant ready to do duty, and when it is done they can turn in the water of all the mines in the district, including the Hamilton new shaft, and an extra stroke or two per minute of this Jumbo will take care of it."

The force at the mine in December was 1,200 men, and 500 tons of ore was being hoisted from, "D" shaft daily, it being dumped from the tramways on to the new stockpile ground, west of the shaft house. These new grounds are among the best in the iron district and afford room for an immense amount of ore. The shipments for the season of 1891, by rail and water, were 488,749 tons.

HAMILTON MINE.

In January, 1891 a new shaft house, or the frame of it, was moved into place at No. 2 shaft. A concrete foundation had been built all around No. 2 shaft some

time before, the ledge being stripped and the concrete wall laid from ledge to surface. The work of connecting the Hamilton and Ludington mines at their lower levels had begun on the Hamilton property and was to begin at the Ludington as soon as a few preliminary preparations had been made. Concerning this work the Norway Current, whose articles showing the necessity of such a connection, were largely instrumental in bringing it about, says "The connection will be made from the 12th level of the Ludington to the 1,125-foot level of the Hamilton No. 1 shaft. Owing to the difference in surface elevation, it will be necessary to raise from the 1,125-foot level of the Hamilton 60 feet before beginning the cross-cut. * * * * The Hamilton is 1,325 feet deep and the Ludington 1,100 feet deep, and will be lowered as speedily as possible. The Hamilton, has no outlet except at surface and the Ludington none below the 9th level, 300 feet from the bottom, and any accident from any cause would leave the miners in the shaft in which it occurred in a very dangerous situation."

The ore to be reached by No. 2 shaft lies at a depth of 1,900 feet, 900 feet of the distance having been traversed during the past 15 months. With the increased facilities the remaining 1,000 feet will be sunk much more rapidly.

The new hoisting plant at No. 1 is working very smoothly. A three decked cage has been provided for this shaft, to be used for lowering and hoisting the miners, making a much more convenient and safe mode of travel.

The company in February placed an order with the Webster, Camp and Lane Machine Company, of Akron, Ohio, for a hoisting plant of unusual size and capacity. The plant consists of direct acting hoisting engines and drums, having a capacity of 10 tons of ore at a single load, from a. depth of 2,500 feet. The engines will have a 32'' bore and 12” stroke and will act directly on a pair of conical drums, each of which will carry 2,500 feet of wire rope.

Hoisting was discontinued at No. 1 shaft in the latter part of March. Some time before a system of wire rope guides had been substituted for the old fashioned crossheads and runners, but they were found riot to work satisfactorily, so to avoid accidents from breakage of the wire rope guides, the management replaced them with runners 5''x6'' in size, and use "lugs" on the buckets (two ton buckets) so as to have them work similar to cages. The shaft has two compartments, and is about a quarter of a mile deep, so that more than a mile of runners were put in, and these in less than three weeks. In May some delay was occasioned and the output of ore lessened by the burning of the Ludington shaft house and pump, as the Ludington had been taking the Hamilton water at the 9fch level and pumping it to surface.

The drift was being driven from the bottom of the winze at No. 1 shaft at the 1,460-foot level to strike the line of the shaft, where a "raise" was to be made to strike the 1,325-foot level,

A Rochester hoisting plant was placed at the 1,325-foot level to hoist from the winze.

In September the hoisting machinery at No. 1 shaft was moved to No. 2 as that which was being used was inadequate to do the work.

The improvements at this mine are all of substantial character, the ore in sight being of a grade and quality to warrant it.

The sinking in October had reached a depth in No. 2 shaft of 1,435 feet, and at the 1,325-foot level, from which a connecting drift was to have been made to No. 1, a station was being cut on one side and on the other a pump room where a new electric pump was to be placed, when on the 21st day of October the miners in the bottom of the shaft tapped a body of water which forced its way through the drill hole at a rate of 200 gallons per minute, and so rapidly did the water pour into the shaft that the men had barely time to remove the drills.

The new machinery for the flooded shaft was being rapidly placed, the cylinders and beds of the engines being in place, but some delay had been occasioned by the non-arrival of important parts. Had the electric pump been in place at the 1,325-foot level it would have amply controlled the inflow. But under the circumstances the mine had to be allowed to fill pending the arrival and placing of the two large hoisting engines which are to be placed at this shaft, when two large tanks holding about 2,800 gals. or 10 tons of water each will be placed in the present bucket guides. It is expected that these bailers will be able to empty the shaft in a couple of months after they are started.

By November 28 the water had risen to within 80 feet of the surface or was 1,355 feet deep.

In the meantime production was going on at No. 1 shaft, and at the 1,460-foot level, 225 feet from the line of the shaft, a cross-cut was being driven north to cut the different lenses of ore. when in December the flooding of the “A" shaft in the Ludington was found to be endangering the No. 1 shaft of the Hamilton, and all work was suspended. The following from the Norway Current of January 4, 1892, gives a full description of the condition of No. 1 shaft and its cause:

"For some time it has been known that the condition of Hamilton shaft No. 1, has been changing for the worse much faster than usual, and Tuesday night the men were ordered not to go down, and only the foreman and a couple of pump men were allowed in the shaft until Wednesday afternoon; when Capt. Carbis and the writer of this, took a trip through the shaft and found its condition so bad and so rapidly growing worse, that Capt. Carbis ordered "everybody up." What this may mean for the Hamilton and its neighbor the Ludington, cannot at this time be definitely estimated. To give a fairer idea of the actual situation, it may be necessary to

outline the relations which these mines bear to each other. The Hamilton corners upon, the properties of both the Ludington and Chapin, and No. 1 shaft of the Hamilton was sunk to strike, in its vertical course, the ore lenses of the Chapin and Ludington in their dip to the north and general westerly pitch. In due time the shaft reached a depth of 1,460 feet, and in conjunction with a series of cross-cuts, drifts, winzes, etc., proved the existence of a large and valuable deposit of ore. In the meantime the Ludington people were continuing the sinking of their shaft "A" which is situated about 200 feet west of Hamilton No. 1, and had attained a depth of 1,420 feet, opening up and numbering consecutively different levels, the lowest being known as the 15th. From these levels more or less ore has been mined by each company, with as we have reason to believe, an, understanding that a 20 foot pillar should be left next the line by each company. Some years ago by a mutual agreement a connecting drift was made from one shaft to the other to facilitate escape should it become necessary. This drift was put about 1,000 feet from surface or at the 11th level of the Ludington. As to the primary causes of the present troubles, the general public is not so much interested as in results. Some days ago trouble began in an unfilled portion of the 13th level at the Ludington "A," and the room closed in; the disturbance extended up to the 12th and from there to the 11th level closing both and effectually severing any connection between, the two shafts. During this time the Hamilton shaft, none too stable at its best, began to show signs of ultimate collapse for more than 200 feet of its depth corresponding with the crushed levels of the Ludington. The timbers are smashed and splintered like matches and the whole shaft looks as though it was going to drop over towards the Ludington. Of course this makes the using of the skips in the shaft a haphazard experiment. Sometimes they go down and sometimes they hang up, and the runners and broken wallplates must be trimmed down. Up to Wednesday evening no ground had broken into the shaft but this result seems inevitable. While the pumps of the Hamilton can be worked there will be no element to increase the danger to the Ludington, but as goon as they cease, and the water begins to rise, it will percolate the crushed ore between, the two shafts and the result in view of the fact that the Ludington shaft is none to stable, will be hard to predict." On the 7th of January, 1892 a tremendous flow of water was struck in the Ludington which closed both mines.

The season's shipment of ore amounts to 58,197 tons.

THE LUDINGTON

comprises the S. ½ of S. E. ¼, S. 25, T. 40, R. 31, and joins the Chapin on the west. During the early part of 1891 much preparatory work was done. Little or no hoisting being done on account of the ice at the hydraulic works.

