

THE PEWABIC MINE.

The history of the Pewabic Mine, together with a longitudinal section, is given in the Commissioner's Report for 1880, and there is little to add beyond an account of the operations for the past year.

Since the purchase of the Edwards property, in Oct., 1879, the mine has been pushed into this new ground. It will be remembered that the old mine was, in horizontal projection, nearly a triangle, lying between the Quincy and the Franklin, to the apex of which the underground openings converged. Opposite this is the new purchase, the southwest quarter of section twenty-three, into which the openings have since been extended.

The purchase was made for \$275,000. The company made an assessment of \$10 per share, on 40,000 shares, which, with \$2 per share previously assessed and cash on hand, gave a total sum of \$481,000, only \$206,000 in excess of the amount paid for the land. Since that time no additional assessments have been made; the copper produced has had to furnish all the necessary funds for opening the mine and for making very many necessary repairs and improvements. Under such circumstances the work has been greatly restricted, and the management has necessarily labored under disadvantages. The mine has succeeded in keeping even, but no dividend has been made.

The company is fortunate in having the services of one of the best mining men in the country for its agent. Captain Vivian, as agent of the Pewabic, Franklin, and Huron, has his hands full, but he is one of the rare men who combine a thorough, practical familiarity with mining, with executive ability and a knowledge of business, that admirably fit him for his responsible position.

The following is a comparison of the product for the past two years:

	Tons of Rock.	Yield per cent.	Mineral, lbs.	Per Cent.	Ingot, lbs.
1880.....	33,982	2.02	1,172,855	84.48	967,384
1881.....	60,427	1.92	2,247,657	83.32	1,872,878

Average price obtained for copper in 1880, 19 12½-1000 cents per lb. Average price sold for in 1881, 17 635-1000 cents per lb; being a diminution in price received per lb., of nearly 1½ cents, thus reducing the net profits of the company \$28,000 below what they would be if the price received had been the same as the previous year.

A surplus of from \$12,000 to \$15,000 or more could be made by taking valuation of rock broken in mine and not hoisted, also by figuring the exact amount received for sales of copper, some of which has been sold at a higher price than estimated.

Annexed are the financial statements of the company, covering the receipts and expenses and the assets and liabilities:

ANNUAL STATEMENT OF THE PEWABIC MINING COMPANY.

Cash on hand Jan. 1, 1881.....	\$7,357 71
" received for 1,725,499 lbs. ingot at 17 635-1000 cents.....	304,294 22
" " " 6,243 lbs. mineral at 18½ cents.....	1,142 34
" " " loans.....	117,920 38

Cash received for interest.....	\$338 92
" " " stamping.....	612 12
" " " supplies sold.....	153 04
" " " sale of drill.....	6,562 93
	\$438,381 66

CONTRA, CR.

Cash paid loans.....	\$105,345 38
" " mine drafts.....	260,449 61
" " smelting.....	20,451 00
Taxes, forfeited stock, brokerage, storage, interest, insurance, freight, etc	25,577 70
Cash on hand Jan. 1, 1882.....	26,557 97
	\$438,381 66

The following are the assets and liabilities, January 1, 1882:

Cash on hand.....	\$26,557 97
418,399 lbs. ingot copper on hand, at 19 cents.....	79,495 81
Supplies at mine—cash value.....	63,910 00
	\$169,963 78

CONTRA, LIABILITIES.

Drafts outstanding.....	\$24,751 35
Bills payable, and loans.....	98,975 00
Due for forfeited stock.....	1,185 60
Liabilities at mine.....	36,762 00
Due for smelting and freight, estimated to balance.....	8,289 74
	\$169,963 78

The number of tons of rock hoisted from the mines in 1881, was.....	68,033
The number of tons of rock rejected was.....	9,687
The number of tons of rock stamped was.....	58,346
The yield of mineral per fathom of rock hoisted was (pounds).....	561½
The yield of ingot per fathom of rock hoisted was (pounds).....	468
The yield of mineral per ton of rock hoisted was (pounds).....	33.04
The yield of ingot per ton of rock hoisted was (pounds).....	27.53
The yield of mineral per ton of rock stamped was (pounds).....	38.50
The total amount of mineral produced was (pounds).....	2,247,657
The total amount of ingot produced was (pounds).....	1,872,878
The per cent of ingot copper to mineral was.....	83 21-100
The total number of feet of shafts sunk during the year was.....	160.4
The total number of feet of winzes sunk during the year was.....	257.3
The total number of feet of drifts extended during the year was.....	1,247.4
The total number of fathoms stoped by hand during the year was.....	658 173-1000
The total number of fathoms stoped with air drills during the year was.....	3,348 117-1000
The total cost of manipulating 1 ton of rock was.....	\$3 49-
The average number of men employed was.....	285
Cost per foot for sinking shafts.....	\$20 86
Cost per foot for sinking winzes.....	14 90
Cost per foot for drifting.....	12 86
Cost per fathom for hand stoping.....	22 53
Cost per fathom for air drill stoping.....	14 08

No. 6 shaft—the one through which all the hoisting is done—is down to the 270th level, and will soon be to the 280th; its depth on the lay of the lode, 54°, is 1,920 feet. The 270th level, from the Franklin to the Quincy boundaries, is 840 feet in length.

The great depth to which the mine has attained renders a man engine very desirable; accordingly some progress has been made toward the construction of a man engine shaft. At present the workmen must go down in the mine and ascend on ladders, a heavy task for so long a distance.

The capital stock is \$1,000,000, divided into 40,000 shares. The office is No. 19 Congress street, Boston. D. L. Demmon, Secretary and Treasurer. Johnson Vivian, Agent, Hancock, Mich.

AGENT'S REPORT.

D. L. DEMMON, Esq., *Treasurer Pewabic Mining Company.*

DEAR SIR—As with this season of the year it becomes my duty to report of our doings for the twelve months ending December 31st, 1881, I beg leave to submit the following for your consideration.

SURFACE.

In this department the following improvements have been made: A drum house, with two drums for operating the incline road to stamp mill; locomotive house, carpenter's shop, with lumber yard enclosed with board fence; blacksmith's shop, which is located adjacent to No. 6 shaft for sharpening miners' tools, etc. An old tenement house has been remodeled and made into an office and warehouse. A dam, which will hold about 100,000 cubic feet of water, which is used for feeding boilers, etc., has been constructed, which will give us a full supply of feed water without melting snow for that purpose, as we were compelled to do last winter.

MACHINERY.

We have put up the other half of the air compressor, and added five drills and a pony engine to the underground outfit of labor-saving machinery; all of which, with our surface machinery, is in good repair except three boilers at the hoisting engine, which will require some considerable overhauling ere long.

We have now thirteen drills at work, and two or three more will be added about the first of March, which will be all that is necessary until more hoisting power is provided.

Some considerable work has been done on the man-engine, which we expect to have in operation to the 160 fathom level by the first of June next.

STAMP MILL.

Repairs, both ordinary and extraordinary, have been and are still being carried on in this department, which have put three heads of stamps, with all the washing machinery and boilers in good running condition, except one mortar, which was put up as an improvement on Ball's mortar, but, instead of that, it falls vastly short of being equal to what was put up by Mr. Ball. The capacity of the mill is now about 300 tons of rock per day.

MINING WORK.

No. 6 shaft has been sunk from the 25th to the 27th level. The lode in this opening is not so productive as we had reason to expect it would be. It seems to be in one of the lean places that are often found in this deposit. In winze sinking below the 26th level, north of the shaft about 60 feet, the lode is showing some good stamp and a little barrel copper.

The 27th level has been opened 15 feet each side of the shaft; the lode at this point has a much better appearance and is more productive than what the shaft passed through. It looks as if some very valuable ground would soon be met with at this level.

The 26th level has been opened north of the shaft to the boundary line

with Franklin. With the exception of about 25 feet near the shaft, this opening has exposed a good paying lode. This level is opened south of the shaft 96 feet. The lode in the drift is very lean, but as there is some good ground going down in the bottom of the 25th level for a long distance, we shall doubtless find that considerable of this back of ground will pay to take out.

The 25th level has been extended north to the Franklin line and south of shaft 240 feet. The lode on the north side is large, and near the line very rich in all grades of mineral. The greatest portion of this block of ground has been removed by stopes. The bottom of this level for about 130 feet in length is well filled with mass, barrel and rich stamp copper, which cannot be taken out to advantage until reached with the stopes from the level below.

On the south side of the shaft some very fair ground was found, and the stopes in this back are still showing a good stamp lode. The last 50 feet opened in this direction are poor.

The 24th level has been extended south 210 feet, all of which, except the last 60 feet, will pay to stope. Considerable more copper has been taken from this point, and the stopes are still showing more barrel and stamp copper in paying quantities.

The 23d level has been extended south 165 feet, at which point it has reached the line with Quincy. The lode exposed in this level contained a very fair amount of stamp and barrel work, and the stopes in this back have paid very well. There is only a small piece of ground left in this block, which is near the line.

The 22nd level has also been opened to the line with Quincy. The lode was found to carry a large amount of good stamp and barrel copper. The 20th level has reached the line, and a winze sunk to the level below. In both of these openings the lode is showing good paying rock. We are now getting a large amount of good stamp work from this point.

We have hired the diamond drill from the Huron Copper Mining Company and started to drill in the foot wall side of the lode, at the 260-fathom level, but up to this date have not found anything of value. We shall also drill in the hanging wall to see if there is anything of value in that direction or not. In the Quincy they have found some rich ground both sides of the main lode.

FUTURE PROSPECTS.

If the 27th level proves to be as productive as it now indicates, the prospects for 1882 are very fair. It seems as if we could reasonably expect at least 1,200 tons of mineral; and should we find another old-fashioned bunch of copper, like what has been often found here (and I think our chances for doing so are very good), the product for the ensuing year would be very materially augmented.

For further information in relation to our business I beg leave to refer you to the section and plan of the mine, herewith forwarded, and which has been very carefully marked up to this date; and also to the clerk's report, which gives in detail the cost of each department.

Capt. Josiah Hall, my assistant in the mining department, has, as usual, taken a deep interest in our operations, and has labored hard to promote the best interests of the company. Respectfully,

J. VIVIAN, *Superintendent.*

THE FRANKLIN MINE.

This mine is looking unusually well and promises to resume the production and paying condition which it held for many years during its earlier history. The company resumed working the mine in 1875 on the expiration of a five years lease, and started with an empty treasury and things badly out of repair. All the expenditures that have since been incurred have been met by the product of the mine, so that no assessment has been made.

Up to December 31st, 1881, there had been made during the year:

349 feet of shaft sunk at an average price per foot.....	\$19 41
281 2-5 feet of winze sunk at an average price per foot.....	11 36
2,535 feet of drifts made at an average price per foot.....	10 57
1,086 fathoms of ground stoped by hand at an average price per fathom.....	16 70
5,664½ fathoms of ground stoped with air drills, at an average price per foot.....	12 40
No. of tons of rock hoisted.....	146,260
No. of tons rejected.....	32,932
No. of tons stamped.....	113,328
The average yield per fathom of ground stoped, of mineral.....	375 lbs.
Average yield of copper per fathom of rock.....	311 "
Average yield of mineral per ton of rock hoisted.....	22.07 "
Average yield of copper per ton of rock hoisted.....	18.31 "
Average yield of mineral per ton of rock stamped.....	28.48 "
The total amount of mineral produced was.....	3,228,270 "
Total amount of copper produced.....	2,678,797 "
The per cent of copper in the mineral was.....	82.97
The average number of men employed was.....	435
The total cost of manipulating the rock per ton was, for the year....	\$2 32

The Quincy, Pewabic, and Franklin are contiguous mines, working the same lodes, but it will be seen from a comparison of the figures that the former is now working in a far richer portion of the deposit than either of the others.

In the Quincy the yield of copper per fathom, in 1881.....	767 lbs.
In the Pewabic the yield of copper per fathom, in 1881.....	468 "
In the Franklin the yield of copper per fathom, in 1881.....	311 "

But the Quincy was never so rich as it is now.

Per cent of copper from rock stamped in 1881.

Quincy.....	3 13-100
Pewabic.....	1 375-1000
Franklin.....	1 181-1000

AGENT'S REPORT OF FRANKLIN MINING COMPANY FOR THE YEAR 1881.

OFFICE OF THE FRANKLIN MINE, }
January 16, 1882. }

D. L. DEMMON, *Treasurer.*

DEAR SIR—I beg leave to submit the following report of the operations at this mine for the year ending December 31, 1881:

SURFACE.

The only extra work in this department is a very thorough overhauling of a number of the old tenement houses which were in a bad condition. The repairs done to them have made them almost equal to new.

MACHINERY.

There has been added to this department the other half of the air compressor referred to in my last annual report, eight Rand drills and a pony engine. We have now 23 drills and 2 pony engines that are operated in the mine by compressed air. All of which, with our other machinery, are in good repair and working satisfactorily.

STAMP MILL.

The mill was never in better condition than it is to-day, except one boiler, which requires a new set of flues, which will be put in in a few days.

MINING WORK.

No. 2 shaft has been sunk from the 20th to the 22d level. The first 60 feet of sinking was done in a small and very poor piece of lode; the balance to the present bottom passed through ground that will pay well to remove by stopes.

We have opened at this shaft by drifts at the different levels from the 16th to the 21st, both inclusive, 1,234 feet, the greatest portion of which was not found to be so productive as in former years, but the 21st level that has been opened, north of the shaft 100 feet, and south 125 feet, has yielded, and is still producing a very fair amount of good stamp and barrel copper. The 22d level will be pushed along as fast as possible, and will doubtless yield more copper to the fathom than anything we have had in this part of the mine for the past two years.

No. 3 shaft has been sunk from the 19th to the 20th level. The lode for the entire distance contained a fair quantity of good stamp and barrel mineral. The openings made in the vicinity of this shaft at the 17th, 18th, 19th, and 20th levels is 656 feet, which in point of value compares favorably with what has been found in this part of the mine for some years past.

The 20th level, which is only opened a few feet each side of the shaft, is showing a good, fair sized lode, with considerable fair stamp rock and a little barrel copper.

No. 5 shaft has been sunk from the 17th to the 18th level. The lode at this point is of more than the average productiveness of the mine. The 18th level has been opened south and connected with the drift at this level from No. 3 shaft, and north of shaft 80 feet, all of which is in good paying ground. There has been opened by drifts from this shaft 644 feet; the greatest part of the lode exposed in these openings will pay to take out.

The section of the mine, plans of which have been sent you, will show at a glance the extent of the openings made and the ground broken in far better language than I could possibly tell you in this report, and to which for further information on mining work I would beg leave to refer you.

FUTURE PROSPECTS.

Prospects for the ensuing year are at least equal to those of the past. And if the ground about No. 2 shaft proves to be as productive as it now indicates, and all other parts of the mine continue to yield as they are now doing, the product for 1882 will be considerably more than in 1881.

J. VIVIAN, *Agent.*

THE HANCOCK MINE.

This mine is situated almost within the village of the same name, and its gravity incline railroad, as are those of the Quincy, Pewabic, and Franklin,

is plainly to be seen from the streets of Hancock and Houghton, and the constant rattling of the cars over these tracks gives evidence of the incessant activity which prevails.

The new company to operate the Hancock Mine was organized in the winter of 1879-80, with a capital stock of \$1,000,000, divided into 40,000 shares of \$25 each, and work was immediately begun, and has since been pushed forward with considerable vigor. During the past year 3 additional "lifts" have been sunk, so that the mine is now down to the 9th level, and will soon be to the 10th. The new levels are 100 feet apart. The depth of the mine is 840 feet.

Heretofore the product has all gone out of the adit, which is in the 3d level, but No. 1 shaft has been fitted up with skip road, etc., and is now used for the hoisting, and the adit is used for drainage only.

The lode is a wide amygdaloid belt, somewhat like the Atlantic, but not so uniform. About 2 tons per month of the product is in small masses—barrel work. One mass was found last summer, however, that weighed 5 tons.

The rock yields only about one per cent. of copper; possibly, if it were selected a larger percentage could be obtained, but it is nearly all sent to the stamp mill. So much of the work has been devoted to making the openings that there has not been sufficient stoping done to keep the mill running, and the rock from the drifts and shafts, etc., has been used; only one stamp head has been used, and that has not run full time. It is difficult in a small mine with limited openings and working with hand drills, to keep a Ball stamp at work.

The Hancock Mine needs a compressor and air drills, so that the openings may be more rapidly pushed, and a greater amount of rock obtained from the mine. A fissure vein crosses the south end of the mine, which carries copper in small pieces; small masses of conglomerate occasionally are found. The best portion of the lode is near the hanging; it is bunchy and very wide in places—from 12 to 30 feet, and as in the Atlantic, the hanging is poor, requiring frequent pillars and much timbering. The lode being wider along the hanging wall, is taken down, and the trap falls out a good deal. The company employs about 125 men.

The average cost for sinking shafts was \$25 per foot.

The average cost for drifting varies with the character of the ground, being \$6, \$7, \$10.

Size of drifts 5 feet by 6 feet.

Stoping costs \$9, \$10, \$14, \$16, \$18, \$20 per cubic fathom.

