STATE OF MICHIGAN

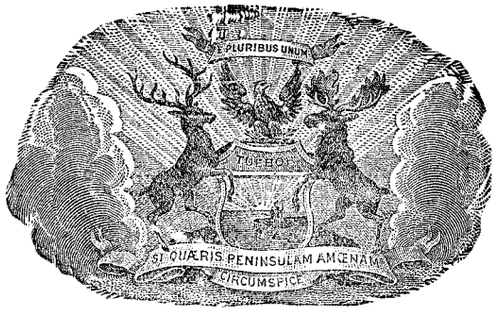
MINES

AND

MINERAL STATISTICS

BY

JAMES P. EDWARDS, C. E.,
Commissioner of Mineral Statistics



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INTRODUCTION.

STATE OF MICHIGAN,
OFFICE OF THE COMMISSIONER OF MINERAL STATISTICS,
Houghton, Mich., 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First, Owing to the fact of the specific tax law having been repealed, and that the Commissioner's request or demand for reports from the companies early in the year cannot be enforced, there being no penalty for refusal to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 safemining, 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.

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 done, 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, 1,049 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 $2\frac{37}{100}$ 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, $12\frac{8}{10}$ 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 Capt. 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, $106,351.23.

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 2½ 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, a very 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 "	621,375 "	651,035 "
" refined copper	10,542,519 "	8,664,253 "	6,405,686 "	6,367,809 "	5,609,762 "
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	6,604,125 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	5,925,519 "	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 31, 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 the 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	6,750½ 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. 3 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 out 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 1,599,670 lbs. of refined copper—being a little less than $\frac{3}{4}$ 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 ft 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 cross-cut 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 coming 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 eastermost, 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 Daniell 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, sametimes 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 open-

ings 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 31, 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	$621,956
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	4,534,127	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 bed-plate, 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 300 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 whieh 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 hoase, 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 30, 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 minutiæ 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		$942,037 12
Showing a mining profit of		$1,066,739 80
Deduct dividends paid during the year		750,000 00
		$316,739 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, $3,150.61; taxes, less rents collected, $3,858.15; 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	
No. 4 shaft and engine equipment	21,434 67	158,177 40
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	301,523 "
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 cross-cuts 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 looking very bright, and should the No. 2 shaft, located some 1,200 feet north 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 stope.* 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 annual 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 up 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	$1\frac{365}{1000}$ per cent
Production of ingot copper	531,983 lbs.
Per cent of ingot copper in ton of rock stamped	$\frac{932}{1000}$ 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. 3 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 $1,500,000; 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, $72,000; production of ingot copper to September 1, 1,866,511 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 $144,757.31. 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 13th 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. 2, 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 15 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	
Total net income for year		199,094 31
Balance of assets, January 1, 1891		19,020 53
Balance of assets, January 1, 1892		144,757 31
		$163,777 84

The assets consist of:

Cash in bank at Boston and copper on hand since sold	$106,592 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 $21,470.37 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 grade 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 30, 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 81.9 feet, the 15th level 90 feet, 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.

THE 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 management 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.

THE 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 300 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
Total expenses as above		$159,621 94
		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 the 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 the 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, $345\frac{6}{12}$ feet, average cost	$17 94
Drifting in vein and cross-cuts, $3,340\frac{6}{12}$ feet, average cost	6 35
Stoping on vein, $2,616\frac{6}{12}$ 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 $839\frac{820}{2000}$ 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 statements 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 has 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	7,120	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	2,662	1,517
Tamarack	Houghton	16,161,312	29,758	1,254
Tamarack, Jr.	Houghton			
Wolverine	Houghton	312,112	1,089	628

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	46⅛	36¼	31¾	23⅛	23⅝	23⅜	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	18¼	15⅞	13⅞	11⅛	11	11¼	16⅜	13¾	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.
Lake Superior	114,388,596
Arizona	39,699,520
Montana	113,200,640
New Mexico	1,599,360
California	3,749,760
Colorado	7,000,000
Utah	1,700,160
Other sources	4,800,320
Production	286,138,356

	Pounds.
Production	286,138,356
Stocks on hand Jan. 1	109,959,360
Imports of pigs, bars, etc.	3,200,960
Total available supply	399,298,676
Deduct exports	109,999,680
Deduct consumption	210,819,840
Supply on hand Dec. 31	78,479,156

Principal copper supplies of the world. †

(In English tons of fine copper.)