"C" shaft, or the old No. 5, was repaired down to the 10th level and converted into a cage shaft. "B" shaft, the new shaft which is sunk on the footwall, to intersect "A" shaft at the 13th level, in the beginning of the year had reached the 9th level, and was rapidly pushed to the point of connection, which it reached in November. This shaft and connection will permit of the safe removal of the pillars of ore left in the upper levels, as well as provide an outlet in case of fire or other accident. The new machinery, shaft house and pockets at this shaft are something different from usual. The shaft house is 105 feet high and the ore pockets are so arranged that the ore can be dumped either into the cars on the track of the C. & N. W. R. R. or those of the C. M. & St. P., by the opening or closing of a trap door. They will have a capacity of 700 tons.

The shaft has three compartments, two being skip compartments and the other having a double-deck cage for the hoisting and lowering of men and timber. In April, "A" shaft, which, is vertical and is sunk in the hanging 175 feet north of the ore, had reached the footwall at the 14th level. A drift at this level was driven north 45 feet and still in ore. Later in the month the shaft house at this shaft was burned, and when rebuilt the shaft was provided with two-ton skips to replace the cages which only carried 1½ tons. The "A" shaft reached the 15th level in September, while "C" shaft had reached a depth of 1,320 feet, or 20 feet below the 14th level. The shafts "A" and "C" are being connected at this level, as are also the "A" shaft of the Ludington with the Hamilton No. 2 shaft. There is also a connection between the Ludington and Hamilton at the 11th level of the Ludington.

A fair body of ore has been opened up in the "old mine," which lies some ¼ mile west of "C" shaft. Underground at "A" shaft the drift west at the 14th level is in 170 feet in ore, and should the same line be continued the ore at the 15th level would extend fully 300 feet west of "A."

Many improvements have been made at this mine during the year, among others being electric signals, and the Bleichert system of wire rope tramways, which will connect the new shaft "B" with the stock grounds.

In December a cave occurred near "A" shaft. A room on the 13th level caved and the ground above it to the 11th level came in and closed the connection with the Hamilton at this point (the 11th level) while an uncontrollable flow of water was struck in the 11th level of the "A" shaft about the 7th of January which effectually stopped production in the lower levels of the Ludington and also in those of the Hamilton No. 2 shaft, and at this writing both mines have closed down indefinitely. The season's output was 141,303 tons.

THE DELPHIC.

At the DELPHIC, N. E. ¼ of S. W. ¼, S. 24, T. 42, R. 33, which was first opened in 1882, but has been closed down for several years, work was resumed in 1890. The mine was unwatered and sinking and drifting begun. In the cross-cut at the bottom several small deposits were encountered but no workable bodies of ore found. No shipments.

Capts. C. T. and Henry Roberts have been exploring on the N. E. ¼ of the N. E. ¼, S. 24 (the same section on which the Delphic is situated) and in a shaft 8 feet deep encountered a thin body of ore, which did not exceed 8 inches in thickness. The location being considered favorable for the existence of ore, they will continue to sink.

SOUTH MASTODON.

Messrs. Ball and Hanscomb of Marquette, and Blake and Foley of Negaunee have been working some 20 men during the early part of the year and were hoisting about 50 tons of ore a day. The body of ore seemed to be increasing. During the summer the mine was closed. In the fall work was resumed and the shaft was down 240 feet. A drift from the bottom showed ore in the breast. No shipments.

THE MASTODON,

which is located on the S. ½ of N. E. ¼, S. 13, T. 42, R. 33, is controlled by Chicago parties under the name of the Mastodon Iron Mining Company, of which Joseph Austrian of Chicago is Secretary and Treasurer. The mine has been worked under a lease for the past five years by C. T. Roberts, beginning with the spring of 1887, while E. S. Roberts has been looking after the interest of the company.

A new compressor was placed at the mine in January, 1891, and the vertical shaft has been sunk to the 400-foot level. At this point and also at the 350-foot level, development work has been going forward. The most of the work has been done at the 300-foot level and above. Diamond drill holes were bored at the 350-foot level, north and south. The hole going south at 60' was in ore.

Capt. C. T. Roberts discovered a deposit of manganese on the property and has mined about 1,000 tons of it, some of which has been sold, but the balance he prefers to hold for better prices.

According to a local paper, five analyses were made by E. P. Jennings and J. Kellershon the best returns being iron .5 per cent, phosphorus trace, silica 3.00 per cent; manganese, 61.50 per cent. The lowest being iron, 17.46 per cent; phosphorus, .064 per cent; silica, 9.10; manganese, 29.81 per cent. Making a safe average of 40 per cent manganese. The bed lies very close to the surface and is from 6" to 3 feet thick. Underneath lies from four to six feet of bog ore.

The end of November Capt. C. T. Roberts surrendered his lease, which expired with the shipping season, and Capt. E. S. Roberts assumed charge of the company, and will work the mine.

Of the outlook a local paper, at the close of the year, says:

"While present appearances are to the effect that the Mastodon has seen its best days, there will be an effort made to discover something new, and Capt. Roberts is well fitted to do the work as intelligently as any man on the range. It is but fair to the outgoing lessees to say that they only contracted to mine the ore in sight, and that the ore lens has gradually growing smaller. The work of the company from now on will be to find an extension of the old lens or the position of new ones, and to mine out the ore left in various parts of the mine, which of course amounts to many thousands of tons."

The season's output was 45,370 tons hard hematite.

THE GREAT EASTERN,

formerly the "Night Hawk," occupies the N. W. ¼ of N. W. ¼ S. 18, T. 42, R. 32, and adjoins the Mastodon on the east. Considerable work has been. performed on this option, but no satisfactory results have been obtained. The shaft is 87 feet deep of which 37 is in ore, and a cross-cut from they bottom is in 16 feet. The parties holding the option do not seem to have the necessary means to push the work to a successful issue.

THE ALPHA.

The alpha occupies the S. E. ¼ of S. E. ¼ S. 11, and S. W. ¼ of S. W. ¼ S. 12, T. 42, R. 33. No work was done during the past year, but in 1890 the shaft was sunk to a depth of 85 feet and a cross-cut 200 feet long, east: and west developed considerable ore similar to that of the Mastodon.

DUNN MINE.

This mine began the work of 1891 with a stockpile of 15,000 tons on hand, which was increased by February 1 to 20,000 tons. A large amount of preparatory work was undertaken in anticipation of the current year's; output. Another large open pit was contemplated, and it was intended to sink two of the shafts deeper, while it was expected that a large amount of ore would be taken from the old open pit.

A compressor plant was put in place and ready for operation early in the year; also an electric lighting plant consisting 100 incandescent lights, operated by a 15-horse power Westinghouse Jr. engine.

Early in March the working force was somewhat reduced, but the stockpiles continued to grow rapidly. One hundred and sixty men were employed, 65 of whom were stripping at No. 2 shaft. By the 21st day of the month the stockpiles had increased to 40,000 tons, and the daily hoist was about 100 tons. At the south end of the mine a piece of stripping 75x125 feet was started and uncovered a large block of ore which was being; mined up to the stripping and raised to the surface through No. 1 shaft. The mine commenced to ship ore on May 4, and shipped at the start about; 20 cars per day. The working force was increased from 150 to 200 miners, and with the hopes of reaching the output of 1890, which was 156,963 tons. The shipping had increased in June to 1,000 tons per day, much of which

was current production and mined from the open pit where stripping was done in the past winter. The stockpiles, which aggregated fully 40,000 tons, remained practically untouched.

In the latter part of June Supt. Florada resigned his position and was succeeded by Capt. Bennets, who has been connected with the mine since its start.

In December a 35-foot trestle was started from No. 1 pocket to the new stock dock, where it was expected to stock some 10,000 tons of ore to be taken from the south room of No. 2 shaft.