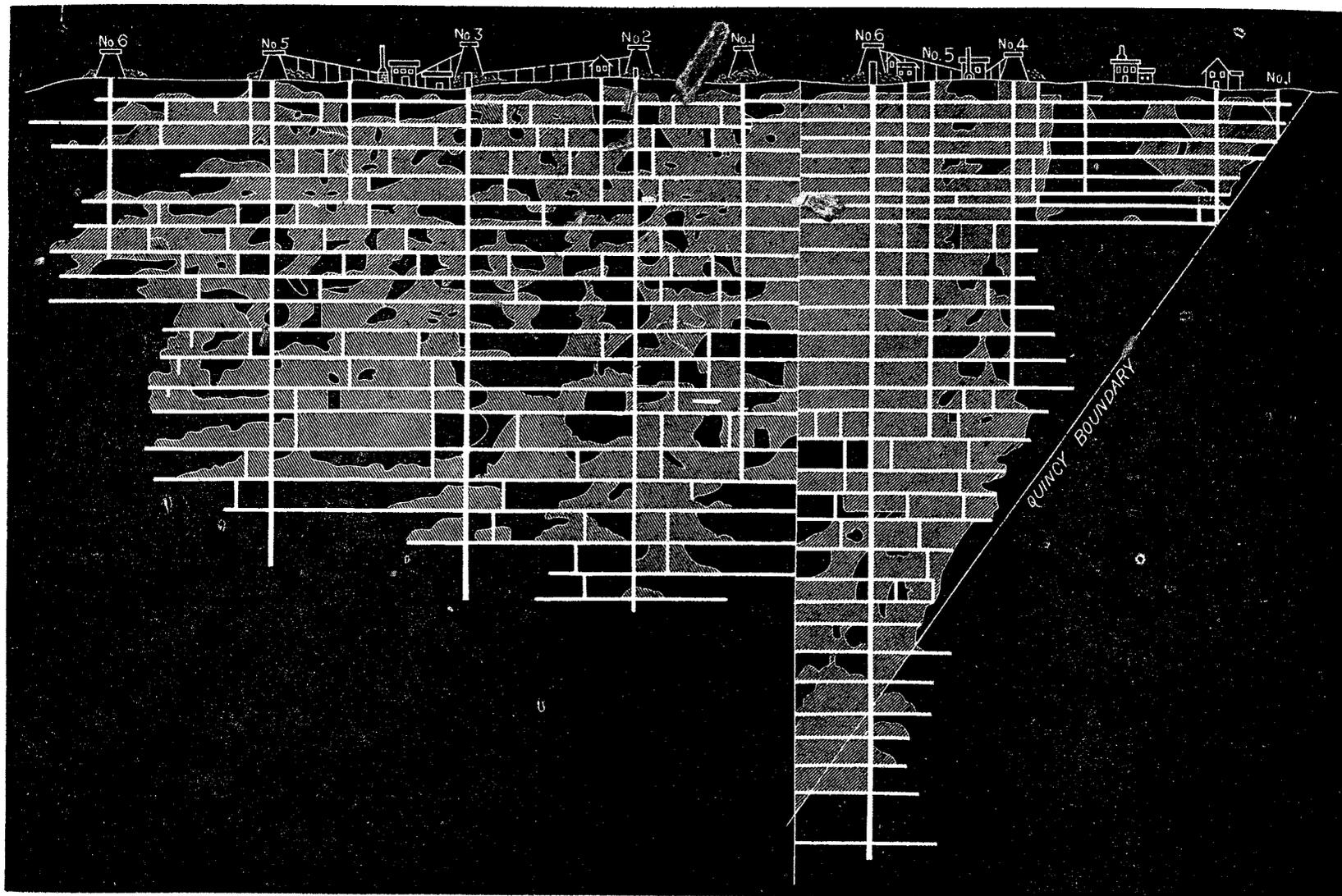
The following is a statement of receipts and expenditures of the Hancock Mining Company from March 1st, 1881, to March 1st, 1882:

RECEIPTS.

For assessment, No. 1.....	\$40,000 00
For assessment, No. 2.....	60,000 00
	<hr/>
	\$100,000 00
For discount amount borrowed.....	10,000 00
For amount realized on copper.....	125,024 65
For amount realized on discounting bills.....	17 71
For amount realized on pasture.....	191 93
For amount realized on sale of lot.....	200 00
For amount realized on rents.....	1,253 84
For amount realized advanced on copper.....	10,000 00
	<hr/>
	\$246,688 13
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	<u>\$246,688 13</u>

LONGITUDINAL SECTION OF THE FRANKLIN AND PEWABIC MINES, JAN. 1, 1881.

Scale, 420 ft. to one inch.



1882, March 1.

To cash balance on hand as above.....	\$1,548 99	
To copper on hand at Chicago and in transit, 50,000 lbs., at 19c.....	9,500 00	
To supplies at mine and mill, including wood, coal, timber, iron, oil, fuse, powder, etc.....	28,263 45	
		<u>\$39,312 44</u>
		<u><u>\$39,312 44</u></u>

EXPENDITURES.

For freight.....	\$3,543 09	
For insurance.....	1,358 50	
For taxes.....	873 05	
For interest.....	901 57	
For smelting charges.....	8,661 30	
For machinery.....	15,250 50	
For construction.....	88,613 13	
For timber, coal, and fire-wood.....	31,296 82	
For freight, insurance and commission on copper sold at Chicago.....	6,095 45	
For expenses at mine.....	75,708 73	
For expenses at mill.....	12,837 00	
		<u>\$245,139 14</u>
Balance on hand.....	1,548 99	
		<u><u>\$246,688 13</u></u>

1882, March 1.

By liabilities as follows:

Amount borrowed.....	\$10,000 00	
Amount advanced on copper.....	10,000 00	
Other accounts unpaid.....	5,414 60	
		<u>\$25,414 60</u>
Net amount of assets over liabilities.....		<u>13,897 84</u>
		<u><u>\$39,312 44</u></u>

The ground opened during the last year did not turn out as rich as was confidently expected.

During the year they have sunk the main shaft 300 feet, and indications in the bottom of this shaft now are better than at any point yet encountered. The total product since commencement of operations was 965,635 pounds of mineral, or 667,307 pounds ingot copper, which was sold at an average price of 18 7-100 per pound, making the gross receipts from the sale of copper \$125,024.65. In addition to sinking the main shaft as above stated, they have made other necessary openings, such as the sinking of winzes and driving of drifts, so as to be prepared for more extensive mining and larger products.

Owing to the tendency of the ground to disintegrate upon exposure, a great deal of timber has to be used in protecting the openings.

This, together with all the wood required for fuel, must be secured a year in advance, as it cannot be procured in the summer months.

It will be seen by the report that there is a large amount of this, together with other supplies, on hand, which necessarily called for a large expenditure which had to be met.

We were in hopes to be able to show better results, but in opening the mine we encountered a poor section of ground between the 70 and 80 fathoms level. This had to be gone through at as great an expense as though it was rich in mineral, and makes a marked difference in our output of copper. We are now through that, however, and have again reached better ground, and hope to be able to increase our product without any additional monthly expense.

Though we have very good reason to hope, it is of course impossible to look through the ground, hence cannot tell what is in store for us; that, time and labor alone can determine. The mine is well equipped with all necessary machinery, and expenses for improvements in this direction will be light. Every precaution is taken to prosecute the work as cheaply and economically as possible; still, what is done is done well, and with a view to permanency and legitimate mining.

We are working at present about 130 men. I don't think we will have to increase this force for some time. I have the greatest confidence that the mine will be a success, and prove a source of profit to its owners. Certainly, all that can be done in that direction is being done by myself and able assistants, who so heartily co-operate with me.

Yours respectfully, EDWARD RYAN,
President.

The stock is held in Hancock, Chicago, Milwaukee, Cleveland, and St. Louis. The officers are: Ed. Ryan, President, Hancock, Mich.; August Mette, Secretary and Treasurer, office Hancock, Mich.

THE ALBANY AND BOSTON MINE.

This is one of the mines of which large anticipations were held. The company called in assessments to the amount of \$840,000, which, in addition to the money derived from the sales of copper produced, was all expended, very largely in surface improvements.

For upwards of twelve years the mine has been idle, until last summer—1881—parties having secured an option for the purchase of the entire estate, began the work of re-opening the mine, and have since regularly prosecuted mining work.

The estate comprises Sec. 8, except the S. W. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ and the N. $\frac{1}{2}$ of Sec. 7, and N. $\frac{1}{2}$ S. E. $\frac{1}{4}$ and N. E. $\frac{1}{4}$ of S. W. $\frac{1}{4}$ of Sec. 7, and the N. W. $\frac{1}{4}$ Sec. 9, and N. $\frac{1}{2}$ of Sec. 11, and E. $\frac{1}{2}$ N. E. $\frac{1}{4}$ Sec. 10, T. 55, R. 33,—in all 1,720 acres.

The mine openings are in the W. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of Sec. 8, and commence a few hundred feet east and north from the west quarter post. There are four known lodes crossing the property. The most westerly one being the Pewabic, passes near the quarter-post between Secs. 7 and 9, and running N. 40° E. The east belt is the conglomerate, and crosses about 300 feet north of the section corner—Secs. 7 and 8.

Two hundred feet to the west is the epidote lode, the one opened on the Mesnard. Midway between the Conglomerate and the Pewabic is the Albany and Boston amygdaloid lode, on which the first mining began on this location; but the work was afterwards transferred to the conglomerate, in which they are now working.

The mine on the conglomerate was opened with four shafts, two of which extended down to the 1st level, and No. 1 and No. 2 to the 3d level. The 1st level was drifted 1,800 feet; the 2d level about 1,000 feet, and the 3d level about 600 feet. The dip is 52° to the northwest, and the length of the lode on the property is 5,100 feet. It is a wide belt, corresponding exactly in character to the Allouez—hard and compact, with many large boulders of feldspathic rock, and occasionally copper boulders, which are very rich.

The belt is underlaid with sandstone about 6 feet in thickness, which latter

rests on a bed of amygdaloid trap. The shafts and levels were made in the sandstone.

Years ago, some of the rock taken to the Huron stamp mill was found to yield 4% of copper, and this result was the basis of high expectations, which were doomed to disappointment when a more general average was obtained. The yield fell to 1.30 per cent.

The parties now operating the mine are Messrs. C. M. Wheeler, of Marquette; J. H. King, James Dolby, of Cleveland; and W. A. Dunn, of Houghton. Their option is renewed to February, 1883, and is \$5 per share—\$100,000. They claim to have already been offered \$100,000 for their chance, besides payment for all the expenses to which they have been.

They commenced regular mining work in November last, and employ about 30 men. They are sinking No. 1 and No. 2 shafts, and the rock which is hoisted is very good, indeed; certainly a 3 or 4 per cent. rock, and it could be selected to a much higher percentage. But the past history of the mine shows that it is well to be cautious. The old company found rich places and held high hopes therefrom, and the good ground through which they are now pushing may not continue.

The large rock-house at No. 1 shaft is the first one built "on the Lake," and is provided with breakers and other machinery, but far less conveniently arranged than are other and later structures.

The stamp mill was burned some years ago, and the timber is now being got out, etc., for erecting another mill. They have contracted for a Ball head, 16-inch cylinder, guaranteed to stamp 200 tons per day. The washers will be on the Collum plan, only no wood will be used—all iron except the launders. The situation of the mill will be about 1,500 feet southeast from the mine. There will be a limited supply of water, but they expect to use it over, pumping it up into the mill and running it back into the pond.

A Burleigh compressor has just been erected to operate two Rand drills, one in each shaft. They are now sinking to the 4th level. The hoisting engine is 24x48 inches; also runs the pump.

A shaft has been started at about 1,550 feet to the east, to strike the Calumet and Hecla lode. The Mineral Range Railroad runs through the property but a short distance from the mine. The location is about midway between Hancock and Calumet.

The capital stock is \$500,000, divided into 20,000 shares. The present holders of the property have not yet organized a new company, but are operating as an association. Capt. W. A. Dunn is directing the operations.

THE OSCEOLA MINE.

This mine has a record for good management, perseverance, and the accomplishment of a large amount of mining work that ranks it second to no mine in the district. It is but four years since work was begun on the amygdaloid belt, and during the first year and a half scarcely anything was done beyond exploration: it was then determined to prosecute mining on this lode vigorously; the preliminary work had proved sufficiently favorable to lead to this decision, so that for two and a half years the work has been pushed, resulting in the opening of a mine to an extreme depth of 850 feet, and to an extreme length of 2,250 feet. There are 4 shafts and 9 levels. No. 1, the most northerly shaft, is down to a depth of 850 feet, and No. 2 is nearly to the 8th level, or 750 feet. No. 3 is down to the 7th level, or 600 feet, and No. 4 is down to the 6th level,

450 feet. All these shafts are connected by drifts in the levels to which they reach except No. 4, which is connected with No. 3 at the 2d and 4th levels.

It is a difficult mine in which to push openings; the lode is so broken up and so full of perplexities—contorted, twisted, bunchy, pockety, rich in places only.

Bars of trap frequently occur; long stretches of utterly barren ground intervene between the productive portions, and it taxes the skill of the miner to avoid the lean and hungry places and to reach enough of the good to keep up the product—to avoid mistakes, which are expensive, so as to secure the maximum of product at the minimum of cost.

The mine shows great original disturbances in the lode, distorted laterally and downward. The shafts preserving their uniform, straight course, are anon in the hanging, and then in the foot wall, and in the lode.

The drifts, following the hanging wall, present all the sinuosities of a stream meandering its tortuous way through the meadow, while upward through the stopes the warped surface has every possible direction—sometimes a vertical wall, when suddenly bending; it becomes a roof, showing in different places every possible angle from 90° to the horizontal, and again in places becoming an arch, bending until it nearly touches the foot wall, and then starting upward it perhaps makes again a similar wave.

In passing along the drifts we observe long stretches of barren ground, left standing, and come suddenly upon open chambers which have been worked out, or upon a body of rich ground which is yet to be stoped; possibly one upon which the stopers are at work.

Sometimes through the barren blocks long sinuous “pipes” have been opened, having been made by following up and extracting the included productive rock. But with all the perplexities the work goes steadily forward. The men are distributed through the mine so that there is no interference or hindrance; each party works to the general result; the openings are made. The ground is stoped down, hoisted, and sent to the stamps, and the result is uniformly the same—the same number of tons in the same period of time.

In going through the Lake Superior mines, one who has an acquaintance with mining work can understand, perhaps, how so much money may be wasted by unfortunate mistakes and injudicious planning in the underground work, but in the Osceola blunders were eliminated in advance; it is not easy to see how the work could be better planned or executed.

Heretofore two mines have been worked, the one first opened in the Calumet and Hecla conglomerate, and the one in the amygdaloid. The former, however, has been yearly becoming circumscribed until now nothing remains but the cleaning up in the upper levels.

Below the 3d level this mine is already filled with water, and by the first of May next those above will be completely scammed and the total abandonment of the mine will follow.

The Conglomerate Mine has enabled the Osceola to keep up its product with the hoisting, and working up a less amount of rock than will hereafter become necessary, owing to the greater richness of the Conglomerate lode, but the results of the past year show that the product will be kept up. Since the copper obtained in 1881 exceeds in amount the yield of the preceding year. It took more rock to produce it, but the cost was greatly reduced. Less copper was obtained per ton of rock, but it was obtained at a less cost.

The figures of mining cost herewith given will be found interesting and

valuable, and are obtained from the books of the company through the liberality and kindness of Capt. Daniels.

A fact of possible importance connected with the interests of the mine is the discovery of an intermediate belt between the conglomerate and the amygdaloid. This fact was ascertained by the Calumet and Hecla Company, in driving a cross-cut, in their mine, to the Osceola amygdaloid. At about 650 feet an amygdaloid belt was reached, which is said to be promising. The Osceola Company have since driven a cross-cut 150 feet to intersect this bed, and purpose to explore it, and if sufficiently favorable, to mine it. This cross-cut is in the 9th level.

The respective depths of the shafts have been heretofore given; the distance which each one has been sunk during the year is as follows:

	Feet.
No. 1 shaft has been sunk in the past year.....	199.1
No. 2 “ “ “ “ “ “ “	242.20
No. 3 “ “ “ “ “ “ “	91.6
No. 4 “ “ “ “ “ “ “	269.8

The shafts in the Operchee, which are to the south, have been sunk within the past year:

	Feet.
No. 1 is below the surface.....	411.9
No. 2 is below the surface.....	249

No. 1 shaft, below the 6th level, continues good, being in the foot wall 130 feet, 20 feet below the 8th level, where a change occurred in the dip; but the lode preserves a good average width, though variable in quality. There seems to be a reasonable certainty of going down in good ground.

The 8th level north of No. 1 is 14 feet wide and of good character, but the same level south does not prove so satisfactory, the lode here being not above 6 feet in width.

The 7th level north of No. 1 shaft has been very good, but has been found to possess less than an average width, being seldom more than 10 feet wide. In the same level south of No. 1 is better ground than any other found in the mine, for the distance thus far opened, some portions being unusually rich and the lode wide.

In stoping upwards the lode rapidly narrows, and becomes lean; it is thus inferred that the larger portion of this rich deposit will be found in the back of the 8th level.

The 6th level, north of No. 1 shaft, has opened up, apparently good, having a good width and carrying a fair percentage of copper. The level south of No. 1 shaft, after passing the first 120 feet, showed poor and narrow; the prospect in this part of the level is the reverse of encouraging.

In the 5th level, north of No. 1 shaft, bars of poor ground were frequently encountered, but a portion of it pays for stoping; the width is sometimes not above 6 feet, and the stopes run poor, as they rise 30 feet or 40 feet above the bottom of the level.

Some exploration was done in extending the 4th level north from No. 1, but it resulted in nothing favorable.

In No. 2 level, north of No. 1, but little work has been done; the ground shows poor, and ventilation is poor.

In No. 1 level, north of No. 1 shaft, work has continued without interruption; the breast now is narrow, but fairly good.

The sinking of No. 2 shaft has at no point shown the hanging wall of the lode or revealed anything of value. Recently in this shaft they cross-cutted

at the 7th level, through the lode to the hanging wall, and found 10 feet of lode between it and the shaft.

The 6th level south of No. 2 shaft proved poor for a distance of 200 feet; it was narrow and hard, but is now improving.

No. 3 shaft has not been pushed for want of pumping facilities.

No. 4 shaft has been generally sunk in the foot wall of the lode.

The best ground is now between No. 2 and No. 3 shafts. The poor ground seems to have a general inclination to the south; it has thus far proved to be very embarrassing. Three small engines are used in the mine for hoisting underground, the motive power being compressed air. The average mining force employed was 156 men, of whom 20 worked on the conglomerate. Twenty-four power drills were worked, one-half of which were used in the openings. In July last an additional compressor was added to the mining plant, a duplex Rand, 16x36 inches, and the rolling stock for transporting the rock to the stamp mill has been increased by the purchase of 1,141 new cars. The new compressor building is of stone, 36x46x16 feet. The pumping machinery from the conglomerate has been transferred to No. 3 shaft, and it will suffice for any depth.

A new rock-breaker 9x15 inches has been added, thus making the number 10 in all now in use. The rock house and machinery from the conglomerate will be transferred to No. 2 amygdaloid shaft. Several new houses have been built on the location; others painted and otherwise repaired.

At the stamp mill, which is at Hancock, a new boiler and condenser have been added, and a new force pump, to furnish the water for washing, is now being supplied.

No hand-drilling is now done; the two compressors supply all the power required for this work. In 1879 drilling was all hand work. In 1880 and 1881 it was done by power drills. The average cost for each of the three years is shown in the following table:

	1879.	1880.	1881.
Shafts cost per foot.....	\$25 38	\$18 67	\$15 22
Winzes cost per foot.....	11 14	12 36	11 39
Drifts cost per foot.....	10 42	10 11	8 66
Stoping cost per fathom.....	15 33	9 72	10 78

GENERAL EXPENDITURES FOR 1881.

	Expenditures.	Per cent. of expenditures.
Conglomerate Mine.....	\$31,287 82	073.22
Conglomerate rock-house.....	5,922 16	013.85
Amygdaloid Mine.....	227,681 41	532.90
Amygdaloid rock-house.....	19,767 16	046.26
Transportation.....	50,812 05	118.93
Stamping.....	70,895 24	165.93
Surface.....	7,966 44	018.71
Office.....	6,836 74	016.00
Incidental.....	6,069 23	014.20
Total.....	\$427,238 25	
Construction account.....	46,128 38	
Total expenditures.....	\$473,366 63	

The total number of tons of rock hoisted from the mine 190,060; number of tons stamped was 160,880; number of tons rejected, 29,180, which yielded 4,807,424 pounds of mineral, and smelted, gave 4,179,976 pounds of ingot copper, which sold for an average price of 10.23 cents per pound, making the aggregate receipts from sales of copper, \$427,238.25, delivered at the smelting works.