Countries.	1890.	1889.
	Tons.	Tons.
Algeria	120	160
Argentine Republic	150	190
Australia	7,500	8,300
Austria	1,210	1,225
Bolivia	500	* 1,200
Canada	3,050	2,500
Chili	26,120	24,250
Cape of Good Hope:		
Cape Copper Co.	5,000	5,600
Namaqua Cop. Co.	1,450	* 2,100
England	* 1,000	905
Germany:		
Mansfield	15,800	15,506
Other German	2,000	* 1,850
Hungary	* 300	300
Italy	3,000	* 3,500
Japan	15,000	15,000
Mexico:		
Boleo Co.	3,450	3,280
Other Mexican	875	500
Newfoundland:		
Betts Cove	735	1,115
Tilt Cove	1,000	1,500
Norway:		
Vigsnaes	925	1,007
Other Norwegian	* 450	350
Peru	150	275
Russia	4,800	4,070
Sweden	800	830

Countries.	1890.	1889.
	Tons.	Tons.
Spain and Portugal:		
Rio Tinto	* 30,000	29,500
Tharsis	* 11,000	* 11,000
Mason & Barry	* 5,600	* 5,250
Sevilla	810	1,350
Portugueza	* 1,200	1,200
Other mines	* 4,425	* 6,500
	53,035	54,800
United States:		
Lake Superior	44,450	38,769
Montana	49,560	46,518
Arazona	15,945	14,419
Other states	6,370	6,068
	116,325	105,774
Venezuela:		
New Quebrada	5,640	5,563
Total	270,485	261,650
Average prices ‡ Chili bars	£54 1s.	£49 10s. 6p.

* 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	30,628	28,891
Havre, Bordeaux, Rouen and Dunkirk, other copper	7,648	7,051	8,968	8,788	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	18,212	2,143	290,780	34,820	24,950,604	448,487		
1870	5,157	418	255,386	31,931	1,936,875	134,786		
1871	3,316	491	369,633	45,672	411,315	42,453	489	$60
1872	2,638,589	578,965	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	134,326	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		198,749	25,585	87,039	11,785		
1879	2,515	352	112,612	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	836	508,901	59,629	1,473,109	147,446	224,052	30,013
1883			330,495	36,166	1,115,336	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	3,866,192	194,785	27,650	1,366
1888	1,787	299	37,620	2,585	4,850,812	381,477	4,971	324
1889	3,160	522	19,912	1,176	3,772,838	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	1,350,896	327,287	152,201	922,409
1869	121,418	237,424	1,134,360	233,932	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	17,200,739	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	565,295	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	8,226,206	16,813,410	1,917,581	86,764	10,230,551
1890	483,180	4,413,067	10,971,899	1,365,379	139,949	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. men employed.	No. feet sunk 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 refined copper per ton.	Yield of refined copper per fathom.	Yield of refined copper per tons stamped.
Adventure	Ontonagon	203	137 8/10	1,388 9/10	9,431 5/10	8,838	102,636	96,164	1,728,509	1,241,423	12 9/10		12 9/10
Allouez	Keweenaw	420	180.	4,595 3/10	19,884 9/10	20,591 1/10	303,618	297,030	5,089,790	3,653,671	12 1/10		12 1/10
Atlantic	Houghton									63,586,620		177 4/10	
Calumet & Hecla	Houghton	190	345 7/10	3,349 5/10	2,616 3/10	3,787		23,946	1,678,820	1,313,197		347	18 646/1000
Keweenaw			1,230 1/10	2,437 1/10	1,750 7/10			28,531	777,635	531,983			
Central	Houghton									1,460,000			
Centennial	Houghton		320	2,466 7/10	8,414 346/1000	8,414 346/1000	175,978	135,578	5,213,642	4,319,840		513 411/1000	31. 865/1000
Copper Falls	Keweenaw									1,215,734			
Franklin	Houghton									7,120			
Huron	Houghton									1,727,390		333.	21. 310/1000
Knolton	Houghton		537 9/10	2,232 7/10		5,185	93,352	81,424	2,108,812	30,114			
Kearsarge	Ontonagon								38,487	103,884			
Mass	Ontonagon								139,379	6,543,398		432.	27. 310/1000
National	Houghton		808 1/10	6,119 9/10		15,155	272,781	234,325	7,590,903	1,599,670			16 665/1000
Osceola	Houghton	179	228 2/3	516 1/3	5,779 1/4		108,560	99,591	2,191,830	10,542,519		685.	39 283/1000
Peninsula	Houghton	652	666 3/10	5,882		15,352	269,817	263,678	12,827,075	43,049			
Quincy	Houghton								52,003	16,161,312			
Ridge	Ontonagon									302,112			
Tamarack	Houghton												
Wolverine	Houghton												