The season's work turned out to be the largest output in the history of the mine, and the Dunn rounded up the year as the second best shipper on the Menominee range.

Mr. T. F. Cole, general manager of the company, furnishes the writer the following authentic facts concerning the Dunn: The property is owned in fee by the Shelden Bros., of Houghton, Mich., and others, and the location of mine is at Crystal Falls. Main office, Milwaukee, Wis. Nature of ore, hematite, running 61% iron. Mine is opened by two shafts, of a depth respectively of 280 and 470 feet. There was sunk in 1891, shafts, 167 feet; winzes, 460 feet. Drifts driven, 1,393 feet. Ground broken, not stated. Number tons iron mined, 157,388; number of tons shipped, 162,721; number of men employed, 159.

Explorations at the Monongahela on S. 36, T. 43, R. 33, west of the Shafer mine have been stopped and resumed at different periods of the year. The shaft has a depth of 70 feet and has a vein of clean ore about 10 feet wide. It is proposed to start another shaft about 100 feet northwest of the present one, and sink to a depth of 120 feet, when a cross-cut will be driven.

THE SHAFER MINE.

This mine changed owners about January 1, 1891, passing into the control of Messrs Jennings & Jones, who began to mine the ore on contract. In January the sinking of No. 1 and No. 2 shafts was going on at a rapid rate, and they were down at that time about 200 feet. Shaft No. 3 was down 140 feet, and was to be sunk to the same depth as the others. Raises have been made at different points from the timbered rooms below to the sand and drifts on surface, and this was to be run down to fill up the rooms and at the same time uncover considerable ore left near surface which will be mined out. In February there was more than 8,000 tons of ore in stock, and the stockpile was being increased at a rapid rate. The principal underground work was in the 3d level which was being opened at this time and presented a fine body of ore. In June this mine was shipping about 40 cars of ore per day. In July the mine was 295 feet deep and resting at that. The new shaft, No. 3, was down to the 3d level, 280 feet. It is a three-compartment shaft and has a fifty-foot shaft house. The hoisting power for this shaft is supplied by a new plant of machinery, and consists of engine with 14x18-inch cylinders and two 6-foot drums. A new building was completed in July for the machinery.

This mine shipped, up to July, 1891, about 20,000 tons of ore, one-half of it coming from the stockpile, which yet contained 20,000 tons.

In August there was trouble at the mine, one of the Crystal Falls banks having out attachment papers and levied upon considerable property to satisfy claims of $5,000 or $6,000. This action temporarily stopped the shipping or mining of ore; but operations were stopped but a short time, the trouble having been satisfactorily settled by Messrs. Jennings, Lindsay & Ross leasing the property or becoming interested in it.

In October development in the 3d level of the mine showed ore better than that yet taken from above and gave evidence of lifting the mine a notch or two in the rank of high grade ore producers. Shipments at this time averaged about 700 tons per day. In November the change house caught fire and in fifteen minutes was burned to the ground. The "dry" was lighted by electricity and heated by steam. How it caught was a mystery. Old pumps were taken out of the mine and a new Barr put in. The shipment of the season was 70,000 tons.

The following statement is official: Mining work in 1891 was done by contract and no superintendent was employed by the company. The property is owned jointly by the estate of ft. Sheldon, Houghton, (one-half) and Shafer Iron Co. (one-half). Lessees, Shafer Iron Co. Location of mine, Crystal Palls. The ore runs 60% iron, 8% silica, .25% phosphorus. The shafts, three in number, are respectively 200, 200 and 280 feet deep, and the number of feet of sinking done by shaft in 1891 was 146, by winze 120. Tons of ore mined in 1891, 76,000; tons of ore shipped in 1891, 70,000. Number of men employed, 120. Main office, 935 Rookery, Chicago, Ill.

TOBIN MINE.

At the TOBIN, in January, they were hoisting ore from the north crosscut in the 100-foot level, and quite a large stock pile was in sight. The quality of the product is steadily maintained as depth is attained and the openings extended.

In March sinking had been stopped at the depth of 105 feet, and a series of drifts and cross-cuts had been entered upon. The mine is provided with hoisting and pumping facilities, but in May the boiler proved inadequate to handle the volume of water, and the pumps were taken out, causing a shut down, which, however, was only temporary, as a larger and more powerful pump was immediately put in place. No shipments.

The exploration on the S. W. ¼ of S. E. ¼ S. 30, T. 43, R. 32, known as the WAGNER, where the parties interested have been looking for ore for two years,

seems to have become a permanency. An engine house and boiler have been placed at the shaft, and from the explorations previous, the prospects for a paying body of ore seem to be very favorable.

The JUNIETTA, south of Crystal Falls, on S. 29, the MAY on S. 28, and the CLAIRE northwest of the city on S. 19, T. 43, R. 32, are all mere explorations and have been previously described, as have also the CALEDONIA on S. 17, T. 43, R. 31, near the Mansfield, the INTERRANGE in S. 4 same town, the LOTTA on S. 33. T. 44, R. 31, and the GIBSON near the Hemlock river on S. 4, T. 44, R. 33.

The YOUNGSTOWN sent out 3,705 tons of ore this year, which was mined and stocked last year, this being all there was on the stock docks.

The Diamond Drill, published at Crystal Falls, says: "This mine shows the greatest width of vein of any iron ore producer in the district, and the resumption of operations would mean much to Crystal Falls."

Supt. Gilbert is still in charge of the property.

THE MONITOR MINE.

In January the new shaft at the MONITOR was being sunk rapidly, and a new shaft house was erected over the old shaft. The mine in March had reached a depth of 275 feet, which was represented by "A" shaft and stoping began soon after. "B" shaft was down 130 feet in March and sinking still in progress. From the bottom level at "A" shaft a drift was to intersect "B" shaft, 247 feet distant. The upper level was then only 55 feet below the surface and had a breast of ore from 40 to 90 feet ready to stope away. The most notable feature of March month was that, as the mine had not paid its labor or local bills for four months, the machinery and other personal property were attached to satisfy a claim of about $2,000 in favor of the Lumbermans and Miner's Supply Co. Mining was suspended on or about April 15, and it was reported that the claims against the company aggregated about $60,000. The labor liens were said to be fully $20,000. A strike was next inaugurated by the miners to secure their just dues. This was on or about April 23. Mr. W. S. Coffman of Chicago, president of the company, visited the mine about this time and seemed satisfied that all matters would be speedily adjusted, and a resumption of operations would soon begin and continue without further interruption. In May John G. Gouth, formerly of the Florence mine, assumed the captaincy of the mine in place of James Rowe, resigned. The company in June were making daily shipments of ore to the National Furnace Company, De Pere, Wis. The stock dock was yet heavy with the winter accumulation of ore, but did not stand long on account of the big pull made on it.

A new hoisting plant was put in during the year of 1891. The plant consisted of two 6-foot Ledyerwood hoisting drums and a double engine. A new engine house was also built 26x66 feet with a lean-to in size 12x28 feet, the former one being too small. The bulk of the mining work in June was carried on chiefly at the 3d and 4th levels. The 3d level had upward of 40,000 tons of ore opened. In the 4th level the vein showed a width of 100 feet, and the ore was of a fine character. The shaft known as No. 1 was completed at the end of June and is connected with the other shafts by drifts on the 1st and 3d levels. A new shaft house was erected at No. 2 shaft west of No. 1 and is 100 feet high. It is a double-cage shaft with separate compartments for ladderway. This mine in July had forwarded nearly 15,000 tons of ore. In September it was stated that the Monitor was again unable to meet its obligations, and in October work at the mine was at a standstill. However a satisfactory arrangement of the difficulty was consummated and operations were resumed. during the month. November found the mine shipping vigorously and the condition, of the company was much improved. In December the mine was sending from fifteen, to twenty large cars of ore per day to the Illinois Steel Works at Chicago. A small vein of rich looking ore was cut in the bottom of the mine. The new find is an ore much different from the run of the mine. It is a rich blue ore, soft, and is identical in appearance with the product of the Chapin. This ore seems to be a seam of but three feet.