The yield of mineral per ton of rock was 29.88 pounds; the yield of ingot per ton of rock was 25.98 pounds.

No. of fathoms stoped on the Conglomerate belt, 1,106.03; price paid per fathom, \$12.74.

AMYGDALOID BELT, 1881.

No. feet of shafts.....	815.2
Price per foot.....	\$15 22
No. of feet of winzes.....	815.60
Cost per foot.....	\$11 39
No. of feet of drifts.....	4,671.20
Cost per foot.....	\$8 66
No. fathoms stoping.....	7,240.97
Cost per foot.....	\$10 78
Amount paid for sinking shafts.....	\$12,408 80
Amount paid for sinking winzes.....	9,292 87
Amount paid for drifting levels.....	40,479 72
Amount paid for stoping.....	78,173 12
Total surface expenses.....	7,966 34
Total construction expenses.....	46,128 38
Total number of tons of rock hoisted.....	190,060
Total number of tons of rock stamped.....	160,880
Total number of tons rejected.....	29,180

The cost per ton is itemized as follows:

Per cent. of refined copper to the rock stamped.....	01.29
No. pounds of copper from each ton stamped.....	25.98

	Cost.	Per cent of whole cost.
Mining cost.....	\$1,6096	60.612
Assorting and breaking rock:		
Rock-house expense.....	1596	060.11
Transportation cost.....	3158	118.93
Cost of stamping and washing.....	4407	165.93
Surface expense.....	0497	018.71
Office expense.....	0425	016.00
Incidental expense.....	0377	014.20
Total cost per ton of rock.....	\$2,6556	100

The following table shows the proportional cost of the underground work, calling the total underground mining cost unity:

	Per cent.
Underground contracts.....	57.86
Tramming.....	09.54
Timbering.....	07.48
Company per cent. of change house cost.....	06.89
Supervision.....	01.54

Mechanic labor.....	01.54
Drill sharpening.....	00.17
Hoisting and pumping.....	07.73
Supplies.....	03.31
Compressor cost.....	04.43
Total underground mining expense.....	100

Labor expense was 56 % of total underground cost; supplies cost 44 % of total underground expenses.

The product of the mine was 4,797,396 pounds of mineral, or 2,403 638-2000 tons, which, being smelted, yielded 87 130-1000 per cent., or 4,179,976 pounds of refined copper, for which, at about 17 76-100 cents per pound has been realized

The sum of.....	\$742,585 84
From sales of silver.....	2,694 25
From receipts of interest.....	8,894 96
Making gross receipts.....	\$754,175 05
Expenses at mine were.....	\$439,491 08
Other expenses were.....	88,178 99
Making total cost of copper.....	527,670 07
Leaving as mining profit.....	\$226,504 98
Deduct amount of constructing.....	46,128 38
Leaves as net profit.....	\$180,376 60
And balance of assets January 1, 1881.....	\$391,041 39
Less dividends paid in 1881.....	225,000 00
Leaves as balance of assets January 1, 1882.....	166,041 39
Leaves as balance of assets January 1, 1882.....	\$346,417 99

From which a dividend of \$50,000 was declared payable January 2, 1882.

No mine on the lake is more completely equipped than the Osceola. In respect to its plant and its arrangement for complete and economical working it is second to no other mine, and has few equals. If the company owned a railroad and could thus do its own transportation, this excessive cost, amounting to 1-8 of all its expenditures, could be reduced. The rock from the mine to the stamp mill on Portage Lake is transported over the Mineral Range Railroad, and cost the past year, as shown in the table previously given, 31.58 cents per ton, or about 3 cents per ton per mile; whereas, at the Atlantic Mine, operating its own railroad, the cost is 1.9 cents per ton per mile. That the mine is well managed no other evidence is needed than the fact that a mine requiring to be so extensively opened as does the Osceola, in order to obtain a rock that yields only 1½ per cent., is able to pay an annual dividend of \$225,000 to its stockholders.

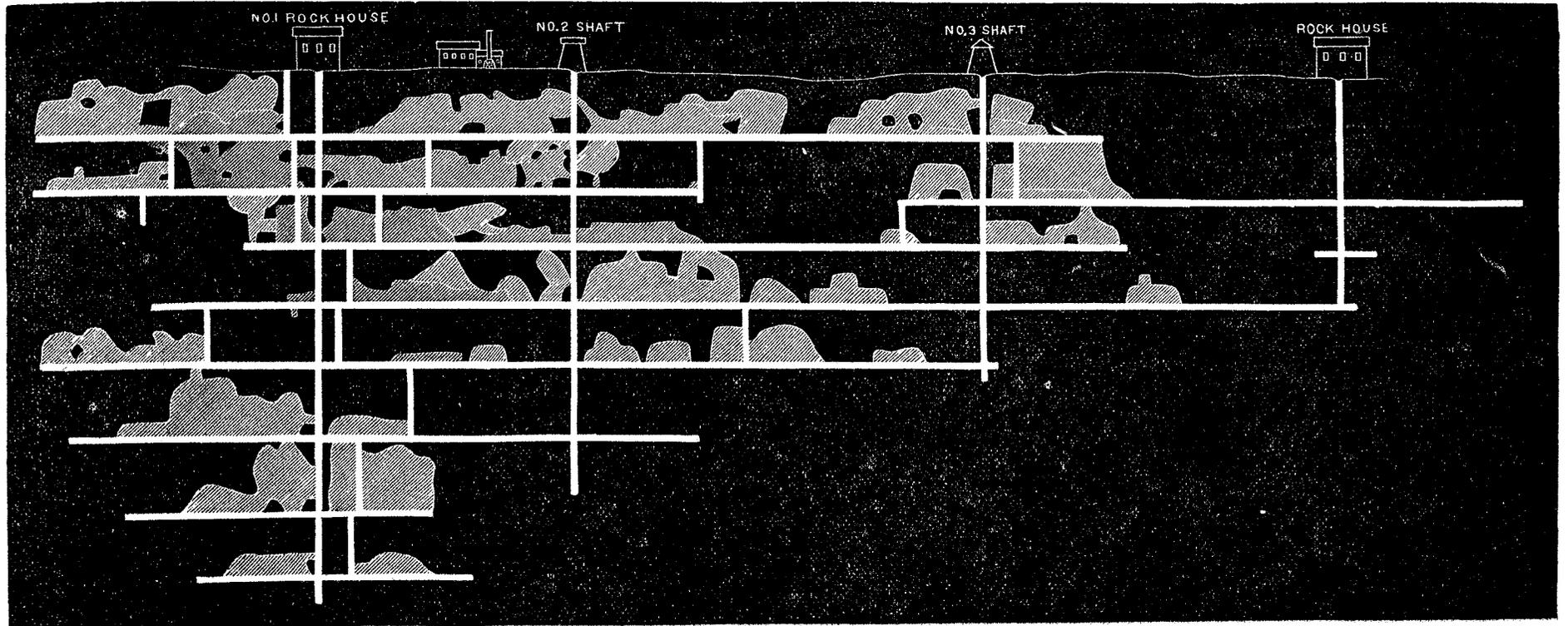
Capt. John Daniels, the agent, is everywhere regarded on Lake Superior as one of the most intelligent and thorough mining men that the country affords.

The capital stock is \$1,250,000, divided into 50,000 shares of \$25 each. The office is No. 178 Devonshire street, Boston. James D. Clark, President; A. S. Bigelow, Secretary and Treasurer. Total dividends paid to date, \$685,000.

The following figures will serve as comparison between the Osceola, the Quincy, and the Atlantic:

LONGITUDINAL SECTION OF THE OSCEOLA MINE (ON THE AMYGDALOID VEIN), 1882.

Scale, 240 ft. to one inch.



	No. tons of rock stamped.	Yield of copper. Pounds.	Yield per ton of rock. Pounds.	Per cent. of copper to rock.
Osceola.....	160,880	4,179,976	25.98	1.29
Quincy.....	98,869	5,702,606	57.70	3.13
Atlantic.....	176,055	2,528,009	14.36	0.718

	Cost per ton to stamp.	Mining cost per ton.	Net profit on business for the year.	Dividend paid, 1881.
Osceola.....	44	\$2 65.56	\$180,376 60	\$225,000
Quincy.....	72.30	2 73	466,438 39	440,000
Atlantic.....	42.54	1 75	82,952 55	80,000

Without power drills and giant powder it would have been impossible for the Osceola to have continued work, much less have made a profit. By employing these great forces they are enabled to push forward their openings 1,000 feet per month, and to do it at one-half the expense it formerly required. A few years ago it cost the Osceola \$25 per foot for sinking and drifting; now it costs but \$12. Formerly it cost \$7 per ton for stoping rock. The directors once passed a resolution requiring Capt. Ryan to bring the cost to \$5 per ton; now it costs but \$2.65 per ton. Hercules powder and air drills have accomplished this; but it is also due in part to the fact that men accomplish more now than formerly. They are required on their contracts to push things; it is known what they can do, and they must do it, or they will fail to get contracts. Formerly when men got a good contract they would take it easy; work but a few hours at a shift, and get about the same done as if they had a poor contract and had to work harder.

THE CALUMET AND HECLA MINE.

The heavy machinery which the Calumet and Hecla Company has been adding to its mining plant, or rather which is to substitute that heretofore used in the Calumet Mine, is all in place and nearly ready to work. The monster engine is estimated at 4,700 horse power, and has an ordinary working capacity of 2,700 horse power. It is designed to work the shafts in the Calumet Mine, both man-engines, the two great pumps, and the compressors. The compressor and hoisting machinery for the Calumet Mine are in the same building with the large engine, constructed for the purpose. The pumping and man-engine machinery are placed in a separate building, standing south of the first, and the boilers are in a building to the east. All these structures are of stone and brick, etc. The new boilers are each 38 feet long and 8 feet diameter, and are steel. The mine has 11 shafts, 5 in the Hecla and 6 in the Calumet Mine. Six of these are down to the bottom level—the 27th—a length on the lay of the lode of one-half mile. No. 5 shaft, in the Calumet, is only down to the 23d, and has heretofore been used as a ventilating shaft, but as the mine is extending in that direction it will be fitted with a skip-road and be used hereafter, in hoisting. In the lower levels the drifts are extending toward it. No. 3 and No. 4 shafts are down to the 9th and 19th levels respectively, and are connected. The main copper ground inclines downward to the north.

A sufficiently full description of the mine is given in the Commissioner's Report of 1880, and there is little more to add. The additional statistical information obtained is so meagre as to be of but little value. The dip and trend of the lode are remarkably uniform, so that the drifts in the lode are very regular; the lode is all stamp rock, and the amount hoisted and treated is about 1,200 tons per day, having been somewhat increased through the introduction of steel skips and the enlargement of the pulleys from 6 feet diameter to 9 feet.

The hanging wall is very insecure, requiring for its support an excessive amount of timbering. Getting these timbers down into the mine consumes much of the working time of the shafts, and in a measure limits the amount of rock hoisted.

The estate comprises 1,720 acres in Secs. 13, 14, and 23, T. 56, R. 33, being all of Sec. 23 and all of Sec. 14, except the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$, owned by the Tamarack, and on which that company has begun to sink its vertical shaft. In Sec. 13 the Calumet and Hecla owns 520 acres, the remaining 120 acres belonging to Messrs. Loring, Palmer, and the heirs of Wm. B. Frue.

It is stated that the Calumet and Hecla has recently contracted for the purchase of this land, agreeing to pay therefor the sum of \$1,250,000, or nearly \$10,417 per acre. The land is said to have cost these parties, some years ago, the sum of \$20,000. Since that purchase, however, the workings of the Calumet and Hecla mine have sufficiently demonstrated the fact that the lode continues in all its richness beneath this land. That such an apparently enormous price should be asked and paid for a limited piece of wild land that has no possible value beyond that derived from the supposed existence of a deposit of conglomerate lying 2,000 feet beneath its surface, illustrates the wondrous richness of this great mine.

But a better illustration is the fact that the mine pays a regular quarterly dividend of \$500,000, and occasionally increases it with an extra, and has paid in all, within the past 14 years, the total net sum of 21,350,000.

Everything about the Calumet and Hecla is done on a scale commensurate with the greatness of the mine, and as the mine has an assured future of continued richness, the buildings and machinery, etc., are intended to endure for a long time to come. The expense does not seem to be much of a consideration; durability and magnitude are the chief requisites. A large machine shop, fully supplied with machinery for making all kinds of repairs is provided, an immense shop for sharpening drills, etc., paint shop, etc., and a new stone building for the machinery used in the manufacture of the electric light employed in the mines.

It is claimed that the machinery at the Calumet and Hecla excels that found at any other mine in the world, particularly the Hecla and the Calumet engines. The former is a compound Leavitt engine, 1,000 horse power, which does the hoisting in the Hecla Mine, and also runs the double compressor. The power is applied by means of wire rope transmission, running over immense, winding drums, of which there are four, in the same building with the engine; they are each 25 feet in diameter and 7 feet face.

The cylinders, high pressure, are 23 $\frac{3}{4}$ inches in diameter, and the low pressure 36 inches, with 6 feet stroke. The 3 boilers that furnish the steam are of steel, each 38 feet long, 8 feet diameter. This machinery, so intricate, so powerful, working so silently, has a marvelous beauty, and is well worth a journey to see. At present there are in use on the location, all told, 16

engines, and the object of the powerful engine now being put in, is to displace some of those smaller engines, and let one do the work of many. The weight of the big engine is given at 700,000 pounds. The cylinders are respectively 5 feet 10 inches and 3 feet 6 inches diameter. The engine is said to be the largest stationary engine in the world, and cost \$100,000.

In the stone building south of the new Calumet engine house, the cost of the machinery is given at \$500,000. It is not easy to see the necessity of such ponderous pumping machinery in a mine that makes so little water as does the Calumet and Hecla.

About the mine have grown up the villages of Calumet and Red Jacket, which have a population of about 6,000 persons, all of whom are directly or indirectly supported by the mine.

The lode extends on the Company's property, across two sections, 23 and 14, on a bearing of N. 39° E., and dipping 38° northwesterly. The mine commences at the south line of the property, and extends north 5,700 feet; further north the value of the lode is doubtful, since on the Schoolcraft, the next mine joining it on the north, the lode proved nearly worthless; 4,200 feet in length of the ground that is opened, is considered first-class, yielding 20 pounds of copper to the ton of rock. In addition, 800 feet to the east, the company has the Osceola amygdaloid belt, which they have just tapped by a cross-cut, and also intermediate between it and the conglomerate, was crossed a heretofore unknown amygdaloid lode, which seems to be equally promising as the Osceola. This cross-cut, extending from the 9th level, will be continued to the east line of the property in order to prove the ground; the distance will be about 2,100 feet. As in the Atlantic Mine, no rock is rejected except such as falls out from the hanging wall, which latter amounts to about two per cent. of the whole. The lode is all taken down, leaving only an occasional pillar; in width it varies from 8 feet to 16 feet, and in texture is compact and hard. It is like a quarry; the slope is a very advantageous as well as a uniform one, and the levels are laid out with the utmost regularity.

The Calumet and Hecla so far overshadows all other mines in the copper district, in its expenditures, in its receipts, in the richness of the mine, in the out-put of copper, and in the greatness of its profits, that there is no comparison to be made between it and the others. A course of operations and expenditures that would speedily swamp any other mine on the lake, can be undertaken by the Calumet and Hecla without the least concern; its profits will be sure to meet all costs, and still leave enough for enormous dividends.

Of the 24,689 $\frac{1}{4}$ tons of refined copper reported from the Lake Superior mines in 1880, over 15,837 $\frac{1}{2}$ tons were the product of this one mine; and of the total amount of 301,053 $\frac{3}{8}$ tons obtained from all the mines since the advent of this industry in that country, up to the same year, 126,558 3-5 tons have been obtained from the Calumet and Hecla in a period of thirteen years.

Of the \$2,805,000 of dividends paid to stockholders by the Lake Superior copper mines in the past year, \$2,000,000 were paid by this company alone; and of the total dividends paid by Lake Superior copper companies to December 31, 1881, amounting to \$32,370,915, more than two-thirds, or \$21,350,000 has been paid by this single company.

The Calumet and Hecla is one of the world's phenomena. There is no other such an uniformly rich deposit anywhere. The other Lake Superior companies, by the best of management and the closest economy, can just

manage to exist. Some of them congratulate themselves on being able to make a small dividend, under favorable circumstances, but this great mine need take no thought of economy; in fact, as compared to its neighbor, the Osceola, it apparently does not. It ships its thousands of tons annual product, and returns as regularly to its stockholders its millions in dividends. Rich in the present and assured of the future, it is no wonder that its shares are a coveted possession.

The capital stock is at the limit allowed by the State law—100,000 shares, par value \$25, though the latest market quotations give the actual value to be \$245 per share, thus making the market value of the mine \$24,500,000.

The officers are Alexander Agassiz, President; Chas. W. Seabury, Secretary and Treasurer: Office 67 Milk street, Boston, Mass. J. N. Wright, Agent; John Duncan, Assistant Agent, Calumet, Mich.

THE CENTENNIAL.

Lying adjacent to the Calumet mine, on the north, is the Centennial,—formerly the Schoolcraft. It will be remembered as described in a previous report that the earlier company worked very zealously for success in the Calumet and Hecla conglomerate; but the extension of the lode on this property proved so utterly worthless that the company, after a few years' struggle, was entirely ruined. Its experience was a valuable acquisition to the country, but an expensive one for the stockholders.

The property comprises the S. E. $\frac{1}{4}$ of Sec. 12, T. 56, R. 33.

In 1876 the property was bought at bankrupt sale, and the organization of a new company decided upon, to be called the Centennial. In the latter part 1880, work was begun by the new company on the Osceola amygdaloid. Two shafts were started 660 feet apart, and the work of opening another mine was begun, and has since been pushed along with reasonable activity.

The two shafts have been connected at the first level, and in addition have driven south from No. 2, 120 feet, making about 780 feet of drifting done in the first level.

No. 2 shaft is down to the 2d level, and they have drifted from it north and south, each way, just far enough to sink to the 3d level. North from No. 2, a winze is sinking to the 2d level, and also south from the same shaft in this level, a winze is sinking to the 2d. Four or five air drills are at work, and they are able to make about 80 feet per month. A Burleigh compressor, one that was on the ground, is employed, but it is the intention to replace it with a Rand duplex.

There are two hoisting engines which operate the shafts, and one of them, in addition, works also the pump, and the other the compressor, the power being applied by wire rope transmission.

In drifting they follow the hanging wall. The lode is bunchy—in one place where they have drifted across it, it shows a width of 24 feet. No stoping has as yet been done, the work being devoted to opening the mine and repairing the buildings, etc. The stamp mill is being put in order. It stands near the highway which runs north through the property, and was supplied with water through a launder from a dam across Calumet Creek. The capital stock is \$1,000,000, divided into 40,000 shares, 20,000 of which were sold to provide the working capital.

It is the intention of the company to cross-cut to the new amygdaloid bed,

cut by the Calumet and Hecla Company, which should lie about 250 feet to the east. The expenditures thus far have been \$55,000.

The officers are: S. L. Smith, President; A. W. Jackson, Secretary and Treasurer, New York. Wm. Harris, Acting Agent, Houghton. Joshua Hostin, Mining Captain.

THE TAMARACK MINING COMPANY.

One of the most interesting projects lately undertaken on Lake Superior is that begun by the Tamarack Mining Company, which company was organized in January, 1882, with a capital stock of \$1,000,000, divided into 40,000 shares. The company is an offshoot of the Mineral Land Company, and the latter has set off to the Tamarack 1,280 acres of land, in Secs. 10, 11, 14, 15, being the N. $\frac{1}{2}$ and the N. $\frac{1}{2}$ S. W. $\frac{1}{4}$, and N. E. $\frac{1}{4}$ S. E. $\frac{1}{4}$ of Sec. 15, and the S. W. $\frac{1}{4}$ and W. $\frac{1}{2}$ S. E. $\frac{1}{4}$, and S. E. $\frac{1}{4}$ of S. E. $\frac{1}{4}$, and N. E. $\frac{1}{4}$ of N. E. $\frac{1}{4}$ of Sec. 10, and W. $\frac{1}{2}$ of E. $\frac{1}{2}$ S. E. $\frac{1}{4}$ and S. E. $\frac{1}{4}$ N. E. $\frac{1}{4}$ Sec. 11, and W. $\frac{1}{2}$ S. W. $\frac{1}{4}$ Sec. 14, T. 56, R. 33.

The company has begun the work of sinking a vertical shaft, near the southeast corner of the property; that is, near the S. E. cor. of the W. $\frac{1}{2}$ S. W. $\frac{1}{4}$ of Sec. 14, giving a length of lode between the south and east boundaries of the 80, where it will be intersected by the downright shaft of about 500 feet. The work is in charge of Capt. Daniels, of the Osceola. In fact the men who are at the bottom of the enterprise are the same parties who control the Osceola—J. D. Clark, Erastus Corning, etc.—and represent a large capital. The plan of the Tamarack Mining Company is to go down with a vertical shaft. At a depth of about 600 feet this would tap the "Allouez conglomerate," and easy cross-cuts would prove that lode several hundred feet deeper than it has yet been seen, and admit of the rapid opening of an extensive mine. This alone, as a mining venture, would deserve careful consideration.

Underlying the Allouez lode, and between it and the Calumet conglomerate, which will be reached at a depth of 2,100 feet, are a series of amygdaloid beds or lodes, which have not been examined in the county of Houghton, except at the surface. Some of these in Keweenaw county are copper-producing.

The fact that a valuable amygdaloid lode was most unexpectedly encountered in the Calumet and Hecla Mining Company's cross-cut, east, at the thirteenth level, lends an importance to this enterprise. After reaching the Calumet conglomerate less than 600 feet of sinking will expose the Osceola amygdaloid. A system of cross-cuts, with modern mining facilities inexpensive and expeditious, would, from the depth last named, make available about 1,800 feet in length of the most productive copper lode in the world.

The Osceola amygdaloid is now proved to be an important and profitable copper producer, and it should be noted that the Calumet and Hecla Mining Company, in cross-cutting to reach this lode, made the discovery before alluded to, thus proving the existence of an important, and at the point of discovery, rich lode, which also dips into this property. Consequently the Tamarack Mining Company will have placed in its hands the opportunity of working three of the best known and defined belts of the country, to say nothing of those on which, comparatively, no examination has before been made.

The Tamarack land on which the lode is sinking "corners in" on the Calumet and Hecla. The shaft is started as far east as practicable, so as to strike

the lode as near the surface as they can reach it. After reaching the lode they can then work down on the incline of the deposit, which, dipping to the northwest, will give constantly additional length as they go down.

The following interesting paper on the undertaking by the Tamarack Company is prepared by Capt. Daniels, for the Report of Commissioner of Mineral Statistics:

"The Tamarack is one of the most interesting, and perhaps important undertakings ever commenced in the copper region of Michigan.

"It is not to be wondered at that the extension of the Calumet conglomerate beyond the limits of that mine should receive attention, for there can be but little question but that this lode will yield more profit in the aggregate than any other vein or lode yet opened in the United States. The Schoolcraft on the north, and Osceola on the south of the Calumet and Hecla, on the same lode, were neither of them permanently successful. The Osceola got a mere taste of the conglomerate productiveness, and the Schoolcraft less than that. The Tamarack, however, takes the dip of the lode from the Calumet and Hecla Mines, and if the copper-courses are continuous, must encounter them. The extent of the territory is ample, and is so situated that it surrounds the main part of the Calumet and Hecla Mines.

"In working the Calumet and Hecla the position of the Frue 80 acres interferes with the sinking of the Hecla shafts, Nos. 3 and 4. A continuation of these shafts on the plane of the lode to depths of 3,500 and 3,800 feet, respectively, will strike the Tamarack lines. No. 2, Hecla, will run nearly 4,400 feet deep, and those further north deeper proportionately, but all will, if sunk, run into the Tamarack. Those furthest north will run deep, but it must be remembered that the Calumet and Hecla is the result of about 16 years' work, and that the 28th level has been reached at a depth of over 2,500 feet on the plane of the lode. This, notwithstanding the fact that the region profited very little either by drilling machinery or the use of high explosives, except in the last five years. On the matter of progress in opening mines one should rather look for further improvement than expect any retrogression.

"The owners of the Tamarack recognize these facts, and believing that the lode can be as easily followed, perhaps more easily followed from perpendicular shafts than by the system hitherto in vogue, they have inaugurated what may be termed a new departure in the copper region, namely, to sink a perpendicular shaft about 2,000 feet deep, and strike the Calumet conglomerate on the same horizon as the Calumet and Hecla Mine reaches when it is 3,500 feet deep.

"The regular mode of working the bedded deposits is to uncover the outcrop, and after cribbing up a shaft on same angle of inclination through the overlying sand, sink on, or follow the lode bed, or belt in its dip with the strata, of which it is an integral part. These shafts are found on inclinations varying from 25° to 54° from the horizon, those at and around Calumet dipping at about 37° to 38°.

"It is easy to see that under these circumstances a much shorter outlet to a mine is attainable by sinking a perpendicular shaft than by following the inclination of the bed worked. Whether other considerations can be as easily met will probably be determined here. The local management of the Tamarack do not hesitate to speak in the affirmative.

"Stepping into the coal regions of this and other countries, and noting shafts deeper than this now proposed, with openings from them extending miles underground, and we conclude that there is nothing new in this undertaking

that has not been successfully met before. For deep sinking the copper region affords advantages rarely met elsewhere. But little water permeates through the rock after a depth of 300 feet is reached, and the increase in temperature is not very apparent in the deepest mines.

"The consideration first with the Tamarack Company is that they have no other means of access to the mineral deposits that underlie their property, so that unless this mode of working is carried out, they could only realize from those which outcrop on the Calumet Mine, by selling to that company. Some of the inducements for retaining these lands are worthy of notice.

"The working length of the Calumet and Hecla, old mine, is not much, if anything, short of a mile. The South Mine, near the Osceola, when developed, will probably exceed half a mile in length, with every prospect of the ore bodies uniting before the South Mine is as deep as the principal part of the mine is at this time. The giving out of the copper in depth has not received serious consideration, and as the rock now treated in the stamp mills of the Calumet and Hecla is of better average yield than formerly, it may be assumed that up to this time the reason for doing so has not become apparent. If the copper holds down the Tamarack gets it. It has continued down 2,500 feet, and less than another 1,000 feet will reach the line that separates the two properties. The risk then is reduced to a small one, and the chances, as we shall see, are large.

"It would be difficult, for lack of data, to speak of the business of the Calumet and Hecla in a particular way, and we further feel that it would be out of place here to do so, but sufficient has been made public to throw a good deal of light on the Tamarack's chances, and these we would merely glance at, confining statements to inside figures.

"The Calumet and Hecla Company divides \$2,500,000 among its stockholders, and the very important improvements of late years would absorb a further expenditure of \$500,000; for the machinery erected is of the most costly character, while it seems large enough to reach any required depth. The receipts then, beyond running expenses, would be, say \$3,000,000. The amount of rock treated in the stamp mills does not exceed 1,000 tons per day, say 370,000 tons yearly. $\$3,000,000 = \$9\frac{1}{2}$ as profit obtained per ton of rock.

"Admit that the price of copper averages high compared with a few years ago, and set the profit at \$8 per ton of rock treated. When it is understood that the Atlantic and the Franklin Mines earn less than \$1 per ton on rock treated, the Osceola less than \$1.50, and the Quincy Mine, in her most prosperous year, less than \$4 per ton, and then on about one-third the quantity of rock, it will be seen that the effort to get a share of those unusual (in copper) profits, is promoted by very strong incentives.

"It would be safe to assume that the rock from the Calumet and Hecla Mines produces from 4% to 5% of ingot copper,—say the less named. A cubic fathom of conglomerate would then produce 1,600 pounds of copper, worth at 15 cents per pound, \$240. Assume that the lode or bed is 8 feet thick—it is probably more—it will then afford for each 40 acres, 80,000 fathoms, or 1,600,000 tons of rock, equal to five years output as at present from the Calumet and Hecla Mines, and \$15,000,000 of profit, if it is practicable to extract the copper as economically as they have been doing.

"Without intending any reflection on the Tamarack management we will say that the working of 40 acres of their property should yield a profit of

\$10,000,000, assuming, of course, that the lode bears its regular size and character for productiveness in the tract worked.

"In running over these figures one cannot but be impressed with ideas that there are indications of extravagance about them; but the statements made are borne out by results in the past, and there is no reason at present to look for less favorable returns than have been made. It may be that this will assist in comprehending more fully the capabilities of the Calumet conglomerate, but it is only put forward to show what the possibilities are for the Tamarack.

"The new shaft will encounter many of the lodes of the country, prominent among them the Allouez, which will be cut at a depth of about 500 feet, and many are of opinion that here it will be highly productive."

COPPER INDUSTRY STATISTICS.

TOTAL DIVIDENDS PAID BY LAKE SUPERIOR COPPER COMPANIES IN 1881.

Companies.	Dividend.	Total to date.
Atlantic.....	\$80,000	\$260,000
Cliff.....	2,000,000	2,227,860
Calumet and Hecla.....	60,000	21,350,000
Central.....		1,664,000
Copper Falls.....		100,000
Franklin.....		240,000
Minnesota.....		1,920,000
National.....		319,255
Osceola.....	225,000	385,000
Pewabic.....		460,000
Phoenix.....	440,000	20,000
Quincy.....		2,810,000
Ridge.....		100,000
Ogema.....		15,000
Total.....	\$2,805,000	\$32,370,915

STOCK QUOTATIONS.

The following table shows the stock quotations in Boston, of Lake Superior copper mines for several years past, taken from Martin's Stock Reporter:

ANNUAL REPORT OF THE
LAKE SUPERIOR MINING COMPANIES.

Lake Superior Cop- per-Mining Com- panies.	Dividends. When paid.	1878.		1879.		1880.		No. of shares.	Assessed per share, total.	
		Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.		Jan. 1881.	Jan. 1882.
Allouez.....		50c	4	3	10	2 1/4	27	80,000	13.75	14.75
Atlantic.....				12 1/2	13	12 1/2	29 1/2	40,000		
Aztec.....				1		2 3/4		40,000		
Calumet & Hecla.....	{ \$5 Fe. \$15, M'y, } { Aug., Nov... } \$3 Feb.; \$3 Aug...	174 1/2	185	170	295	200	260	100,000	12.00	12.00
Central.....		27	35	24	43 1/2	35	52	20,000	5.00	5.00
Copper Falls.....		%	3 1/2	12 1/2	8 1/2	5	20	20,000	38.50	42.50
Copper Harbor.....								20,000		
Duncan (silver).....		7	7	2 1/2	7	1 1/2	5 1/2	60,000	5.00	5.00
Franklin.....		5	8	4	31	18 1/2	50	40,000	16.00	16.00
Huron.....								3	15	40,000
Madison.....								1	3 1/2	40,000
Mesnard.....				1 1/2	5	1	5	20,000	8.50	8.50
Minnesota.....				2 1/2	5 1/2	2 1/2	9	20,000	21.80	22.30
National.....				1	7 1/4	1 1/2	7 1/2	40,000	3.00	10.00
Osceola.....	{ \$1 1/2 Jan. 1, \$1 1/2 } { Apr. 30, \$1 1/2 } { Oc., \$1 Jan. '82 }	9	17	10	35	30	48	50,000	17.60	17.60
Pewabic.....		1	2	20	40	11 1/2	69 1/2	40,000	21.25	21.25
Phoenix.....		5	10	5	6 1/2	1 1/2	16	40,000	38.00	39.00
Quincy.....	{ \$5 Feb. 15, \$3 } { Aug. 22 }	10 1/2	41 1/2	10	33 1/2	22	46	40,000	10.00	10.00
Ridge.....		1	2	75	9 1/2	3	10	20,000	20.00	20.00
Silver Islet.....		1 1/2	54	20	65	11	55	40,000	2.50	4.50
Star.....				1 1/2	2 1/2	1	5	40,000	14.25	14.25
St. Clair.....				25	1 1/2			40,000		

LAKE SUPERIOR MINING COMPANIES.—Continued.

Lake Superior Cop- per-Mining Com- panies.	1881.												1882.
	January 1.	Jan. 1 to April 1.		April 1 to July 1.		July 1 to Oct. 1.		October 1.	Oct. 1 to Jan. 2.		January 2.		
		Low.	High.	Low.	High.	Low.	High.		Low.	High.			
Allouez.....	5 1/2	3	5 1/2	3	2	3	2	3 1/2	3	4	3 1/2		
Atlantic.....	19 1/2	12	19 1/2	12	12	15.06 1/2	12	11	17 1/2	14	18		
Aztec.....	1 1/2	1	1 1/2	1	75c	1	1	50c	75c	50c	50c		
Calumet & Hecla.....	258 1/2	235	258 1/2	239	201	245	230	210	232 1/2	220	239		
Central.....	42 1/2	34	44	34	28	34	30	30	29	30	30		
Copper Falls.....	16 1/2	8 1/2	16 1/2	8 1/2	5	10	5	2 1/2	6 1/2	4	5 1/2		
Copper Harbor.....	50c	50c	50c	50c			50c	1	1	3	25c		
Duncan (silver).....	4	3 1/2	4 1/2	3 1/2	2	3 1/2	2	50c	2	50c	56 1/2 c		
Franklin.....	18 1/2	12	18 1/2	12	10 1/2	14	11	10 1/2	13 1/2	12	15 1/2		
Huron.....	6 1/2	3 1/2	7 1/2	4	50c	4 1/2	3 1/2	3 1/2	3	3	4 1/2		
Madison.....	1 1/2	1	1 1/2	1	50c	1 1/2	50c				75c		
Mesnard.....	1 1/2	1 1/2	1 1/2	1 1/2	50c	1 1/2	50c	1	1		75c		
Minnesota.....	4	2 1/2	4	2 1/2	2	2	2	2	2	2	2		
National.....	2 1/2	75c	2 1/2	75c	25c	2 1/2	2	2	2 1/2	2 1/2	3 1/2		
Osceola.....	38 1/2	35	40	35 1/2	30	35 1/2	32	28 1/2	32	29 1/2	33		
Pewabic.....	24 1/2	16	25	17	10	18	11	10 1/2	15 1/2	13	17		
Phoenix.....	3 1/2	2 1/2	3 1/2	2 1/2	1 1/2	2 1/2	2	1 1/2	2	1 1/2	3		
Quincy.....	44	31 1/2	45 1/2	31 1/2	31 1/2	38 1/2	36	32	40	38 1/2	51 1/2		
Ridge.....	7	4	7	4	3	4 1/2	3	3	4 1/2	3	4 1/2		
Silver Islet.....	34	27	40	27	25	48	45	30	47 1/2	30	41		
Star.....	2 1/2	1 1/2	2 1/2	1 1/2	1	1 1/2	1				21		
St. Clair.....	3 1/2	3 1/2	3 1/2	3 1/2			3				75c		

INGOT COPPER.—Monthly Lowest and Highest Prices for a Period of Eight Years.

YEARS.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.		YEAR.		
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Average.
1874.....	91 1/2	95	91 1/2	95	94 1/2	94 1/2	94 1/2	94 1/2	95	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2
1875.....	92 1/2	93 1/2	92 1/2	93 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2	92 1/2
1876.....	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2	93 1/2
1877.....	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2	94 1/2
1878.....	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2	95 1/2
1879.....	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2	96 1/2
1880.....	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2	97 1/2
1881.....	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2	98 1/2

Lake Superior Copper-Mining Companies.—Monthly Products.

MONTHS AND YEAR.	CALUMET AND HECLA.		QUINCY.		OSCEOLA.		FRANKLIN.		PEWABIC.	
	1879-80.		1880-81.		1881-82.		1880.		1881.	
	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	Tons.	lbs.
May.....	1,411	1,086	1,713	1,928	1,764	1,919	140	1,505	135	485
June.....	1,336	1,388	1,727	1,898	1,763	1,898	132	1,041	130	730
July.....	1,307	1,051	1,672	1,699	1,685	1,817	139	1,059	130	85
August.....	1,379	879	1,701	1,645	1,818	1,839	141	1,776	131	95
September.....	1,444	1,649	1,684	1,881	1,612	1,487	131	90	131	705
October.....	1,446	482	1,750	822	1,722	1,560	124	179	134	465
Six months.....	8,405	339	10,250	928	10,317	10,70	709	46	792	480
November.....	1,617	320	1,655	1,804	1,646	1,89	115	812	128	230
December.....	1,757	1,253	1,703	1,870	1,703	1,870	141	485	130	59
January.....	1,757	1,587	1,632	2,071	1,632	2,071	160	375	138	575
February.....	1,519	951	1,435	1,835	1,435	1,835	172	1,204	135	72
March.....	1,733	1,64	1,710	1,496	1,710	1,496	150	413	140	520
April.....	1,701	972	1,881	1,797	1,881	1,797	150	140	140	140
Year.....	18,405	1616	20,200	1137	19,81	1947	1,598	1,335	1,623	1,864
Per cent.....	77.32		77.86		85.21		81.68		82.81	
Ingot.....	14,277	1,425	15,797	1,900	1,690	1,061	1,805	1,683	1,344	1,656
do lbs.....	28,555,425		31,555,900		3,881,061		4,213,423		2,611,683	

(b) Mill running only a few days.

(c) Quincy: Mill not running in February, 1880, and only 14 days in January.

† Not official.

STATISTICS FROM VARIOUS SOURCES.

The following extracts, from mining journals, relating to the copper industry, are introduced:

CENSUS REPORT ON THE COPPER INDUSTRY.