The shipment for the season was 26,266 tons.

PAINT RIVER MINE.

The winter work of 1891 commenced in January, and was principally development for the work to come. The "B" shaft was sunk 60 feet below the bottom level and the pillars were taken out of the upper levels for the purpose of "caving," so as to allow the surface drift and sand to reach the bottom level where they would serve to fill the old rooms as well furnish "filling" for the future work. A new 21x42 engine, 3 six-foot hoisting drums, and one 16x24 air compressor were added to the plant, and a new fire proof engine house was built, and a new trestle was built over the west end of the "cave in," to accommodate an additional side track to the "B" shaft. Some ore was hoisted from "A" shaft in the caved ground in the spring, but work was temporarily suspended in June. Some exploratory work was done during the summer, but as the ore market did not warrant any great output, the working force was reduced in October to the day shift. Preparations are being made during the winter for an, increased output should the market warrant it in the spring.

Mr. Frank Scadden. superintendent of the company, furnishes the following official statement concerning the ownership, and industrial data for 1891, etc.

Mine is owned by E. Breitung estate, J. K. Stack and others, and leased by the Paint River Iron Company. Main office, Ashland, Wisconsin. Location of mine, Crystal Falls. The ore mined is red hematite, iron, 57.50 per cent; silica, 3 per cent; phosphorus, .450 per cent. Openings by shaft are two in number, "A" shaft 320 feet deep, “B" shaft 220 feet. Average width of ore deposit 80 feet. Number feet shaft sunk in 1891, 130; winzes

160 feet. Tons of ore mined, 45,435; tons shipped, 45,435. Number of men employed, about 60.

LINCOLN MINE.

The following information is from Vice President J. B. Schwartz, of Crystal Falls:

This property formerly known as the Fairbanks, in the early days of the Crystal Falls district was operated by the "Crystal Falls and Youngstown Iron Company." The entire work consisted of an open pit some 150 feet long, 40 feet wide, and about 50 feet deep, from which in the years 1882 and 1883, about 8,570 tons of ore was shipped, but the venture not proving encouraging, was abandoned in 1883.

The present owners believing from the fact, that both the mines to the east and west were producing ore in paying quantities, that mining could be made profitable by sinking to an equal depth undertook the task, and the results have proved their belief to be correct, and 3,000 tons were mined of which 1,813 tons were shipped.

The ore has been taken from one shaft which has been sunk to a depth of 350 feet, the ore being found eastward toward the Great Western line and resembles the ore from that mine. New machinery is being added, also air compressor and power drills. The shaft, which is vertical, is equipped with a cage.

The following items are from the official report: The fee-owner is the Lincoln Mining Company; main office, Escanaba, Mich. The ore is a brown hematite, running 60 per cent metallic iron. The mine has one shaft, depth 350 feet. Average width of ore deposit, 40 feet; number of feet shaft sunk in 1891, 150 feet; wizes, none; fathoms stoped, not reported; fathoms ground broken in openings, not reported; number men employed, 20; cost per ton. mining, $1.00; vice president, J. B. Schwatz; superintendent, F. H. Brotherton.

THE GREAT WESTERN MINE.

The working force at this mine in February was about 75 men, and the stockpile contained little short of 10,000 tons. Underground work was in excellent condition. In March a considerable reduction was made in the working force, and work from that time to the last of May was devoted principally to opening the lower levels. In August the mine was sending out about 1,000 tons per day, and continued to keep it up till toward the middle of September, when the output was somewhat retarded by a shortage of vessels. Capt. Allen resigned, early in September, and was succeeded by Capt. John Jewell, of Hurley, Wisconsin.

In December mining work was going on with a vim and 10,000 tons of ore was on the stock docks. The mine has two stock docks with a total capacity of 45,000 tons. A new machinery plant was on the ground ready for erection at the beginning of the new year, and conservative mining men did not hesitate to predict that, with a favorable condition of the iron market, the output of the Great Western for 1892 would reach not less than 125,000 tons.

The Great Western mine is owned by the Lake Superior Ship Canal, Railway and Iron Company, and leased by the Iron Star Company. It employed about 120 men in 1891, mined 70,500 tons of ore, and shipped 62,464 tons. Two shafts are sunk on the property, each 400 feet deep at close of 1891.

Manager. V. K. Moore. Main office, Detroit, Mich.

CRYSTAL FALLS.

This exploration, if it may be so called, is situated on the E. ½ of N. E. ¼, S. 21, T. 43, R. 32, and adjoins the Great Western on the east. It employed 15 men during the summer, and sunk its one shaft "A" 100 feet, making its depth 145 feet. This shaft is sunk in the footwall. From the bottom of the shaft a cross-cut was carried west into the ore bed which was found to be about 40 feet wide. From a test pit some 200 feet south of the shaft, a cross-cut showed 50 feet of ore.

Operations was discontinued in November, no ore was mined or shipped. during the year.

Supt O. F. Riebel is in charge.

THE HOPE MINE.

In June satisfactory results were being made at the hope mine, S. 27, T. 43, R. 32. The shaft was down 175 feet and two levels were being extended, while a cross-cut going from the bottom south of east was showing well. An average analysis of the ore gave about 62% metallic iron.

In August work was temporarily suspended and that, too, in the face of developments which were-said to be greatly to the good of the mine. In October a spur track from the C. & N. W. railroad was completed. In November, owing to some derangement of the boiler plant, the pumps of the mine ceased to work and it was allowed to fill with water. But before the end of December, the mining work having been, resumed, under the charge of Capt. Harry Roberts, the mine had been "forked out" and the captain had bought a heavier machinery plant and was busily engaged in putting it in place.

The ownership of the Hope property is vested in the St. Mary's Mineral Land Co., which owns one forty, and —— Glidden, the owner of two forties. The mine location is at Crystal Falls. Main office, Cleveland, Ohio. The ore mined is hematite, yielding 62% iron, 4.50% silica, .425% phosphorus. Mine has one shaft 200 feet deep. Width of ore deposit 25 feet. In 1891 the number of feet sunk was 75, the amount of other openings made and of fathoms stoped, ground broken, tons of iron mined, etc., for 1891 are not reported. Number of men employed, 40. At end of 1891, 6,000 tons of ore were in stock and

the management expected to ship 25,000 tons in 1892. Superintendent, Harry Roberts.

During the month of June operations at the LEE PECK mine were suspended to await the advent of better times, but were soon resumed and. prosecuted on a large scale. The old machinery used at the Junietta mine was repaired and set up at the property. This property is in the hands of Messrs. King and Wheeler of the Cherry Valley Furnace Company. Samuel M. Wheeler of Marquette is the local superintendent. The new shaft and engine house were completed in December, and underground work was commenced. Sinking was resumed and the shaft was to be dropped 100 feet and development pushed during the winter.

The ARMENIA mine, on the east range, is idle, was not operated during 1891.

The HOLLISTER mine resumed operations in December, 1891, after a long idleness. It will be operated by monied men of Ishpeming under the management of Capt. James Cundy, late of the Champion mine in Marquette county.

The season's shipment was 1,057 tons.

THE MANSFIELD.

This mine, situated on the west bank of the Michigamme, shows the results of persistent efforts. Some eight years ago a shaft was sunk a hundred feet and abandoned. In 1889 the veteran explorer W. R, Calhoun, began operations in the interest of the Mansfield Iron Mng. Co., and today it may well be called the "Embryo Giant of the Crystal Falls district." The ore produced is a high grade bessemer, averaging 65 per cent in iron, and is especially well adapted for making steel rails.