Until the Chilian copper fields rose into importance, the world depended on Cornwall for this mineral. In 1842 some Buffalo hunters discovered a rich mine in the Lake Superior region, which has yielded thousands of tons of copper. At present the world's production of copper is about as follows:

Chili and Peru, 34,000 tons; United States, 25,500 tons; Australia, 14,500 tons; Russia, 5,600 tons; England, 5,200 tons; and all other countries 19,000 tons, making an aggregate of 103,800 tons. The United States is the second copper-producing country in the world, and the census of 1880 will show that we produced over 25,500 tons of copper, or to be more exact, 51,091,188 pounds. This amount of copper would make a cube, whose edge would be $45\frac{1}{2}$ feet, or, in other words, would cover 25.9 acres with a sheet one inch thick. The copper product has increased since the census of 1870, 116.41 per cent. in weight and 70.25 per cent. in value, the fall in price per pound, according to Prof. Pumpelly, being almost exactly accounted for by the rise in the value of the paper dollar. In 1870 the Lake Superior region produced 83 per cent. of the entire product; in 1880 it attained 89.71 per cent.

A curious fact, tending to show the increased skill in copper mining, and the extensive introduction of steam power and improved machinery, notably the drills driven by compressed air, is brought out by this inquiry. Though the product has increased 116 per cent., the number of employes has increased only 13.7 per cent., while the capital has increased 303 per cent., the horse power of the steam engines 119 per cent., and the consumption of material 136.5 per cent. The gain in production per hand is 90 per cent. The same labor which in 1870 produced 4,387 pounds of copper now produces 8,344 pounds.

The following table from the census report shows the copper product of the United States for 1880 in pounds of ingot copper, and the value of the products.

	Product pounds of copper.	Value of Product.
Michigan.....	45,820,202	\$7,979,232
Maine.....	83,080	10,115
Maryland.....	164,640	1,200
Missouri.....	230.77	25,730
North Carolina.....	1,640,000	350,000
Pennsylvania.....	476,508	5,630
Tennessee.....	Not reported.	
Vermont.....	2,747,894	469,495
Wisconsin.....	18,087	1,549
Colorado.....		
Arizona.....		
Idaho.....	5,764,460	Not reported.
California.....		

The production of the extreme western states and territories (Colorado,

Arizona, Idaho, California), as far as received by the census office, is 5,764,560 pounds, or 11.28 per cent. of the amount produced in the eastern districts. Eleven new mines in Maine, Maryland, and New Hampshire, report the employment of 162 men, the payment of \$31,985 wages, and 7,650 for material consumed. They have spent \$658,570 for machinery, dead work, etc., but have produced no ingot copper. The returns from this class of mines are not included in above table. The value of the plant in Michigan is placed at \$5,275,185, and all copper mines in the United States at mineral produced which valued, depends, of course, on the averaged price of copper during a term of years, and on the expectation of productive life for each mine, is placed at \$24,116,300 in Michigan, and \$24,517,164 for the entire country, and total capital at \$30,417,551 for Michigan, and \$31,675,096 for the United States. As compared with the iron ore mining industry copper employs 80.53 per cent. less hands, uses 60.61 per cent. less value material, and represent 48.61 per cent. of the capital. The product of copper is worth 38.98 per cent. of value of iron ore mined, but it costs 39.92 per cent. as much in labor to raise it. The average monthly wages in copper mining is 49.98, against \$32.26 in iron ore mining, in addition to which the miner has the great advantage of more continuous employment. Copper mines involve the employment of skilled and high-priced labor.—*P. L. Gazette.*

A FACT THAT SHOULD NOT BE FORGOTTEN.

The mines of one county of Michigan—that in which this paper is published—have divided more money among their stockholders, during the eight months ending August 31, than the mines of any other single state or territory in the whole union. The dividend record of the Houghton county copper mines for 1881 stands as follows:

Calumet and Hecla.....	\$2,000,000
Osceola.....	225,000
Quincy.....	440,000

The copper mines of Houghton county, saying nothing whatever of the copper-producing industries of Keweenaw and Ontonagon, and the iron mines of Marquette and Menominee—have paid \$720,000 more than those of California; \$393,750 more than those of Colorado; \$1,310,000 more than those of Dakota; \$1,670,000 more than those of Montana; \$697,475 more than those of Nevada; \$1,539,000 more than those of Utah.—*Northwestern Mining Journal.*

The sales of mining stocks in New York for the week ending Saturday, February 18, amounted to 1,311,887 shares, in which not a single share of Lake Superior copper or iron mining stocks was included. Lake Superior mines paid their shareholders over \$6,000,000 in dividends during 1881, while all the gold and silver bonanzas of the east, west, north, and south, whose shares are the favorites with the Gothamites, paid only \$13,229,318. The mines that paid the Michigan dividends have an aggregate capital stock of less than \$9,000,000; those that paid dividends in other parts of the country have a capital stock amounting to millions.—*Northwestern Mining Journal.*

The New York Daily Stock Report of the 17th ult., gives a list of gold, silver, and copper mining companies in Arizona, California, Dakota, Maine, Nevada, and North Carolina, which have levied since January 1, \$1,921,900 in assessments, and collected, since their organization, a grand total of \$75,360,680. This total only, recollect, includes mines that have levie

assessments since January 1, 1881. Of the entire list, embracing 93 companies, 11 have paid dividends amounting to \$83,058,000, of which \$74,444,000 were paid by the California and Consolidated Virginia, which are now considered "busted bonanzas." Deducting the total assessments from the total dividends, it appears that the net surplus divided among stockholders has been \$7,698,000, or a little over ten per cent. on the capital collected by assessment.

Look on that picture and then on this: The Michigan copper mining industry, from its beginning in 1844 to the present time, has required in its development less than \$22,000,000, and has paid in dividends very nearly \$32,000,000, or about \$10,000,000 more than the entire capital invested.—*Northwestern Mining Journal*.

MICHIGAN METALS.

A comparatively small, narrow part of the State of Michigan, skirted its whole extent on the north by Lake Superior, and on the south, in large part, by Lakes Michigan and Huron, and known as the Upper Peninsula, in little more than a quarter of a century, has contributed to the realized mineral wealth of the country nearly \$300,000,000 in ingot copper, pig iron, and iron ores. Of this immense product the iron mines have furnished nearly \$130,000,000. Last year the copper product was in value about \$10,000,000, and the iron about \$18,000,000, making a total of \$28,000,000, while the promise for 1882, both for copper and iron, is that the product will be greater. A pretty good showing for a strip of wilderness, and there is to-day more iron in sight than ever before, more new mines than old ones, and more iron territory remaining to be opened and explored than has been explored up to this time, three acres to one.—*Mining Record*.

Five copper mines of Michigan have paid 36 96-100 per cent. of the total dividends distributed by 32 companies engaged in mining in ten states and territories; and 27 mines of all descriptions, in other states than Michigan, have paid 63 4-100 per cent.

From the beginning of mining operations in the Lake Superior copper region up to date, very nearly \$32,000,000 have been paid in dividends, from the earnings of mines all but one of which are to-day actively working, and most of them in better condition to produce copper than ever before in their entire history. There is in their several treasuries a surplus aggregating about \$5,000,000; their outlook at depths ranging from 500 to 2,700 feet is excellent; their product, as hitherto shown in these columns, was greater, with one exception, in 1881 than ever before in one twelve month; they have paid on a total paid up capital of \$6,261,000, dividends amounting, in exact figures, to \$31,899,742, an amount more than one-third greater than the total sum expended in the development of all the copper mines ever worked on Lake Superior, or more than 152 per cent. on the entire outlay.

The above is a brief history of the development of the Lake Superior copper district, so far as such development has occasioned an outlay of dollars and cents, and been productive of substantial returns. It is a plain statement of facts—a record that can challenge comparison with that of any other mining district in the United States.—*Northwestern Mining Journal*.

COLORADO GOLD VS. LAKE SUPERIOR IRON AND COPPER MINES.

There is still a large difference in favor of the Lake Superior iron mines, or rather iron mining companies. Referring to a statement made by the Chicago

Times that 17 Colorado mines, with an incorporated capital of \$63,700,000 had returned to shareholders \$3,141,750 (about 5 per cent.) in 1881, the Hancock Mining Journal says:

"Compare the aggregate capital of those 17 mines and the dividends paid thereon, with the capital of the undermentioned Lake Superior copper mines and the dividends paid by the same on the earnings of 1881.

	Capital stock.	Dividends.
Calumet and Hecla.....	\$2,500,000	\$2,000,000
Atlantic.....	1,000,000	80,000
Central.....	500,000	60,000
Osceola.....	1,250,000	225,000
Quincy.....	1,000,000	440,000
Total.....	\$6,250,000	\$2,805,000

"Dividends in one year equal to 40 4-10 per cent. on the aggregate capital stock of five companies."

The Mining Journal can name three iron mining companies doing business in this Upper Peninsula with an incorporated capital of \$2,100,000, whose net earnings in 1881 were greater than those of all the gold and silver mines of Colorado. And yet we presume the Times item was published with a view of inducing the investment of more capital in Colorado mining! The showing is bad enough as it is; what would it be if the whole truth were to be stated, by giving a list of the hundreds of Colorado mines in the working of which millions have been expended, and from which shareholders have never received a single cent in return. There is no such dark side to the Lake Superior picture.—*Marquette Journal*.

CALUMET AND HECLA.

The Calumet and Hecla stands at the head of the world's mining enterprises, having paid more in dividends, in proportion to the investment, than any other mine of ancient or modern times. Twenty millions and a half in property and plant, on an investment little, if any, more than one million, is a record never beaten—never equaled, or likely to be. Neither California nor Australia, with their gold, nor Nevada or Colorado, with their silver, come near the pride of the copper region, and it is just now in bonanza again, having found the amygdaloid to reinforce its conglomerate wealth.

Operations on the manganese lode, near Copper Harbor, have been suspended for the present. Mr. McCandless, of Pittsburg, a part owner in the industry, and also representing the interests of others, arrived at Copper Harbor on the 17th inst., and will settle all accounts of the mine to date. A majority of the owners deem it advisable to make further investigations as to the value of the ore before proceeding further. The ore produced carries considerable copper and they are afraid it may be difficult to separate the one from the other.

Mr. J. F. Bennett, under whose direction the work has been conducted thus far, has been east for the past month, but is expected back soon. On his return he may decide to resume work at once. He is very sanguine as to the ultimate success of the enterprise, and does not anticipate trouble in separating the copper from the manganese.—*Hancock Journal*.

A CHEERFUL VIEW OF THE BUSINESS OF MINING.

The unusual care with which mining properties are now examined before purchase, and the cautiousness of the investor, although in marked contrast to the condition a few years ago, indicates one of the most healthful and beneficial states of public sentiment for those who have properties truly valuable. Although the enthusiastic prospector, with a few samples in his pocket, who who has been dreaming of the hundreds of thousands of dollars that can be secured for his claim, may be rudely awakened upon his arrival in the eastern market, yet every true friend of the mining industry must see, in this return to the basis of business, a most hopeful sign for the future of mining, and the certain investment of intelligently directed capital in its direction. Mining has rapidly and successfully passed a number of trying periods, all of which were dangerous to its best prosperity and development, but each one has brought its sterling character and real worth before the people in a clearer and better light, until it is now generally understood that mining investments and mining developments in the direction of production is the only legitimate line of activity, and that all the intelligently directed effort to this end has ever proved substantially and permanently profitable. We confess that the people have paid a large price for the wisdom they have learned, but it is valuable knowledge now they have obtained it.

Mining, under all the disadvantages and obstacles, natural and artificial, that have been thrown around it, through all the epochs of excitement, ignorance, and mismanagement, dishonesty and speculation, has at last revealed a place where it is beginning to be better understood and comprehended in its true light than ever before. A mine and a farm are found to be much alike in regard to the object of improvement and development, which is production. Bread and bullion, the two great motors of human activity, the two strong staffs of life, do not grow ready made. Both are the result of time, capital, labor, and intelligence, hence their real worth and value. Men are beginning to perceive this fact, and are returning from their expensive chase after a glittering *ignis fatuus* to find that mining is a plain, substantial, solid, and permanent reality, partaking largely of the character of the enduring rock and eternal mountains which generally surround the repositories of mineral wealth. Readjusted to a working and business basis, mining may be robbed of much of the romance and gorgeousness with which it has been clothed by ignorant and designing persons; it will lose much of its speculative and uncertain aspect, but every true friend of this colossal industry will rejoice to see all those false and deceiving trappings torn away, so that mining may stand in her own rude and simple raiment upon the solid rock of truth, a giantess of strength and power, a stern but beautiful queen, magnificent in the grandeur and wealth of her mighty kingdom, in which new states and massive industries will be born, to grow and flourish in the sunshine of a perpetual prosperity.—*Mining Review*.

STATISTICS OF THE PRODUCTION OF THE PRECIOUS METALS IN THE UNITED STATES.

The plan followed by the Census Bureau has been to try to secure individual returns; but many causes tend to render this method a difficult one. It was found to be impracticable to do more than obtain returns from the larger producers. In some instances, well-based and careful estimates were sub-

mitted by experts, covering aggregates of a large number of small mines for whole districts.

Even with greatly increased facilities, says Mr. King, there were many gaps in the testimony, which had to be filled out by estimates derived from other data than those collected directly by the experts. Where such estimates have been applied in the tabulation, they have been indicated by an asterisk (*). In all cases a careful scrutiny has been exercised in the selection and comparison of material. It is believed, in view of the more extended and fuller details accessible, as compared with previous researches of the same nature, that the results reached in this compilation are as close an approximation to absolute accuracy as it is possible to attain without a far greater expenditure of money and time than the subject demands.

The total product of each State and territory, including the silver contents of placer gold, appears in the accompanying table, which shows the aggregate bullion output of the United States for the census year.

The figures given in the table are of assay values, and are therefore considerably higher than the actual market value. Disregarding express charges, commissions, and cost of refining and coining, there is still a large deduction to be made for this discount, in estimating the cash value of the bullion to the producers. Assuming the gold to have brought on the average \$20 per troy ounce and the silver \$1.12½ per troy ounce, the cash received would have been \$32,394,794 for the gold, \$35,772,160 for the silver, and \$68,166,954 total. The loss to the miners, as compared with the full assay value, would therefore have been \$984,869 on the gold, \$5,338,797 on the silver, and \$6,323,666 altogether, or about 1-34 of the full gold-coining value, over ½ of the nominal silver value, and over 1-12 in all, during the single census year. While there is no regular discount on gold, the large amount of placer gold sold at an undervaluation renders the average price assumed a probable one. The price for the silver is an estimate of average local rates for the year.

The bullion product of the deep mines of the United States for the year under review amounted to 35 tons 900 pounds avoirdupois (1,033,974.6 ounces troy) of fine gold, and 1,087 tons 900 pounds avoirdupois (31,717,297) ounces troy of fine silver. That of the placer mines weighed 19 tons 1,824 pounds avoirdupois (580,736.6 ounces troy) in fine gold, with which were alloyed 2 tons 1,498 pounds avoirdupois (80,177.3 ounces troy) of silver. The total weight of fine bullion was no less than 55 tons 724 pounds avoirdupois (1,614,741.2 ounces troy) of gold, and 1,090 tons 398 pounds avoirdupois (31,797,474.3 ounces troy) of silver. These huge figures may be better grasped, perhaps, by considering that the gold represents five ordinary carloads, while a train of 109 freight cars of the usual capacity would be required to transport the silver. Historians have stated that during the early Spanish occupation whole galleons were freighted exclusively with silver from the mines of Mexico and Peru. This would hardly seem to be an exaggeration, in view of the fact that the present annual product of the United States would suffice to form the full cargo of a large modern vessel.

In addition to the returns received directly from the mines, there are several minor points to be included in the total yield. A larger item than it is usually considered to be is the annual hoarding of rich specimens. This is not accounted for in the mine production as reported. While it is impossible to state the actual amount thus absorbed with any degree of precision, a

careful estimate would place the value of the gold nuggets and ore annually added to the cabinets of collectors at not less than \$150,000, and that of the silver ore at about \$50,000. This, in view of the great number of mineral collections maintained throughout the mining territory, is certainly not an over-estimate.

There is also quite an extensive manufacture of gold quartz into jewelry and souvenirs, particularly in San Francisco. The value so absorbed probably does not fall short of \$50,000 annually. In 1870 the United States Mining Commissioner estimated the amount of gold hoarded as specimens or worked up by local jewelers at \$400,000. The same authority, at that period, estimated the annual loss of gold dust in handling as currency at \$100,000. As the practice of using dust for money has almost disappeared, the amount so lost is now very small.

Another indefinite quantity is the value of precious metal lost in melting, in assay grains, etc. Summing up the estimates for these additional items, the following result is reached:

	Gold.	Silver.	Total.
Bullion product shown in preceding tables...	\$33,379,663	\$41,110,957	\$74,490,620
Estimated value of specimens hoarded.....	150,000	50,000	200,000
Estimated value of gold quartz made into jewelry and souvenirs.....	50,000	-----	50,000
Estimated value of gold dust lost in handling as currency.....	10,000	-----	10,000
Estimated loss in melting and assaying, assay grains, etc.....	20,000	10,000	30,000
Total.....	\$33,609,663	\$41,170,957	\$74,780,620

DIVIDENDS PAID FROM AMERICAN MINES IN 1881.

Name of Company.	Location of mines.	Amounts paid.
Ætna, silver, lead.....	Colorado.	\$66,667
Alice, silver.....	Montana.	400,000
Black Bear Quartz, gold.....	California.	24,000
Bonanza Developing Company, silver.....	Colorado.	135,000
Boston and Montana, gold.....	Montana.	200,000
Brown and Urton, silver.....	Nevada.	8,333
Bulwer Consolidated, gold.....	California.	10,000
Calumet and Hecla, copper.....	Michigan,	2,000,000
Catalpa, silver, lead.....	Colorado.	120,000
Central, copper.....	Michigan.	120,000
Consolidated Gold Mining Company of Georgia, gold.....	Georgia.	32,000
Copper Queen, copper.....	Arizona.	150,000
Christy, silver.....	Utah.	24,000
Chrysolite, silver, lead.....	Colorado.	500,000
Deadwood-Terra, gold.....	Dakota.	480,000
Dunkin, silver, lead.....	Colorado.	110,000
Eureka Consolidated, silver, lead.....	Nevada.	225,000
Evening Star, silver, lead.....	Colorado.	500,000
Exchange, silver.....	Nevada.	15,000
Father De Smet, gold.....	Dakota.	200,000
Gagnon, silver.....	Montana.	5,000

DIVIDENDS PAID FROM AMERICAN MINES IN 1881.—Continued.