A description of the present condition of the mine, taken from the Crystal Falls Diamond Drill of December 12 is herewith given:

"The mining reporter of The Diamond Drill visited the Mansfield mine early this week, and, thanks to the affable and accommodating local officers, is able to give a pretty clear understanding of what is being done at the splendid property. All active mining work is being confined to the 3d and 4th levels at present, though the 2d is by no means out of date. On this level the length of the vein has been shown 750 feet and has not given out. Of this distance 532 feet is to the south, the vein having an average width of 30 feet and the ore holds up to the standard of excellency characteristic of the mine's product. The south end of the property will be taken in hand as soon as arrangements can be made, and extensive exploratory measures adopted, which is sure to result in the sinking of a shaft at that part of the mine. It has been shown beyond a doubt that the vein does not cross the river at that point, but continues to the end of the Mansfield's leased ground and will be found on the forty adjoining, under option to Messrs. Smith and Hay, of Milwaukee. The daily output of the 3d level is about 150 tons, while 100 tons are daily removed to surface from the 4th level. Mining in the 4th level is fully established and is going along in a manner most satisfactory to the management. The openings now measure ninety feet to the north of the shaft and 100 feet to the south, both being the width of the vein. Taken as a whole the mine is in the best possible shape for the time of the year and has ore in sight estimated at 250,000 tons. The shipment per day is about 250 tons to the Illinois Steel Company's Union Works, at Chicago. The contract with this concern will end with the present month or thereabouts, and no more ore is likely to be sold for a time; but as soon as the existing contract expires stocking will be inaugurated and a goodly block of ore piled up to commence the 1892 shipments with. A large Gordon pump, dimentioned 12x22-8-½x18, capacity of one thousand gallons per minute is in place on the 4th level and is doing good work. The work of sinking No. 1 shaft from the 4th to the 5th level was started Tuesday night and no time will be lost in accomplishing the task. At the 4th level the mine's depth is 290 feet, no mention of sump. The drop to the 5th level will be seventy feet, carrying exploitation 860 feet into the earth. And it is quite probable that the shaft will be lowered for the 6th level before spring—depending how rapidly work now in hand is done away with. It will be remembered that this shaft is in the hanging wall and the ore vein is reached by cross-cuts, permitting of removing the ore clean between the walls. The pitch is not very great and the mine will be many hundreds of feet deep before the shaft cuts the vein. The footwall is a better location for a shaft, but in this case it is impossible, as the great Michigamme river flows over the Mansfield's foot. The Mansfield expects to make a larger output next season, than ever before. The largest and best dry in the district is a late addition to surface equippage. Its dimensions are 26x60, two stories high, the floors are of hardwood and there are closets enough to accommodate 300 mining outfits. The second floor is devoted entirely to these closets, each of which is provided with lock and key, while on the first floor are three large washing troughs of four compartments each. Hot and cold water is supplied and the whole is heated by steam."

A shaft is being sunk about 500 feet north of the main shaft to test a new discovery made in the bed of the Michigamme river, a fine outcropping of ore between three and four hundred feet long. The ore is almost identical with that found in No. 1 shaft, and is probably the north continuation of the vein.

The shaft, 4x5 feet inside, has been sunk to a depth of 60 feet and a cross-cut is being driven east, under the river, which will probably strike the ore in about twenty-five feet. Should the vein prove of worth the shaft will be enlarged to working dimensions, and be known as "No. 2."

I owe acknowledgments to W. R. Calhoun, supt., and John Erickson, clerk, for their courtesy in furnishing the following official statement:

The location is L. 5, S. 17, and L. 8, of S. 20, T. 43, R. 31. The mine is owned in fee by the Caledonia Mng. Co., lessee, Mansfield Iron Mng. Co. Main office, 313 Phoenix Bldg., Chicago. Average width of ore deposit, 30 feet; number feet sunk in 1891, shafts 150, winzes 150; number of men employed, 100 (average); number of tons mined, 50,531; number of tons shipped, 49,835.

HEMLOCK RIVER MINE.

This mine is located near the center of the S. W. ¼ of S. 4, T. 44, R. 33, about 16 miles from Crystal Falls.

The deposit worked was found by Mr. Mat Gibson, in July, 1887, he being sent to explore the land in the interest of the owners of the fee.

Mr. Gibson was fortunate inasmuch as the ore was struck at once.

The mine was leased in 1889 to Messrs. Pickands, Mather and Co., who organized the present company. The mine has been under the supervision of Mr. Henry E. Warner until his death, November 7, 1891, since which time Mr. J. F. Armstrong has been in charge.

The deposit as far as explored is about 1,000 feet in length and has an average width of 30 feet. It is a non-Bessemer hematite ore, and averages 62 per cent in iron, though assays have been made as high as 75 per cent in metallic iron.

In February the company made their first shipment; the Northwestern R. R's. spur to the mine being but then completed.

The shafts are two, "A" and "B," the shaft house at "B" being built during the year. Both shafts have attained a depth of 150 feet. The shafts are 300 feet apart, "B" shaft being south of "A." This shaft (B) is vertical, and will be completed and ready to hoist from the 2d level about February 1, 1892. At "A" shaft mining in the 2d level is being pushed both north and south from the shaft. From the official statement the number tons ore mined in 1891 was 35,000, tons shipped 35,531, men employed, 100.

THE SHERIDAN.

In 1887, Mr. Peter Sheridan, of Fort Howard, Wisconsin, secured an option on the S. E. ¼ of the S. E. ¼ of S. 26, T. 43, R. 35 from the Mc Kinnon Brothers who owned the fee. Mr. Sheridan explored the property till 1890 with not very satisfactory results, when a party of gentlemen from Escanaba, Michigan, bought an interest in the option, leaving Mr. Sheridan in charge. His management, however, did not suit his associates and they bought his remaining interest, and installed Capt. A. Gulgren, an experienced miner of the Gogebic range, as superintendent Capt. Gulgren, after a careful examination of the surroundings, made up his mind that the ore must lie to the north of the shaft. A drift was started in that direction, which after passing through about 25 feet of mixed ore and about 50 feet of hard rock, struck good clean ore into which it penetrated 25 feet without finding the rock wall. Having thus proved the existence of a considerable body of ore, they sunk the shaft 90 feet deeper, and again drifted toward the ore, finding it in clean shape at about 150 feet north of the shaft. The drift was carried through the clean ore ten feet, when it encountered fifteen feet of mixed ore and rock, and beyond that again struck ore that was clean, as could be wished. A drift was then started west from a point about 40 feet from the shaft, and carried through rock about 30 feet when it penetrated a 13-foot vein of good clean ore. They next started a drift to the northwest, about 80 feet from the shaft and after about 20 feet struck clean ore into which they drifted 10 feet and stopped.

Having satisfied themselves that they had a large quantity of ore, the holders of the option took a lease, ceased exploratory work until they could make a sale of ore and organized themselves into a corporation as the Sheridan Mining company.

In September, 1891, the company was reported to have made a sale of all the ore they could mine and ship for the season. About this time mining operations were commenced, and in October work was being pushed at the 1st level, and an average of 120 tons of ore per day was coming out, with a force of only 30 men. Measurements were taken at this time, of the developments in the 1st level, and it was found that the ore had been penetrated for a distance of 125 feet, with good, clean ore at the farther end, and had been cross-cut thirty-six feet without striking either wall. The ore is soft and easily mined, and an assay made late in 1891 gave it nearly 60 per cent metallic iron, and .064 phosphorus.

In November a drift to the north, through about 40 feet of rock, struck a new deposit of ore which is somewhat harder than what had been taken from the mine during the summer.

Things at the mine at this time were being pushed with a vim, and Capt. Gulgren expected to have about 10,000 tons of ore on the stockpiles by the opening of navigation.

The official statement is as follows: The Sheridan property is owned by D. C. and Alex. McKinnon, leased by the Sheridan Mining Company whose main office is at Escanaba, Mich. Mine office Iron River, Mich. The ore mined is soft hematite. Per cent iron, 61; silica, 6 per cent; phosphorus, .064 per cent. Mine has one shaft 180 feet deep, which was sunk 30 feet in 1891. Twenty men were the average force employed.

Iron ore mined in 1891, 8,000 tons. Ore shipped, 7,000 tons.

THE IRON RIVER MINE.

At the iron river mine, in January, 1891, the pumps and tracks were pulled up by orders from the Schlesinger people.

Although this mine has an extensive deposit of ore and has been a large producer since 1882—its total shipments to January 1, 1891, being 843,380 tons,—its ore is of a low grade,—60 per cent iron, .33 per cent in phosphorus, that finds but little demand, still considerable ore has been shipped from the stockpiles. The shipments reached for 1891, 59,345 tons.

THE NANAIMO MINE,

the fee of which, as well as that of the Iron River and Beta mines, is in the McKinnon Bros., of Stambaugh, is leased by parties from Escanaba and Milwaukee. They have also the lease of the Beta.

The mine was flooded in the early summer, but was soon after in working order and ore was being shipped from the upper shaft, and also from the Beta, about 100 men being employed.

In December the fee owners attached the mining plant to secure themselves for the royalty due them. This forced an assignment, and the mine was closed down and the pumps removed.

IRON PRODUCTION OF MICHIGAN FOR 1891.

Name of mine.	County.	Tons of 2,240 lbs. shipped.
American	Marquette	21,604
Buffalo	"	479,569
Cumberla	"	84,193
Champion	"	138,413
Cleveland	"	221,288
Iron Cliff Company	"	278,570
Cheshire	"	7,301
Dexter	"	5,500
East New York	"	50,293
Fitch	"	15,093
East Jackson	"	600
Grand Rapids	"	9,263
Humboldt	"	19,879
Jackson	"	92,979
Lake Angeline	"	242,000
Lake Superior	"	318,383
Little	"	17,105
Lucy	"	27,906
Negaunee	"	64,218
Michigamme	"	23,169
Republic	"	191,127
Riverside	"	6,1-8
Saginaw	"	4,320
Volunteer	"	92,699
Winthrop and Mitchell	"	122,043
Wheat	"	4,412
		2,478,846
Imperial	Baraga	18,552

Name of mine.	County.	Tons of 2,240 lbs. shipped.
Aragon	Dickinson	96,829
Cyclops	"	10,599
Curry	"	100,681
East Vulcan	"	78,279
West Vulcan	"	597
Lexington	"	141,301
Millie	"	5,889
Norway	"	4,099
Pewabic	"	69,507
Walpole	"	8,995
Groveland	"	1,049
Chapin	"	498,549
Hamilton	"	58,197
		1,099,734
Beta	Iron	1,400
Dunn	"	162,721
Great Western	"	62,464
Hemlock River	"	35,531
Hollister	"	1,057
Iron River	"	59,345
Lincoln	"	1,513
Mansfield	"	49,926
Mastodon	"	45,370
Monitor	"	26,226
Nanaimo	"	13,200
Paint	"	45,435
Shafer	"	70,770
Sheridan	"	7,187
Youngstown	"	5,705
		586,009

Name of mine.	County.	Tons of 2,240 lbs. shipped.
Anvil	Gogebic	5,135
Ashland	"	266,961
Aurora	"	83,552
Benjamin	"	1,200
Brotherton	"	46,574
Colby	"	38,605
Comet	"	10,125
Eureka	"	13,907
Federal	"	6,778
Jack Pot	"	1,500
Newport	"	105,937
Norrie	"	756,774
Pabst	"	130,236
Palms	"	32,577
Sunday Lake	"	64,902
		1,583,514

Range.	County.	Tons of 2,240 lbs. shipped.
Marquette	Marquette	2,478,849
Menominee	Baraga	18,552
"	Dickinson	1,099,734
Gogebic	Iron	586,009
	Gogebic	1,583,514
Total		5,306,658

GOLD.

The milling and exploration for gold in Michigan has not been very successful during the past year. New "finds" are being made with seemingly fair prospects, while others have ceased to operate. The Peninsula has surrendered its lease and the Grayling is idle at is the Gold Lake.

The only properties being worked on the Serpentine range are the Michigan and Ropes mines.

MICHIGAN.

The MICHIGAN has been working for about four years with variable fortunes. One fact has been demonstrated during the year, and that is that the rich shutes of quartz pitch sharply to the southeast so that the perpendicular shafts cut but a small portion of the rich ground.

Most of the work has been done in the No. 4 shaft. One trouble that the present management have had, is that no records have been kept of work previous to June 1, 1891. Mr. E. D. Zukoski in his official report says, "The work has only been exploratory and no data can be given that would not mislead. For instance one lot of rock of 100 pounds treated produced over $1,000."

The report also shows five shafts varying from 25 to 141 feet deep. Average width of vein, 3 feet.

The location of the mine is the N. W. ¼ of N. E. ¼, S. 35, T., 48, R. 28, about 7 miles northwest of Ishpeming.

THE ROPES GOLD MINE.

The pioneer gold mine of Lake Superior began the year with poor prospects as far as the ore in sight showed, and although the result of the year's work has not been the most encouraging, yet it has proved that gold can be mined at a profit in Michigan.

The president, Mr. Julius Ropes' report to the stockholders at the end of the fiscal year, is herewith given:

To the Stockholders of the Ropes Gold and Silver Company:

At the beginning of our fiscal year ending February 29, 1892 the ore bodies near the main shaft had been nearly all mined out, leaving very little good ore in sight. Drill holes to the east of the old workings gave promise of an early development of good ore in that direction; drifts were immediately started to develop the new bodies, resulting in the finding of workable ore on all the levels below the 7th at about 200 feet east of the main shaft. These long drifts and the sinking of shaft in barren ground, the dip of dyke having changed to north, made the development very slow and expensive, and most of the ore treated having to come from the new workings, which at first were narrow, necessitated the treating of considerable very low grade ore.

The yield for past two months has increased very materially, showing a profit over all expenses. The developments promise a still further increase in the near future.

The shaft is now 765 feet deep and sinking for another level is now in progress.

Number of feet drifted 1,463.

Winzes sunk 485 feet and shaft lowered 126 feet.

The number of tons of ore milled was 21,855.

The ore in sight is now estimated to be about 14,000 tons.

To the plant has been added the other half to the 18x80 Rand air compressor, making a complete duplex machine.

The yield of ore in. mill for past year .averaged $8.86 per ton.

JULIUS ROPES, *President*.

Statement of bullion and concentrates for the year ending February 29, 1892.

	Amount gold.	Amount silver.	Mint charges.	Net proceeds.
Bullion	$53,635 45	$1,909 34	$171 13	$55,373 66
Concentrates	10,125 14	6,116 05	8,705 68	7,535 51
Total	$63,760 59	$8,025 39	$8,876 81	$62,909 17

	Amount gold.	Amount silver.	Net proceeds.
Total product of mine to March 1, 1891	$313,837 71	$34,225 97	$295,954 58
Product for year ending February 29, 1892	63,760 59	8,025 39	62,909 17
Total product of mine to March 1, 1892	$377,598 30	$42,251 36	$358,863 75

Gross gold	$377,598 30
Gross silver	42,251 36
Total	$419,849 66

New discoveries have been made in the Dead river valley, about nine miles north of Ishpeming, the most promising being those known as the

BEAVER AND FIRE CENTER.

Veins ranging in width from a few inches to three feet have been located. The general strike of the formation (which is granite) is north 70° west, while the course of the vein at the Beaver is nearly east and west. The general dip 60° to the south.

The rock is very different from that at the Ropes and Michigan, and the indications are much more favorable for paying deposits. The veins carry free gold and some rich quartz has been found.

The FIRE CENTER Company have made preparations at the Ropes' mill for a test of a couple of hundred tons of ore.