Name of Company.	Location of mines.	Amounts paid.
Gem, nickel.....	Colorado.	\$3,750
Glass-Pendery, silver, lead.....	Colorado.	25,000
Gold Stripe, gold.....	California.	67,500
Grand Central, silver.....	Arizona.	200,000
Great Western, quicksilver.....	California.	25,000
Green Mountain, gold.....	California.	109,375
Hecla Consolidated, silver.....	Montana.	90,000
Hibernia, silver, lead.....	Colorado.	120,000
Hom Lake, gold.....	Dakota.	360,000
Horn-Silver, silver, lead.....	Utah.	300,000
Idaho, (Grass Valley), gold.....	California.	263,500
Indian Queen, silver.....	Nevada.	51,500
Inyo Consolidated, gold.....	California.	40,000
Iron Silver, silver, lead.....	Colorado.	500,000
La Plata, silver, lead.....	Colorado.	180,000
Leadville Consolidated, silver, lead.....	Colorado.	20,000
Moore Mining and Smelting Company, silver, lead.....	Colorado.	36,000
Morning Star, silver, lead.....	Colorado.	75,000
Napa Consolidated, quicksilver.....	California.	90,000
Navajo, silver.....	Nevada.	25,000
New York Hill, gold.....	California.	100,000
North Belle Isle, silver.....	Nevada.	15,000
Northern Belle, silver.....	Nevada.	387,500
Oetario, silver.....	Utah.	800,000
Osceola, copper.....	Michigan.	225,000
Plumas, Eureka, gold.....	California.	135,468
Plumas Mining and Water Company, gold.....	California.	7,500
Polonia, silver.....	Michigan.	12,000
Quicksilver, preferred, quicksilver.....	Nevada.	396,945
Quicksilver, common, quicksilver.....	California.	128,446
Quincy, common.....	California.	320,000
Richmond Consolidated, silver, lead.....	Nevada.	788,292
Rising Sun, gold.....	California.	25,875
Robert E. Lee, silver, lead.....	Colorado.	50,000
Robinson Consolidated, silver, lead.....	Colorado.	400,000
St. Joseph, lead.....	Missouri.	60,000
Sierra Buttes, gold.....	California.	78,125
Silver King, silver.....	Arizona.	300,000
Silver King, silver.....	Colorado.	50,000
South Yuba Water and Mining Company, gold.....	California.	120,000
Spring Valley, gold.....	California.	50,000
Standard Consolidated, gold.....	California.	975,000
Starr-Grove, silver.....	Nevada.	120,000
Stormont, silver.....	Utah.	20,000
Tip Top, silver.....	Nevada.	100,000
Tombstone, silver.....	Arizona.	600,000
Vizina, silver.....	Arizona.	80,000
Western (Contention), silver.....	Arizona.	775,000
Yuba, gold.....	California.	8,000
Total.....		\$15,034,776

Total amount paid by gold mines.....	\$3,286,343
Total amount paid by silver mines.....	4,213,333
Total amount paid by silver and lead mines.....	4,015,959
Total amount paid by copper mines.....	2,815,000
Total amount paid by quicksilver mines.....	640,391
Total amount paid by lead mines.....	60,000
Total amount paid by nickel mines.....	3,750
Total.....	\$15,034,776

Amounts paid by mines located in the States and territories are as follows:

Arizona.....	\$2,105,000
California.....	2,654,734
Colorado.....	2,903,417
Dakota.....	1,040,000
Georgia.....	32,000
Michigan.....	2,665,000
Missouri.....	60,000
Montana.....	695,000
Nevada.....	2,035,625
Utah.....	844,000
Total.....	\$15,034,776

Bullion Product of the United States for the Year Ended May 31st, 1880.

STATE OR TERRITORY.	DEEP MINES.						PLACER MINES.						ALL MINES.						
	Gold.		Silver.		Total.		Gold.		Silver.		Total.		Gold.		Silver.		Total.		
	Ounces.	Dollars.	Ounces.	Dollars.	Dollars.	Ounces.	Dollars.	Ounces.	Dollars.	Dollars.	Ounces.	Dollars.	Ounces.	Dollars.	Ounces.	Dollars.	Dollars.	Ounces.	Dollars.
1 Alabama.....	62.9	1,301			1,301														
2 Alaska.....																			
3 Arizona.....	8,302.6	*181,066	1,708,732	*2,325,568	2,607,534	5,051	*321.4	51	5,002	287.9	1,301	5,961	5,961	287.9	1,301	5,961	5,961	287.9	1,301
4 California.....	414,577.7	8,569,039	8,569,039	1,682,619	9,651,658	1,451.2	*39,000	*108.5	9,651,658	1,451.2	8,569,039	10,120.0	8,580,882	52,804.2	8,633,686	10,120.0	8,580,882	52,804.2	8,633,686
5 Colorado.....	195,685.7	9,598,193	12,790,571	16,547,913	19,148,584	5,420.9	101,440	1,032.5	19,148,584	5,420.9	1,032.5	1,861	2,689,808	13,800,119.8	16,547,913	2,689,808	13,800,119.8	16,547,913	2,689,808
6 Dakota.....	197,459.3	3,254,084	94,577	70,963	3,328,657	2,664.3	30,839	193.1	3,328,657	2,664.3	193.1	239	5,065,843	31,770.1	70,963	5,065,843	31,770.1	70,963	5,065,843
7 Georgia.....																			
8 Idaho.....	29,923.4	606,069	347,676	449,510	1,048,519	3,234.9	60,863	230.6	1,048,519	3,234.9	60,863	15,040	1,473,663	33,369.1	461,550	1,473,663	33,369.1	461,550	1,473,663
9 Maine.....	445.1	2,959	3,569	5,720	8,289	10.999			8,289	10.999			2,959	3,569	5,720	8,289	10.999	2,959	3,569
10 Michigan.....																			
11 Montana.....	31,068.4	642,871	2,240,387	2,866,669	3,535,730	56,233.6	1,033,908	6,341.3	3,535,730	56,233.6	1,033,908	8,109	4,888,242	18,635,767	2,240,387	4,888,242	18,635,767	2,240,387	4,888,242
12 Nevada.....	234,050.0	4,838,243	9,614,239	12,430,239	17,288,432	2,418.7	*49,969	*331.3	17,288,432	2,418.7	*49,969	*428	4,888,242	9,614,239	12,430,239	4,888,242	9,614,239	12,430,239	4,888,242
13 New Hampshire.....	832.1	10,999	12,375	362,337	441,691				441,691				10,999	12,375	362,337	441,691	10,999	12,375	362,337
14 New Mexico.....	2,287.5	49,354	303,465	19,607	114,397	226.7	4,685	831.0	114,397	226.7	4,685	40	118,953	108.0	140	118,953	108.0	140	118,953
15 North Carolina.....	8,227.7	114,287	77	19,607	130,972	44,811.5	926,335	6,331.2	130,972	44,811.5	926,335	8,186	1,067,701	21,436.2	27,493	1,067,701	21,436.2	27,493	1,067,701
16 Oregon.....	8,239.8	171,363	6,499		6,499	916.4	*6,941	*43.3	6,499	916.4	*6,941	*96	13,040	43.3	56	13,040	43.3	56	13,040
17 South Carolina.....	314.4	6,499			6,499				6,499										
18 Tennessee.....	96.7	1,398			1,398				1,398										
19 Utah.....	13,158.0	271,687	3,665,433	4,742,915	5,014,563	967.5	*30,000	*132.5	5,014,563	967.5	*30,000	*171	291,587	3,665,433	4,742,915	291,587	3,665,433	4,742,915	291,587
20 Virginia.....	490.9	9,321			9,321				9,321										
21 Washington.....	812.7	16,800			16,800				16,800										
22 Wyoming.....	837.9	17,321			17,321				17,321										

* Estimated.

COPPER SMELTING WORKS.

One of the most important enterprises connected with the Lake Superior copper production are the smelting works at Detroit and Portage Lake. Both establishments belong to the same company, and the Detroit works were started contemporary with the origin of copper mining on the lake, and the operations of the company have kept pace with the growth of that industry. The operation of smelting copper began in Detroit in 1850, and its inauguration is due to Mr. John R. Grout, who has also, until his recent death, continued in the management of the business. A smelting house, reverberatory furnace and other fixtures were built. Without being smelted the copper would be of little avail. It comes from the mine in masses, or from the stamp mill in an impure state, the masses, barrel work, and stamp work being 90 % to 60 % copper. The masses are shipped in bulk, if too large to go into barrels; the smaller portions, including the particles from the washers and slime huddles are packed and sent in barrels. The barrels are graded according to the degree of purity of the contents, from 1 to 5; they are weighed at the mine, as are also the masses sent in bulk, and the weight of each and name of the mine stamped upon the package or mass.

At the smelting works the shipment, upon its arrival, is invoiced and credited to the company sending it, and is then smelted in the order of its receipt. Each package of stamp mineral is sampled for assay when it is opened to be put into the furnace. After it is smelted, the product is weighed and returned to the company. The smelting of the mineral of each mine is done by itself.

The melted copper is drawn off into moulds, the castings thus made being termed ingots, cake and bar. The terms indicate both shape and quality, and are made to suit the general use to which the metal is to be subsequently put. Ingot is used in making the several alloys of copper as combining it with tin, zinc, etc., while the cake and bar go to the rolling mills, etc., and are made into sheets and wire, etc., and used in the manufacture of the numberless articles to which this metal is especially adapted.

The smelting furnaces that were first employed were the Welsh reverberatory air furnace, and the common cupola blast furnace, the former being used for reducing the mineral, and the latter for separating the final copper from the slag; but as in all metallurgical processes the comparatively primitive methods and apparatus thus employed have undergone great changes. The quality of the product was below the standard desired, and a residuum of copper was also run off with the slag.

The reverberatory furnace was altered so as to convert the coal into gas, and then to ignite the gas by passing through it currents of highly heated atmos-

pheric air, the purpose being to attain a powerful and steady heat, and equally diffused throughout all portions of the burden, thus tending to produce a more uniform quality of metal.

The elliptical form was adopted for the cupola, with the usual blast furnace bosh, and as in the blast furnace the melting of the tuyère, and the too rapid cutting out of the hearth is prevented by the water pipes, which draw off the heat.

The works of this company are by far the most important in the country, and the company has done more to bring the business of copper refining to its present degree of perfection than all other similar works combined. The officers and operatives are skillful and experienced in the business, and the company has commanded large capital. The works at both places have been remodeled and enlarged from time to time as increase in the business, or changes and improvements required.

The Detroit works are situated on the Detroit river in that city, and comprise two large brick smelting houses, in one of which are two reverberatory furnaces, and in the other there are three. A suitable structure also contains two cupola furnaces with blowing engines, etc. The entire plant in this city covers six acres of ground, including the wharf, which is 250 feet in length. The capacity of the works here is 12,000 tons per annum. Another furnace is being added.

The works at Portage Lake, Hancock, were built in 1860. They occupy a narrow strip of frontage on the lake, between it and the Quincy hill, which rises up to the north. Here are two stone buildings, each one containing four reverberatory furnaces, and a building containing three cupola furnaces; also there are three additional reverberatory furnaces and one cupola. Besides these there are, of course, the engine house, machine shop, warehouses, offices, sheds, etc. These works have a capacity for smelting 28,000 tons of mineral per annum. In 1867 the works at the two places were united under one company, the Detroit and Lake Superior Copper Company.

It is probable at an additional cost, that the company operates works at two different points, but these works originally belonged to different organizations. Each point has its advantages, and at present there is but little, if any, difference in the cost of reducing per ton, between the two places. The following table shows the number of tons reduced by this company:

	Tons.
1855.....	2,895
1860.....	5,533
1865.....	6,631
1870.....	12,700
1875.....	18,019
1879.....	21,080
1881, at Portage Lake.....	25,000
1881, at Detroit.....	11,000

This company has long been identified with the Lake Superior copper interests, and during the past dozen years has smelted all the copper produced except a small amount, which is smelted at the works of C. G. Hussey & Co., of Pittsburg.

The officers are C. H. Carter, President, Waterbury, Conn.; F. J. Kingsbury, Secretary; Horatio Bigelow, Treasurer; J. R. Cooper, Manager.

The works of C. G. Hussey & Co., of Pittsburg, antedate those of Detroit by about two years. They were established at about the time the Cliff Mine began its operations, by Dr. Hussey and Dr. T. N. Howe, who were chief

owners in the Cliff. After some preliminary experimenting, these gentlemen in the spring of 1848, erected in Pittsburg, for the Pittsburg and Boston Company, two English reverberatory furnaces, similar to those used in Wales, for smelting copper—similar to that now used by Dr. Hussey, except that it is larger. These works now comprise one reverberatory furnace for the treatment of rich slag, and one ordinary cupola furnace, for the treatment of the slags from the reverberatory slag furnace. These works are conveniently situated to obtain coal, but are too far away from the copper mines. The only mineral now refined at these works comes from the Mass and adjacent mines.

LAKE SUPERIOR NATIVE.

The Lake Superior Native copper is an important business enterprise started at Hancock in September, 1880. The officers of the company are Ed. Ryan, President, Hancock; T. E. Stewart, Vice President; R. Uren, Secretary and Treasurer.

The works are known as the Rolling Mill, and the company are using 40 tons of copper per month in the manufacture of copper sheathing for braziers, locomotives, etc., and pressed copper bottom, etc. The company is meeting with all the success that was anticipated, and the business seems to be one of importance.

SLATE.

SLATE.

BAY SLATE COMPANY.

It will be remembered that the Huron Bay Slate Company, which began work in 1872, ended its career, as did also that of its neighbor, the Clinton Slate Company, in complete ruin. The panic came on soon after the companies were fairly started, which with previous unfortunate management, caused the disaster of what should certainly be a successful undertaking.

Subsequently the property owned by the Huron Bay Slate and Iron Company, the Clinton Slate and Iron Company, and the Superior Slate and Mining Company, was purchased by a party of gentlemen from Jackson and Lansing, Mich., who have organized the Michigan Slate Company, and transferred to it the lands and property formerly possessed by the three previously mentioned companies. This estate comprises 6,300 acres of land in T. 51, R. 31, and extends to the shore of Huron Bay. The capital stock is \$500,000, divided into 20,000 shares. Of this capital stock \$400,000 has been paid up, leaving \$100,000 to be called in as the needs of the company may require.

The officers are: James M. Turner, President, Lansing, Mich.; W. K. Prudden, Secretary and Treasurer; J. M. Turner, S. F. Seager, S. L. Smith, Lansing, Mich.; C. R. Knickerbocker, W. D. Thompson, Jackson, Mich., Board of Directors.

The new company began work at the quarry in the fall of 1881, and have thus far built a new stone engine house, and placed in it a 75-horse power engine, for hoisting and pumping; have built a small saw mill to obtain, for immediate use, the timber and lumber required for repairing the buildings and erecting new ones, etc. The tramway has been overhauled and repaired, and on a portion of the way heavier rails put down to replace those formerly used. The dock has been also rebuilt, and the quarries are supplied with modern slate tools and machinery. In fact a good degree of preparation has been made to get out a considerable product the coming year. The company claim to have orders from New Orleans to the Pacific for this slate, to be used in covering public buildings where first-class slate is required. The new State capital building of Texas is to be covered with it, and several other important edifices, including the new University Library building at Ann Arbor.

The slate is receiving high praise everywhere. Good architects and judges pronounce it the strongest, clearest in color, and the most durable of any produced in this country. Its cleavage planes are very true, so that the slates lie very perfectly and even, forming a smooth, durable roof.

There is no reason to doubt the existence of a practically inexhaustible

deposit of most excellent slate rock, so situated as to be readily mined and manipulated, and got into market as cheaply as can be done elsewhere.

The company is said to be composed of gentlemen who possess almost unlimited capital, and who are likewise thoroughgoing, practical business men, who are nearly certain to carry on the business successfully, and in the not distant future to make the Huron Bay Slate product one of the chief industries in the Upper Peninsula.

As it may be of public interest and value, the report of Mr. N. A. Litchfield, of Vermont, obtained through the courtesy of Mr. S. L. Smith, is here-with given:

CLEVELAND, O., June 17th, 1880.

MESSRS. WM. BINGHAM AND AMOS TOWNSEND, Trustees, CLEVELAND:

GENTLEMEN—Before expressing an opinion as to the merits of your Slate Property, I beg leave to say a few words in relation to my appearance in this case.

In the year 1874 I was visiting your city, and during my stay was called upon by T. J. Towson & Co. to pass my judgment upon some slate then on the dock, that but a short time previous had arrived from your quarry.

My impression of your slate at that time was not favorable except as regards color and metal, and I so expressed myself, and from that time, with the accounts I have received in relation to the progress made in developing, down to the present examination of the same, I was forced to believe the same opinion I entertained respecting the slate quarries of the east was applicable to your case, and it was with serious misgivings that I was induced by my friend Towson to enter upon a more minute investigation of your property and its advantages, and I should have declined the invitation tendered by you but for Mr. Towson's representing his friends were interested, and were desirous of obtaining the opinion of a disinterested person.

I consented to act, and though my opinion may or may not be in accord with your interests, of which I know nothing, whatever I may say in relation to the matter is after mature deliberation, a personal examination and careful investigation with the means at hand, and without fear of contradiction by any one of truth and experience.

Pretending a positive knowledge of what there is in this vein of slate would be foolishness on my part, but taking the surface indications as a guide, which govern every one in their calculations, I am enabled to form some opinion of its purity and greatness, and from the quarries now opened this opinion is strengthened by the knowledge gathered relative to the beds, joints, seams, cleavage, quality of the rock, course of the vein, dip of the stone, etc., and which opinion so nearly agrees with that of C. E. Wright, Esq., Commissioner of Mineral Statistics for the State of Michigan, that I am pleased to quote his words. After explaining the formation of slate in the Marquette district and the objection to it for practical purposes, he says: "In the Huron Bay district slate fully equal, if not superior to the best eastern slate has been found, and is now produced at two quarries. The slate formation in these quarries forms a wide belt and extends over a portion of the Huron mountains. It consists of several strata or narrow beds of good slate and slate rock. The cleavage or splitting planes of the slate dip very uniformly to the south; but the natural bedding is in broad anticlinal and synclinal waves which have a trend of nearly east and west, and a consequent dip to the south or north, as the case may be."

He then speaks of the "Huron Bay quarry and the expensive error made in its opening." I cannot quite agree with him in this, as I consider it was ignorance, as any man possessing a knowledge of slate sufficient to superintend a quarry should know the difference between the bedding planes and its cleavage. I make this statement as an expression of my belief that the property was worked at that time, and if I mistake not, has been since, by thoroughly incompetent managers; but I can readily understand Dr. C. Rominger's mistake in failing to discover the difference between the bedding and cleavage, when he visited the quarry, in the interest of the State, as State Geologist, relying as he did upon these men for information: but let me quote again from Wright's report, that you may notice the error, as he terms it.

"The bedding of the Huron Bay dips about 15° to the north, while the cleavage pitches about 30° south. In the Clinton the bedding dips about 12° to the south and the cleavage pitches about 30° to the south, or nearly conforms to the bedding."