The CRESCENT is another claim worked by the same parties. This exploration also shows several small veins carrying free gold.

Other parties are also exploring in this neighborhood, one of which is the SUPERIOR GOLD COMPANY. Mr. A. Boulson has also made a discovery about three miles north of Teal lake, and has a shaft down in a vein which shows a width of nine feet in the bottom. An analysis of two specimens taken from the vein is said to have given results as follows:

Gold 8.85 ounces to ton.

Silver 80.25 ounces to ton.

COAL.

The coal production for the year 1891 does not make as good a showing as in previous years. In fact less coal was mined in Michigan during this year than in any one year since 1877, many of the mines having been exhausted. Notably the Corunna Coal Company's, which was on its last legs, and the mines previously worked by Emerson and company, at Jackson, although they have opened up a new mine in that vicinity. Numerous drill tests show up a very large body of good coal, from three and one-half to four feet thick. A shaft 91 feet deep was sunk during the spring months and production once more resumed.

The Bennett Sewer Pipe Company mine coal, but only enough for their own use in the manufacture of sewer pipe and pottery, in which, by the way, they use some 20,000 tons of potters and tire clay, which is mined some two and one-half miles north of Jackson, and consists of a bed about 8 to 10 feet thick underlying a surface of 10 to 15 feet.

At Corunna, Mr. Kincade has severed his connection with the old Corunna Coal Company, and in July, 1891 began sinking a shaft about one-half mile from the old mine, where a good body of coal had been found by drills and tests. The following is a record of the hole where the shaft is being sunk:

	Feet.
Surface clay	24½
Black slate	2½
Light slate	14
Dark slate	4
Schale	12
Sandstone	6
Gray slate	8
Black slate	8½
Coal	3
Total depth	82½

At Sebewaing, Huron county, the SAGINAW BAY Coal Company, of which John C. Liken is president, W. M. Webber of East Saginaw is vice president, and Richard Martins is the secretary, began sinking a shaft in December, 1890, near a spot where a drill had encountered coal, and at a depth of 110 feet struck a bed four feet thick, and by the end of the year 1891 had produced over 10,635 tons of coal. A test of which was made at Saginaw by the Swift Electric Light works, with the result that $4.50 worth of Sebewaing coal produced 15 per cent more horse-power, than $5.50 worth of Ohio coal.

This coal has been very successfully used on locomotives where the Dorrence grate is used.

THE SEBEWAING COAL Company, of West Bay City, of which S. O. Fisher is president, has a new "shaft down 125 feet to a coal bed 4½ feet thick and were preparing for production.

So the production for 1892 will probably far exceed the production of any previous year.

Coal production of Michigan for 1891.

Name of company.	Location.	Production in tons, 2,240 pounds.	
		Tons.	Pounds.
Bennett Sewer Pipe Company	Jackson	4,700	
R. H. Emerson & Co.	Jackson	13,977	
Grand Ledge Coal and Clay Co.	Grand Ledge	576	64
Thomas M. Jenkins	Grand Ledge	470	
Saginaw Bay Coal Co.	Sebewaing	10,635	2,045
Corunna Coal Co.*	Corunna		
Total		30,658	2,109

* No report.

SALT.

The following is a portion of the report of State Salt Inspector M, Carey. from which we find that the salt producing territory of the State is divided into nine districts having a manufacturing capacity as follows:

DISTRICT NO. 1—SAGINAW COUNTY,

has 44 salt companies, with 40 steam, live pan blocks and 4,000 salt covers, having a manufacturing capacity of 1,400,000 barrels of salt.

DISTRICT NO. 2—BAY COUNTY,

has 30 salt companies, with 32 steam blocks; with a manufacturing capacity of 1,300,000 barrels of salt.

DISTRICT NO. 3—HURON COUNTY,

has 12 salt companies, four steam, and eight pan blocks and with a manufacturing capacity of 350,000 barrels.

DISTRICT NO. 4—ST. CLAIR COUNTY,

has 10 salt companies, with eight steam, and four pan blocks with a manufacturing capacity of 1,000,000 barrels.

DISTRICT NO. 5—IOSCO COUNTY,

has six salt companies, with six steam blocks, having a manufacturing capacity of 300,000 barrels of salt.

DISTRICT NO. 6—MIDLAND COUNTY,

has two salt companies with two steam blocks, having a manufacturing capacity of 75,000 barrels of salt.

DISTRICT NO. 7—MANISTEE COUNTY,

has 10 salt companies, with nine steam, and two vacuum pan blocks, having a manufacturing capacity of 1,250,000 barrels of salt.

DIRTRICT NO. 8—MASON COUNTY,

has three salt companies, with two steam blocks and one pan, having a manufacturing capacity of 400,000 barrels of salt.

DISTRICT NO. 9—GRATIOT COUNTY.

has one salt company, with one steam block, having a manufacturing capacity of 15.000 barrels of salt.

RECAPITULATION.

From the above we find there were 113 firms engaged in the manufacture of salt during the fiscal year of 1891, operating 102 steam and 20 pan blocks. Total number of blocks, 122, and 4,000 salt covers, with an estimated manufacturing capacity of 5,950,000 barrels of salt.

Table showing production in each county in 1891.

County.	Fine bbls.	Fine bulk.	Packers bbls.	Fine Packers.	Solar bbls.	2d Qual. bbls.	Total bbls.
Saginaw county	686,885	231,083	317	502	17,335	26,832	962,954
Bay county	626,482	158,395	4,800	395	.....	21,848	811,890
Huron county	30,675	16,719	13	.....	.....	.....	47,407
St. Clair coun	202,614	47,297	3,528	972	.....	1,114	255,525
Iosco county	239,365	.....	.....	.....	.....	.....	239,365
Midland county	36,758	750	.....	.....	.....	3,095	40,603
Manistee county	984,961	67,879	2,742	670	.....	58,444	1,125,696
Mason county	404,921	29,324	.....	50	.....	9,936	444,231
Total	3,212,661	551,447	11,400	13,559	17,335	121,269	3,927,671

Table showing increased and decreased inspection per district.

District and county.	Bbls. 1890.	Bbls. 1891.	Increase.	Decrease.	Total increase.
No. 1, Saginaw	1,006,854	962,954	.....	143,900	.....
No. 2, Bay	820,103	811,890	.....	8,213	.....
No. 3, Huron	55,681	47,407	.....	8,274	.....
No. 4, St. Clair	242,011	255,525	13,514	.....	.....
No. 5, Iosco	289,232	239,365	.....	49,867	.....
No. 6, Midland	49,609	40,603	.....	9,006	.....
No. 7, Manistee	1,006,525	1,125,696	119,171	.....	.....
No. 8, Mason	368,622	444,231	75,609	.....	.....
Total	3,838,637	3,927,671	208,294	119,260	89,034

There was from the above table 89,034 barrels more salt inspected than in 1890, but this table does not show the amount actually manufactured during the inspection year 1891.

	Barrels.
Add to the amount inspected	3,927,671
Salt in bins November 30, 1891	1,103,810
Total	5,031,481
Deduct salt in bins November 30, 1890	1,064,697
Amount of salt manufactured during the fiscal year 1891	3,966,784

SANDSTONE.

The sandstone belt of Michigan, that is, the sandstone that is profitable to quarry at the present time, may be said to lay around the shores of Keweenaw bay.

It extends from "Malones or PORTAGE ENTRY BED SANDSTONE CO'S." quarry, which is the most northerly of those situated on Keweenaw Point on the west shore of Keweenaw bay, south around the head of the bay and up the east shore to Pequaming, a distance of about 30 miles. The stone on the east shore varying from that on the west in being a hard, pure sandstone of a purplish brown color, while that on the western shore is of a deep, rich, red color.

The first of the quarries in order, beginning at the north, is that of the

PORTAGE ENTRY RED SANDSTONE COMPANY.