From this you cannot fail to see the great difference in the two quarries, and note

the ignorance of the superintendent of the Huron Bay, at its opening. The cleavage of this rock I find to be true, excepting the bed in which are found what are termed ribbons. This bed is slightly harder than the others and liable to be bowingly inclined. Much of this stock could be worked advantageously in a mill, and by reasonable care could be turned into roofing slate, but from the appearance of the dumps has heretofore found a resting place there.

The joints and seams in the quarry are not regular, but fully up to the average of those in the eastern quarries, and from all indications, blocks of good size can be produced if less powder and more brains are assigned to the work.

Nothing can surpass the quality of the rock, and from my knowledge of slate rock throughout the country, I am safe in saying there is none equals it at the present time, as regards color or metal. The black slate of Maine, commanding \$6 to \$7 per square at the quarries, has not the color, but the quality is good. Vermont and New York have no black slate, and their green and purple slates, commanding \$2.25 to \$3.50 per square at the quarries, have not the confidence of architects and builders, as the color changes, and mars the appearance of a roof. Pennsylvania, the largest producer of black or blue slate, commanding \$3 to 3.50 per square at the quarries, is not in a position to furnish a slate, either in color or metal, equaling those I have seen at your quarries. Virginia, with her blue slate, commanding a price of \$5 to \$6 per square at the quarries, has not, unless recently placed on the market, a slate suitable for first-class work, on account of its thickness, uneven surface, and general make. California has yet to produce from her black quarries a slate larger than about 10 inches square, but the stock compares in color and metal favorably with yours. Canada, who cannot reach us on account of duty, can produce large quantities of blue slate, a small proportion being of good grade, but unlike yours in color or metal.

With these facts in view, and as the demand for black slate increases daily, while that for Vermont slate decreases, I can see no reason why the production of these quarries should not find a ready market.

In the examination of the thickness of this slate vein, at well as its length, I had not that time to devote to it I had wished, but commencing at the southwestern corner of Huron Bay, lot Sec. 33, thence to the east line, one-half mile, and from the south line of the lot Sec. 33 to Sec. 28, one half mile or more past Huron Bay quarry, I became fully satisfied of the quantity of slate, and with the advantage of having a ditch cut across the vein for some 500 feet or more, showing the rock, its clearness from flint, etc., I could not but feel impressed with its vastness and the years of labor necessary for its development. Here we have one-half mile in thickness and length of a slate vein, the like of which has never before been found in this country, and although this amount is sufficient for all practical purposes, I might add, it is stated by parties well informed, who have had more time to examine the ground than myself, that the vein has been traced for 1½ miles across it, and from the outcroppings seen by myself I should agree with them, which justifies me in asserting that its actual thickness is yet to be determined.

It is truly astonishing, and I return east satisfied in my own mind of your ability to produce sufficient slate for all the western country, and with the decided advantages you possess for low freights, quick transportation, etc., I do not hesitate to say it is but a question of time when Vermont and Pennsylvania will both have to look for a new outlet of their products.

To say much in favor of the work that has already been done there, I cannot, and I might at this point remind you of the expensive error in opening Huron Bay, and advise you that in any future working of your lands, it would be better to abandon this opening and start in another place at a comparatively small expense, when you understand that the successful working of the Huron Bay necessitates the removal of the larger part of the rubbish that has been made during its developments.

The Clinton having been opened to much better advantage is in a condition to produce much slate, the success of which depends upon men of experience, proper machinery, tools, facilities for shipping, and economy in all things.

The same judgment and discretion exercised in the working of your quarries, seems to have entered largely into the case of your houses, machinery, and in fact nearly everything there; even the tramway requires a small expenditure of money to make a continuous incline from the quarries to the Bay and put it in good condition, but with this accomplished, plenty of slate in the vein, produced at a fair price, made in a most approved manner, cheap freights and the business conducted on business principles, leads me to conclude that no field of enterprise in the Northwest

can offer better inducements for the safe investment of capital, with every indication of very large returns.

From this statement of mine, though simple it may be, I trust you will be enabled to form your conclusions of the value I place upon the property.

With this I am done, and it only remains for me to hope the day is not far distant when I shall learn of the opening up of the quarries and their success.

Yours obediently,

N. A. LITCHFIELD, *Hydenville, Vt.*

IRON MINES.

MARQUETTE DISTRICT, MAY AND JUNE, 1882.

THE JACKSON IRON COMPANY.

In the Commissioner's Report for 1880 the Jackson Company's mines are very fully described, and there is, apparently, but little to be said that would not be in reality a repetition of what has been heretofore stated. The experience of the past year at this great mine, embraces the same peculiar features that has characterized its record for many years, and what may be expected in the future. The mine is fruitful in surprises; however discouraging the outlook in any part of it may be, something favorable is sure to develop somewhere, perchance when least expected.

Captain Merry has so long been familiar with this location that he is never alarmed; he knows from experience that something will turn up, and that the explorations which he is constantly making by means of trial shafts, drifts, and cross-cuts, will result in finding the treasure which he seeks. He is familiar with the peculiarities of this contorted, twisted formation, and long familiarity has inspired him with faith in his ability to meet with and to overcome the difficulties which occur.

A year ago No. 7, the most easterly pit of the mine, seemed to be about exhausted of ore; now it is the most promising part of the mine. They had reached the wall upon all sides, and the bottom was only rock. A drift, 800 feet in length, to the northwest, and then bending around to the north, had been driven all the way in rock without discovering ore. Under these circumstances the outlook for No. 7 was not, certainly, very encouraging. However an upright shaft was started down from the bottom of the pit, which, after penetrating the rock for a distance of about 20 feet, came into ore and continued to a depth of 60 feet, when a chamber was cut out to the south, which proving to be also in ore of such excellent quality that it was concluded to cross-cut and test the deposit, the drift was continued to the south for 75 feet, and remained and terminated in ore. A drift was also opened to the north 100 feet, which also proved to be in ore. Under these circumstances the upright shaft was abandoned and a new one started from the surface, having an inclination downward to the south of 66°. This shaft has been completed to 150 feet in depth, provided with track and skip, and is now worked for hoisting the ore up in the pocket, which has also been built close to the north side of the pit and close to the main line of the railroad—(M. H. & O).

From the bottom of this shaft a pit has been worked out to the south 100 feet in diameter, and the workmen are daily extending the area. No walls of rock have as yet obstructed the progress. On the south side and on the west the soap rock had been met with which, at first, seemed to indicate that a

limit had been reached; but penetrating this it proved to be of but limited thickness, and beyond the ore was found to continue as before.

On the east side a wall of jasper was also reached, and they really thought that here a limit was attained; but concluding to test the matter further they pushed into it and very speedily came again into a fine black slate ore. Fully half of the ore is left in the supporting pillars. The ore is very rich and pure; high in metallic iron and exceedingly low in phosphorus, but then no less could be said of the Jackson ore. It has far too long been a standard for excellence in the market to need commendation. In this pit it presents a very singular appearance, having all the indications of the action of water, showing innumerable holes, cavities, "vugs," etc., and the various discolorations which water occasions, yellow, ochreous, black, brown, blue, red, and green. From the bottom of the pit to the drift which above was run to the south is 40 feet, and for that distance it is all ore. Capt. Merry is about to begin to sink for another level. He says that if he had left the mine, and had afterwards been told of the finding of this great deposit of ore in this place, he would not have credited it; only actually seeing it could produce conviction. What makes the occurrence of this deposit more surprising is the fact that on the surface from the south margin of the open pit, the soapstone extends south 200 feet, and dips to the north. The south wall of the open pit is of this rock, extending down with all regularity and meeting the north wall, which is jasper, between which and the soapstone was the ore deposit; which has been worked out. The present discovery underlies both the soapstone and the jasper; both formations are cut off, and beneath them is the ore deposit; what has become of the rock is not satisfactorily apparent. One would think it were a fold; if so, it has been cut off, and the bottom and part to the north has been carried away. There is no return to the fold. There is, simply, a wall of this rock, dipping to the north at an angle of about 50°, and limited in both directions, at the surface and at the bottom.

The jasper dips to the south, on the north side of the pit, but in the jasper, which forms the east end of the pit, there are, possibly, indications of a fold. However, there are a great many knotty geological problems to be observed in the formation at the Jackson mine, and any experts who have the leisure, and who derive a pleasure in this sort of study, will find here in this location geological paradoxes that will tax all their skill to unravel.

No. 6 pit, which was fully described last year, continues now, as it was then, the best portion of the hard ore mine. It is looking fully as well as ever before; another level has been sunk, being 400 feet below datum. The vein has continued to widen, and now has a width of 25 to 30 feet, giving stipes in the ends of the drift, either way from the shaft, of 40 feet in height.

The success met with in No. 7 induces Capt. Merry to undertake a like exploration in old No. 1 pit, and he also inclines to the belief that the Pioneer Mine, the most westerly workings, will yet reveal deposits of an equal to any that this portion of the mine has heretofore afforded.

The Iron Cliff Company no longer obtains its ore in this mine for the Pioneer furnaces. The contract made 25 years ago with the Pioneer Iron Company, of which the Iron Cliff Company became possessed when the two companies consolidated, expired in April last (1882). This lease has proved a very advantageous one for the furnaces. Under it the company was permitted to mine its ore in the Jackson Mine, paying therefor a royalty of \$1 per ton of pig iron made; that is, for every ton of pig iron the furnaces turned out, \$1 per ton was paid to the Jackson Company.

A new enterprise has been inaugurated in which the Jackson Company is directly interested, and which promises to be of much importance to the city of Negaunee and of value to the iron industry. This is the undertaking to crush the rock in the waste dumps, and obtained from the jasper walls of the Jackson Mine, and to separate out and save the ore contained in the rock. An immense building to contain the machinery for the necessary manipulations is now constructing. The situation of this mill is 600 feet north of the mine, in the direct line of the railroad, which comes out from the tunnel, and is built against the side of the bluff, which rises to the north from the level of the small lake, which lies to the west, from which the necessary water is to be obtained. The size of the buildings is 116x180 feet, and from the level of the engine house to the top is about 100 feet. There are nine floors. The rock cars will be drawn up into the top of the building on an incline at the west end, and from the bins into which it will be dumped, it will be drawn out into the large 1,500 pound crushers, of which there are five; from thence the material will pass through the separators; all but the finer portion, which escapes, passes to the smaller breakers, placed upon the floor below; of them there are 10; thence again through separators and to the floor below to the rollers in which the rock is crushed to the requisite fineness, and finally goes into the washers, placed upon a succeeding floor in which the work of separating is completed. The company is called the Negaunee Concentration Company. It expects to work up 1,000 or 1,200 tons of rock per day, thus obtaining 300 or 400 tons of iron daily. For this rock the Jackson Company is to receive 45 cents per ton of iron made. The concentrators mine the rock themselves. It is said that the iron rolling mills will take the entire product. The South Jackson, joining the McComber, is looking extremely well. The product is a rich, manganiferous, soft ore, not so high in metallic iron as the Jackson hematite, but from its high percentage in manganese it has an especial value, and thus sells for nearly as much in market.

The mine produced last year about 25,000 tons of ore, and the total output by the Jackson Company was 118,930 gross tons. The aggregate product to date is 2,186,187 gross tons.

Capt. Henry Merry, who for upwards of 20 years has acted as agent, and has conducted the mining operations of the company, still continues in charge.

THE LAKE SUPERIOR IRON MINING COMPANY—(MAY, 1882).

This company enjoys the reputation of shipping more ore than any other company in Michigan or in the United States. The total output of its mines in 1881 was 262,235 gross tons, 200,000 tons of which were first-class ore, the remainder being made up of the second-class ore, the hematite and the Lowthian Mine's products. It is one of the oldest mines on the lake, and from 1857 to the present time the aggregate of its shipments amounts to 2,666,456 gross tons. The company owns 20,000 acres of land, mainly in T. 47, R. 27, on which are several valuable mines, in addition to those worked by the company. The others are worked as the National, New England, etc., on a lease from the company.

The Lake Superior Mine, proper, is in the city of Ishpeming, joining the Cleveland Mine on the west and the Barnum on the south. The several contiguous mines or pits on the location that are now worked are the A shaft, No. 3 pit, No. 2, No. 6, and No. 7, and the Hematite Mine, lying south of the others. Of these pits the most productive at present are Nos. 2 and 3.

A year ago A shaft was a wonder. It is the most easterly pit, and separated from the others by nearly 1,000 feet. The work during the last year has determined the dimensions of this deposit, and it proves to be an immense pocket or brace of ore, commencing immediately under the drift and having a depth, vertical, of 70 to 75 feet, and a maximum width of 111 feet, narrowing to the ends, giving an average width of 50 feet to 60 feet, and an average length of 105 feet. From this pit has been taken, in the last year, about 25,000 tons of ore. It will last two or three years longer, giving annually about the same product as last year. The remaining portion of the lens lies to the east, extending to beneath Main street. Four hundred and fifty feet north of this pit a hole was bored on the "base ball ground," 960 feet deep, which passed through 50 feet of ore in one body, 200 feet below the surface; from the pit a boring was made in the direction of this hole, which will continue in the same intervening ore. This boring was followed by a second one at a greater pitch, but before reaching the hole the drill bit was lost and the work suspended. This latter boring is now following with a shaft, which will continue in the same inclination until the horizon of the ore is reached, when a drift will be opened to it, and the ore mined out in such manner as the situation shall develop. The length of this shaft will be, on the line of the boring, 270 feet; 200 feet are yet to be accomplished.

Another diamond drill hole is boring from the surface 250 feet east of the former one, which is down now 180 feet. The shaft, which is sinking, conforms nearly with the old one used in working the pit.

In Nos. 2 and 3 pits the ore is worked out, substantially, above the 240-foot level. In the 180 a drift connects with No. 6 pit, and in the latter, in this level, several diamond drill borings have been recently made, in one of which 36 feet of ore was found. A drill hole in the 240-foot level passed through 24 feet of No. 1 ore, and from No. 6 pit a drift is extending toward it. No. 6 pit is northwest of No. 3 pit, and is connected with it. The product has come from the 280 and 320-foot levels. The former level in No. 2 shows that the ore lies in an upturned fold or synclinal, giving it 2-foot walls and no hanging. On the north side the dip is to the south at an angle of 65° or 70°, and on the south wall the dip is to the north at an angle of about 80°. There is no immediate prospect, however, of finding a bottom. At the present rate of narrowing the deposit is good for five or six levels yet. This ore basin, if such it is, widens out to the west and has an inclination to the west.

At the east end the distance between the walls, as above described, is 90 feet, and at the west end of the workings this distance becomes 200 feet, from foot to foot. Between these walls is included three separate veins, running east and west nearly parallel with each other, each one having a well defined foot and hanging wall, and having about the same width, averaging 15 feet or 20 feet wide. The south vein is a little the narrowest, but it is the most regular. The north vein has been worked in this level a length of 800 feet; the middle vein 450 feet, and the south vein 600 feet.

The north foot wall vein is a continuation of No. 3 pit, and of the Barnum Mine; it connects with No. 3, which lies to the northwest 300 feet distant. The openings in the veins are of course connected by cross-cuts as required.

The 320-foot level has not been so extensively worked as has the 280. The veins lengthen to the west, each successive lift giving greater length as they go down.

In the 320-foot level, in No. 2 pit, are five important stopes: at the west end of the south vein, west end of the middle vein, and west end of the north

vein, and at the east end of the south and middle veins. In the 280-foot level, in this pit, are three stopes: at the west end of the south and middle veins, and at the west end of the latter.

There is a perceptible narrowing in the total width of the pit in the 320-foot level from the 280. The amount of ore remains, apparently, about the same. The squeezing out is in the rock, that in the upper level separates the veins of ore. The main drawback is, that in the absence of rock more ore has to be left in pillars, so that the yield may be to that extent the less. The veins in that level have been worked out to about the same length as in the other, for which the distances have been given. In this pit another lift has been sunk and opened for stoping, the 360-foot level, and the shaft has been lowered to the 400-foot level, but no openings have been made to that depth. In the 360 the veins are crowded together still more, showing a less amount of intervening rock, but an equal body of ore.

No. 3 pit is worked out in the levels above the 240-foot, and the main stoping now is in the 280-foot level; it is divided into a north and a south vein; the foot wall vein, the former, is worked out and they are now working in the hanging wall vein, which going east will connect with No. 2 pit; going west it is 50 feet wide; the south vein, which is stoped out, is 70 feet wide. In the west end of the vein is a magnificent stope, in this level, 120 feet long, 50 feet wide, and the full height of the level. It seems too good to be lost, but in the level below, the 320, it seems to hold all right. There is danger that the jasper foot may flatten out and cut off the deposit under. There are no indications of such an occurrence. The foot wall slopes at an angle of about 45°, and if it so continues there will be no trouble, but, as frequently happens, it may flatten and cut under the ore; but at any rate they are sure of the full body of ore, 120 feet, to the Barnum line, and reasonably certain of an equal fortune in the level below. The hanging is a chloritic schist. They are now mining in this pit, No. 3, 1,800 to 2,000 tons per month, all No. 1 ore.

They are also stoping in the 320-foot level, in this pit, and here will be taken out a large portion of the season's product. They are drifting toward the large stope described in the level above, and also are drifting south to the south vein; very large pillars are left, and are frequent. At some future time these, or some of them, may be removed, but at present, where there is so much heavy blasting and so many men, it is deemed best to make the roof very secure, even at the expense of a large amount of ore. The openings are pushed well ahead, giving as many stopes as possible.

Both pits tend to the northwest toward No. 6, and will in time come together at No. 6, so that the shaft, which is sinking at No. 6, will be, in time, the main working shaft of the mine. The shaft is being substantially made with that view. In the upper levels, as in the 140, in No. 2 pit, a good deal of second-class ore is taken out; 10,000 tons have been mined here in the last year, and the same amount, probably, will be taken out the coming year. The second-class ore obtained in the mine is as carefully selected as is the first-class. A market has been made for it, and it sells readily. It is sold under the name of Essex ore.

No. 6 is really an extension of No. 2 pit. It is the prolongation of the foot wall vein of No. 2, and is looking very favorable. Three diamond drill holes have been bored to the south from this pit, which passed through considerable bodies of ore. They are working in the 180-foot level.

No. 7 is the same as described last year, except that another level has been sunk, making three now in the 220-foot, though the levels here do not corre-

spond with those in the other pits. This latter level in No. 7 is called the 5th. The company is working 40 men to a shift in No. 7, and it is looking as well as heretofore.

The new engine house is a very substantial stone structure, in which has been placed the new machinery comprising a double engine each 24x48, and 4 hoisting drums each 12 feet diameter, 6 feet face, Lane's pattern, Akron, Ohio. These operate Nos. 2, 3, and 4 shafts; No. 2 is a double skip road. In this building has also been placed the straight line engine for supplying 16 electric Brush lights used on the surface in the engine house, trestle stock pile, etc.; it is not used in the mine.

A somewhat extended description of the system of mining practiced in the Lake Superior Mine may not be uninteresting, and applies, measurably, to all the other mines.