This company has been operating for years, and uncovered and stripped to an average depth of 25 feet, to the u sheet" which is about eight feet thick. This quarry is situated in S. 18, T. 53, R. 82. They have quarried and shipped this year 400,000 cubic feet of stone.

The fee is owned by Earl Edgerton, of L'Anse, and it is worked under lease by the Malone Bros., of Cleveland.

J. B. PARKER, *Sup't.*

The adjoining quarry on the south is that of

FURST, JACOBS AND COMPANY.

This, the first quarry that was discovered at Portage Entry, is situated in S. 19, T. 53 N, R. 32 W. It was first opened by Samuel Craig in 1886, in partnership with Furst and Jacobs, and has been in continual operation every summer since.

They have stripped to date 725,000 square yards of surface, and have quarried 1,900,000 cubic feet of stone. The last season's output being 406,000 cubic feet of this finest of red sandstone.

This firm has also a brown stone quarry at Marquette. Heretofore the company has been working on lands belonging to the "Burt Freestone Company," paying a royalty of five cents per cubic foot. But this year the work has been done on their own land which adjoins the old quarry. The company stripped a piece 250x100 feet. As the average thickness of the stone is 12 feet this gave them 300,000 feet of stone ready for the machines.

MICHIGAN RED STONE COMPANY.

Next in order on the shore of Keweenaw bay is the MICHIGAN BED STONE COMPANY'S quarry, which has been opened during the past year by Jackson parties. Everything at this mine is in first-class order, waiting for the opening of spring to commence operations, but little work having been done other than stripping a space 100x100 feet, and quarrying about one-third of that area. The stripping at this quarry will not average over 15 feet, while the stone measures 8 feet in thickness, thus making this one of the best properties on the belt.

These are at present the only quarries working, but several promising explorations have been made to the south and east, which will probably be developed during the coming season.

MINE INSPECTORS' REPORTS.

KEWEENAW COUNTY.

Record of fatal accidents in mines of Keweenaw county.

JOSEPH RICHARDS, *Mine Inspector.*

Name of mine.	Nationality of victim.	Occupation.	Cause of death.
Allouez	Swede	Miner	Fall of rock.

HOUGHTON COUNTY.

Records of accidents in mines of Houghton county.

JOSIAH HALL, *Inspector.*

Name of mine.	Nationality of victim.	Occupation.	Cause of accident.
Calumet and Hecla	Italian	Trammer	Fall of hanging wall rock.
Huron	Italian	Trammer	Jump off skif, fell down shaft.
Calumet and Hecla	Finlander	Miner	Fall of vein rock.
Huron	Finlander	Trammer	Leg jammed bet. skip and wall.
Atlantic	Finlander	Trammer	Fell down shaft.
Calumet and Hecla	Italian	Trammer	Fall vein rock.
Calumet and Hecla	Irish	Miner	Explosion. Premature.
Tamarack	English	Mng. capt.	Riding on cross-head jammed against timber.
Atlantic	Finlander	Miner	Blasted.
Huron	Finlander	Wheeler boss	Jumped off skip down shaft.
Tamarack	Austrian	Laborer	Fell down shaft.
Tamarack, Jr.	Austrian	Miner	Fall of rock.
Tamarack	English	Miner	Premature explosion.
Tamarack	English	Miner	Premature explosion.
Quincy	German	Trammer	Fell down shaft.
Calumet	English	Mn'g. Capt.	Fell from bucket.
Osceola	English	Miner	Blasted.
Tamarack	Finlander	Miner	Fall of rock.
Centennial	Italian	Laborer	Fell from bucket.
Pewabic	Irish	Laborer	Struck on head by rock.
Osceola	Finlander	Miner	Blasted.
Calumet and Hecla	Polander	Laborer	Str. by tim. falling down shaft.
Atlantic	English	Lander	Fell off trestle tram road.
Calumet and Hecla	Austrian	Trammer	Struck by skip.
Calumet and Hecla	Scotch	Miner	Str. by plk. and fell down shaft.
Quincy	Swede	Miner	Struck by skip.
Tamarack	Finlander	Trammer	Fall of vein rock.
Atlantic	Finlander	Miner	Blasted.

Total number men employed 7,702.

GOGEBIC COUNTY.

Record of fatal accidents and number of men employed in Gogebic county.

C. M. BOSS, *Inspector.*

Name of mine.	Location.	Men employed.	Fatal accidents.
Anvil	Bessemer, Mich.	65	
Ashland	Ironwood, "	595	2
Aurora	Ironwood, "	374	2
Brotherton	Wakefield, "	170	
Colby	Bessemer, "	329	3
Comet	Wakefield, "	76	
Eureka	Bessemer, "	55	
Federal	Bessemer, "	39	
Lowell	Bessemer, "	27	
Mount Hope	Ironwood, "	121	
Norrie	Ironwood, "	1,210	1
Pabst	Ironwood, "	225	
Palms	Bessemer, "	169	
Sunday Lake	Wakefield, "	167	4
Various explorations		219	1
Totals		3,851	13

MARQUETTE COUNTY.

List of fatal accidents in Marquette county, for 1891.

ANTHONY BROAD, *Inspector.*

Name of mine.	Nationality of victim.	Occupation.	Cause of accident.
Pittsburg & Lake Angeline	English	Miner	Fell down shaft.
Fitch	Swede	Miner	Fall of ground.
Fitch	Manx	Miner	Fall of ground.
Winthrop	English	Miner	Fell down stope.
Winthrop	English	Miner	Premature blast.
Volunteer	English	Engineer	Caught in hoisting tram.
Volunteer	Swede	Miner	Fall of ground.
Volunteer	Canadian-French	Laborer	Fall from trestle.
Queen	Swede	Miner	Premature blast.
Queen	Irish	Miner	Premature blast.
S. Buffalo	Finlander	Laborer	Breaking of shute.
Queen	Finlander	Miner	Replacing timber after blast.
Champion	Finlander	Miner	Fell in shaft, backward.
Champion	Swede	Miner	Fall of ground.
Champion	Finlander	Miner	Fall of ground.
Champion	Finlander	Miner	Fall of ground.
Champion	English	Miner	Fell down shaft.
Champion	Finlander	Laborer	Run of ore in stock piles.
Champion	Italian	Laborer	Run over by cars.
Republic	English	Miner	Knock down shaft by fall. plk.
Republic	American	Miner	Suffocated, fire in mine.
Republic	American	Fireman	Suffocated, fire in mine.
Republic	Finlander	Miner	Fall of loose ground in burnt mine.
Republic	Finlander	Miner	Fall of loose ground in burnt mine.
Republic	Finlander	Miner	Fall of loose ground in burnt mine.
Cleveland	Finlander	Skip tender	Caught in pump rod.
Cleveland	Swede	Miner	Fell down shaft.
Cleveland	Finlander	Miner	Fall of loose ground.
Cleveland	English	In charge of explosives	Premature explosion of cap, blinded permanently.

Number men employed 8,230.

MENOMINEE COUNTY.

Record of accidents in mines in Menominee county.

J. B. KNIGHT, *Inspector.*

Name of mine.	No. men employed.	No. persons killed.	No. persons injured.	No. men employed to each man killed.	No. men employed to each man injured.
Appleton	16		1		16
East Vulcan	301		3		100
West Vulcan	182	1	8	182	23
Curry	258	2	10	129	26
Aragon	328	1	7	328	47
Harrison	24		1		24
Perkins	18				
Norway	141		8*		17
Cyclops	35				
Pewabic	346		3		115
Walpole	25				
Millie	59	2	1	29	59
Chapin	1,567	12	58	131	27
Old Ludington	30				
New Ludington	470	7	16	69	29
Hamilton	293	2	3	146	98
Smaller mines	115				
Totals	4,208	27	119	156	35

No reports from Ontonagon or Iron counties.