Mining work naturally begins with the opening of the mine; that is, the sinking of the shafts, driving the tunnels, sinking winzes, etc.; thence follows the breaking of the ore, trammings the ore underground to the shafts, hoisting the ore to the surface, trammings to the ore pockets, stock pile, or cars, and weighing.

The preparatory work in mines is begun soon after the close of navigation; but generally in all mines there is some portion of it where the opening work is continuous, going on simultaneously with the stoping of ore. This is the case in the Lake Superior, in No. 2 shaft, where the preparatory work never ceases, and as this is a typical part of the mine a full description of the work here will convey a sufficiently clear idea of the whole. No. 2 shaft was started 8x18 feet in size, measured inside of the timbers from the 140-foot level at an angle of 36° from the horizontal, and looking 65° S. W.; it was thus continued down 70 feet to where they drifted south and opened up the 180-foot level, in which they are now stoping in one or two places. Continuing the shafts about 100 feet further, they made a short cross-cut, striking ore and opened the 240-foot level, giving a 60-foot stope. Leaving some ground standing, they continued the shaft through a winze and drift about 70 feet, when they opened up the 280-foot level, and afterwards took out the ground left standing and brought the skip tracks down to this level. This work was done at various times and in different ways, requiring but little timber, the shaft being mainly in chloritic schist. From the 280-foot level it has been sunk in a regular and systematic manner. The work is under the superintendence of a competent man, whose gang of men consist of one machine runner and helper, and five fillers, one of whom is a miner. The drilling is all done during the day time, and the filling and hoisting is done by night; thus there is no interference in the work, and with one air drill enough ground is broken to keep the men busy through the night. All hitches are cut by the foreman and the runner, and the timber is put in place by the same gang of men heretofore mentioned.

As soon as a level is reached a drift is started, and when the drift and shaft are far enough advanced, so that no injury will be done to the timber work, a platform is put in and the skip track extended to this new level. The shaft and drift are continued on at the same time. As soon as the preparatory work is done, the new level is opened up by the regular mining force, and divided into its several stopes under the direction of an experienced mining boss, and at the same time the sinking of the shaft is pushed forward. In this way the company finds it can sink a good shaft at a minimum cost.

"A" shaft is sunk in much the same way except in the number of men,

having an additional force of fillers and keeping the machine going in two shifts, as the ground is much harder.

Winzes are sunk mostly by contract, the usual size being 6x6 feet. They are put down at such points as will give the best ventilation. A winze is partly made by raising, yet but little of the mining is done "over hand," *i. e.* breaking from the back or roof. They are usually sunk to a depth of 20 or 25 feet from the bottom of the level, and a raise is made from below to connect; much pumping and hoisting are thus avoided. The drifts are run with power drills, and are carried about 7x8 feet in size. The "dirt" is sent up, usually, "on company account," and as soon as the drift is about under the winze, an "inclining raise" is made of a height sufficient to connect with the "sink." The work is raised to some extent, to suit the place.

The work of breaking the ore is carried on under the immediate supervision of the shift bosses. It consists in drilling holes for blasts with power drills or by hand work, and in charging and firing the holes, barring the roof and sides of the chamber where the blast occurs.

The ore is mostly worked out by breast and back stopes, leaving a floor of about 10 feet thick to form the bottom of the level. This bottom is laid with railroad track on which the tram cars are run. This standing ground, in the bottom, also supports the walls and is measurably necessary to protection. At suitable distances, depending largely upon the character of the hanging wall, whether it be firm or treacherous, pillars are left for support. These pillars are about 30 feet diameter, and reach from level to level *i. e.* from the floor of a level to the roof, or they extend from foot to hanging wall with an arch below, thus leaving the opened ground in chambers, connected by the arches or short drifts, made through the pillars.

The drilling is nearly all done with power drills, each machine having its own set of tools, for which the "runners" are held responsible. All repairing, and extending of air pipes is done by a man kept by the company for that purpose, leaving the drill runners to drill the holes and to bar the ground after blasting. The blasting is done by the shift bosses, and an assistant who has charge of the powder and supplies, the different parties with oil, etc.

In a few places contracts have been let to break ore by the ton, but there are, at the present time, no such contracts in the mine. The aim is to have as large number of stopes as possible, so that as soon as a stope is cleaned up by the trammers, to put a machine to work in it, and have the ground broken at another stope to which to transfer the trammers. The drill will continue in a stope as long as the men can work to advantage, when it will be taken to another stope and the trammers set to work to clean up after the drill. The two sets of men are thus kept out of each others way, and there is also an advantage in planning the holes.

The "filling" and trammings to the skip is done on contract, by the ton. The fillers sort the broken mass into first and second-class ore, and take out the rock and tram it to the shaft, and dump it into the skip. The frames of the tram cars are made of hard wood; the body of the car is 26x54x19 inches; the sides are of $\frac{1}{4}$ -inch iron; the bottom is double $\frac{3}{8}$ -inch iron, strongly riveted with angle iron. They hold about one ton each, and when the tram is long they are provided with flaring sideboards. The tracks are made, and all repairing on them is done by or under the direction of a man whose business it is to attend to this underground work.

A man at the skip sees that the skip-road is clear and that the load is prop-

erly in, when he signals the engine-house to hoist, and also signals the scale-house what kind of ore it is, and from where sent; it is thus credited.

The skips are made of ½-inch iron, 36 inches square, with double bottoms, and are 5 feet in length, holding from two to three tons each of ore. The skip ropes are 1½ inches diameter, made of steel wire. They require the attention of a rope splicer and an assistant, who make all splices and dress the ropes with tar or pitch as frequently as becomes necessary, to prevent rust.

The ore, after reaching the surface, is dumped into railroad cars, or into tram cars. If into the latter it is trammed to the pockets or to the stock pile. To handle the car requires one to three men, according to the amount of ore sent up in the skip, and the distance to tram, condition of the road, etc.

The tram cars are large and flat, made of wood heavily ironed and arranged to dump either at the side or at the end. A slope is given to the tracks so that the cars have a down grade out with the load and are drawn back with horses. All the ore is weighed immediately after leaving the shaft house.

SHAFTS.

No. 2 shaft dips south 60° west at an angle of 36°, and can be used at the 180, 240, 280, 320, 360, 400-foot levels. It is provided with a double track, made of 10x12-inch runners, on which are laid 60-pound steel rails. The number of skips hoisted in this shaft average 170 to 180 per day, or a skip every six or seven minutes.

No. 4 shaft dips south 30° west at an angle of 75°, and is used in the 280, 320, and 360-foot levels. Its size is 8x12 feet, furnished with a single track.

No. 3 shaft dips south 61° west, at an angle of 47° at the top, but increasing to 59° at the bottom. It can be used in the 240, 280, and 320-foot levels. Its size is 10x14 feet, and it is provided with a single skip-road and ladder-way, and one pump, the water mainly running to No. 2 shaft in the 240-foot level.

No. 6 shaft is 8x12 feet, and is only worked down to the 180-foot level, and has a single skip track. This shaft has its own ladder-way and pump. It dips north 10° west at an angle of 46°.

A shaft dips north at an angle of 34°, and is down 70 feet below the bottom of the open pit. It is 8x12 feet in size inside the timbers.

The yearly product of the different pits reckoned from May 1st, 1881, to May 1st, 1882, is as follows:

	Tons.
Old Mine, first-class ore.....	119,850
Old Mine, second-class ore.....	48,670
A shaft, first class ore.....	18,560
Summit, or No. 1 pit.....	19,520
Old Mine Hematite.....	44,460
Lowthian Mine.....	30,880

THE LAKE SUPERIOR HEMATITE.

The Lake Superior Hematite has proved to be a valuable mine, and there is every assurance of its continuing as good in the future as it has proved to be in the past. The mine is situated a few hundred feet to the south of No. 3 pit and a little to the east. It consists of a large open pit, beneath which are the underground workings. These, in the 220-foot level, have already, for a hematite mine, become somewhat extensive. In this level 40,000 tons were mined the last year. The length of the pit is about 800 feet, and at the west

end the width is 100 feet. The main pit is at the west end of the mine. This west end is 140 feet east and west by 161 feet north and south, having its roof supported by three or four immense pillars, aided by timbering. In the center a drift through jasper connects this part of the mine with the shaft. From the shaft to the southwest runs a drift 180 feet through the ore, a narrow vein. To the northeast from the shaft there are extended two drifts, which go around a large block of ground, left on account of its poor hanging; both are timbered drifts, and they come together at 100 feet from the shaft, where they again separate, the south drift continuing straight on, and the north one making a large bend to include a still larger block of ground than the one to the west of it. These drifts again come together at 180 feet from the shaft, to the east of it, from which latter point to the northeast 220 feet, was a large body of ore, which has been stoped out to an average width of 20 feet. From this latter chamber, 100 feet northwest of the shaft, a drift to explore the ground was run to the northwest 120 feet long, but it proved to be mostly in jasper.

The shaft is vertical, furnished with a double skip road, and has been sunk another 60-foot lift, to the 300-foot level, where the product of the mine for the coming year will be mainly derived. In this level a drift has been thus far run to the northwest 60 feet, and from the west side of the shaft to the north a drift runs 100 feet. There is to be found no reason to question but the 300-foot, and succeeding levels, will prove as favorable as has the 220-foot. Like most of the hematite mines, much timbering is required, and where such extensive underground workings exist, entered only by a single shaft, great care must be taken to avoid caving in. The hematite hoisting engine also operates "A shaft" by wire rope transmission.

THE LOWTHIAN MINE.

The Lowthian Mine, owned and worked by the Lake Superior Company, is situated about three miles to the south of Ishpeming.

A large open pit 250 feet long and 125 feet wide has been worked out, from the bottom of which the vein has been followed, and worked out underground. The vein is split up into three veins. The past year the principal mining has been done in the 240-foot level. The south vein in this level has been worked out 200 feet in length and to an average width of 35 feet. The middle vein averages 25 feet wide, and has been worked a length of 75 feet, and the north vein to about the same extent. Another 60-foot lift has been sunk and a new shaft is making, more nearly in the center of the mine. It was intended to have this shaft completed early in the spring of 1882, but unexpected delays have occurred, and the time of completing the shaft will be much extended, greatly to the hinderance of the mining work. The deposits pitch about 55° to the north, having a foot wall and hanging of jasper. The ore is a good quality of soft hematite, averaging 58.8 % metallic iron. The mine yielded 35,000 tons the last year (1881), but hardly that amount will be shipped the ensuing season on account of the delay occasioned in building the new shaft.

In the next level, 300 feet, a floor, or rather roof, of 20 feet, will be left, in order to have less pillars. A new pump has been added, an improvement much needed, and preparations are making to build a new stone engine house for the hoisting machinery, etc. When this is done, and the new shaft is completed the mine will be in good shape.

Section 19 Mine, which belongs to and was formerly worked by the Lake Superior Company, is now worked on a lease by the Saginaw Mining Company. The management remains as heretofore: C. H. Hall, Agent and General Manager; W. H. Johnston, Superintendent; John McEncore, Mining Captain; C. F. Howe, Mining Engineer.

THE CLEVELAND IRON MINING COMPANY.—(MAY, 1882).

The history of the Cleveland Mine has been pretty fully chronicled in previous reports. Its career as a mining company has been one of uniform success, and the explorations made with the diamond drill during the past few years have discovered such a vast amount of first-class ore, yet untouched, that the company is nearly assured of a continuance of its prosperity for an indefinite future.

The output of the mines for the past year was 198,569 gross tons, exceeded only by the Republic and the Lake Superior Mines. Its total shipments foot up to 2,327,698. The past year's product was chiefly obtained from what are called No. 3 pit, the Incline pit, and from the Cleveland Hematite. No. 3 lies adjacent to the New York Mine, and commences at the northwest corner of Sec. 11, and runs west 960 feet, 650 feet of which distance to the west is underground. The remainder, to the east, comprises the portion of which the roof fell in several years ago. In this pit, the past year, the main mining has been in the west end, which is about 200 feet below the datum, a point on the surface. Here the opening has been pushed about 100 feet, and an extreme distance north and south of 150 feet, making a surface measure of the deposit worked out in the west end of this pit in the last year of 13,000 square feet. To secure the roof five large pillars have been left, four of which have a horizontal sectional diameter of 25 feet, and one of 18 feet. Further to the east, 150 feet, in this pit, on the north side, two blocks of ground have been stoped out, one 35x20 feet, and the other 30x15 feet. Also along the south side of the pit, connecting with the main westerly extension, a narrow strip of ground 8 or 10 feet wide, and 150 feet long, has been taken out.

In the New York Mine, which is worked down to the line of the Cleveland considerably in advance of No. 3 pit workings, shows a breast of ore 20 feet to 30 feet high all along the south side of the New York openings. Nine diamond drill holes have been made in this pit, mostly to the west and to the southwest, and another has just been started in the direction of A¹ boring. South of the pit five borings have been made from the surface, and the sixth is in progress. The most easterly of these is called B shaft, and is 160 feet distant from the southwest margin of the pit. This boring is 393 feet deep, and passes through 60 feet of No. 1 ore; 130 feet west from B shaft is P boring, 358 feet deep, and intercepts 53 feet of ore in successive deposits, but at 343 feet it had passed through a deposit of 18 feet No. 1 ore. P shaft is 95 feet south from the pit. West from P shaft 100 feet is Q shaft, which is 260 feet deep, and was 9 feet in No. 1 ore when the drill broke, and further progress was stopped. Q shaft is 70 feet south of the mine; 115 feet a little south of west from Q is A¹ shaft, which is 453 feet down, and passes through several deposits of ore, which aggregate 100 feet in thickness. At 421 feet down a single deposit 25½ feet thick of No. 1 ore was intercepted, and of the total deposits found in this hole the No. 1 ore amounts in all to a thickness of

59 feet. Besides the one above mentioned the next thickest seam found in this hole was one of 21 feet thick, at a distance down from the surface of 289 feet. It is in the direction of the lower deposit of ore in this hole that the boring has just been started in the mine. The hole will be, in the distance which it takes, 300 feet long. B¹ shaft, 135 feet to the west, was sunk 381 feet, but no ore was found. At 60 feet distant from it another boring is in progress. These two holes, A¹ and B¹, were sunk at the same time, in 26 days from the time they were begun.

The Incline pit, lying south of No. 3, has also been greatly pushed during the year. The underground margins of these two pits are 200 feet apart. It is entered, as is No. 3, by inclined skip-roads descending to the west. No. 3 has a double skip road, which starts from the surface 200 feet south from the section corner, and descends into the mine in a direction nearly due west to the limit of the workings. In addition a single skip road starts from about the same place and descends to the south part of the mine called No. 2 pit, making an angle with the double skip of 15°; it bends around to the north after penetrating some distance into the mine. From the main skip road branches extend in various directions as required.

The Incline is a large open pit inclining sharply to the west, and from the bottom of which the underground opening extends to the west upwards of 400 feet, and having a width, north and south, of 250 feet. Four skip roads descend into the mine from the east side of the pit, and the loaded skips, which are drawn up these tracks, discharge their contents into the railroad cars through the ore shutes, erected above, to the tracks.

A year ago the Incline pit was looking remarkably well; one of the finest stopes to be seen anywhere in the iron region was found in this pit. The product of the pit last year was 115,000 tons. At present it shows far less favorably, though still looking reasonably well. From the west end the extent of new opening, is to the west from 50 feet to 90 feet, and to a width, north and south, 200 feet. The surface measurement of this west end opening is 14,000 square feet. Its depth below the surface is 130 feet to 180 feet. Extending east along the north margin of the pit is a belt of new opening 130 feet, north and south, and 20 feet to 25 feet wide. Also on the south side of the pit, in the last year, three considerable blocks of ground have been stoped away. The east one is 40x20 feet; the next 60x35 feet, and the west one of these three having an average length of 35 feet, and a width of 20 feet, and on the north side of the pit 140 feet east of the east end of the openings previously mentioned, a chamber has been made of 40 feet diameter, 126 feet below the surface. Ten borings have been made with the diamond drill in this pit the past year, mostly to the west, to explore the ground, both ahead and downward. The results have frequently been favorable, discovering the existence of other deposits beneath the present workings.

In the saw mill pit the underground workings have been extended to within 25 feet of the main engine house. No large amount of work has been done in this pit, however, in the past year. Three chambers have been opened; one at the southwest extremity of the pit, which is 30x18 feet, and from the north and west sides of this new opening diamond drill borings have been made.

Sixty feet northeast of this opening, another of about equal size has been made, in the corner of which is H shaft, in which 6 feet No. 1 ore was found at a depth of 48 feet; 140 feet to the east of this latter another opening has been worked out, somewhat smaller than either of the other two.

Three hundred feet west of the southwest corner of the Incline pit D shaft passed through $18\frac{1}{2}$ feet of No. 1 ore, and E shaft, 480 feet west from the northwest corner of the pit, intercepts 20 feet of ore. To the southwest, 1,500 feet from the Incline, commences a series of holes extending east and west 700 feet, and north and south the same distance. These are mostly in the meadow, in the north slope of the hill that runs down to the M. H. & O. Railroad. The most easterly one in which ore was found is L, in which 18 feet of No. 1 ore was struck at a depth of 254 feet; 140 feet southwest of L is K, in which 10 feet No. 1 ore was found, at a depth of 269 feet. West of K 80 feet, is E, which was bored 310 feet deep, but no ore was found. North of this 80 feet is N, 415 feet deep, and $4\frac{1}{2}$ feet No. 2 ore was found, at a depth of 139 feet below the surface. West from N 80 feet is J, in which at a depth of 357 feet, 52 feet of No. 1 ore was found; 180 feet west of this is I, in which $38\frac{1}{2}$ feet No. 1 ore was found. The lode is 411 feet deep. In T, 180 feet north of I, 16 feet of No. 1 ore was found. In X, 210 feet west of I, 14 feet of No. 1 ore was found. At a depth of 417 feet the boring is 520 feet deep. G, 230 feet south of I, is 466 feet deep, and 10 feet of No. 2 ore was found. In W, 245 feet west of T, 45 feet of ore was found; the hole is 511 feet deep.

Thirty-one of these borings have been made from the surface, embracing an arc in the northeast part of Sec. 11, within the city of Ishpeming, of a half a mile east and west, and a third of a mile north and south, and in most of these ore has been discovered; in more than half the deposits have a thickness of 10 feet to 60 feet. From the underground pits nearly an equal number of borings have been made with, on an average, encouraging results. The Cleveland management do not wish to grope in the dark. They are endeavoring to determine, in a measure, the extent of their mineral deposits, where and how they lie, and thus be able to mine for them in the most intelligent manner.

Recently, the opening of a new mine has been begun, to the southwest, at K and J. In the former a shaft has been sunk and completed, and they are now mining ore and hoisting from this shaft. The drift in the ore is extending towards J, which latter is sinking, and when the ore is reached a drift will be pushed forward to connect with K. The waste rock is run out on an elevated track over the main line of the M. H. & O., and dumped into the swamp. A side track will soon be built to the shafts.

In this mining work four power drills are used, which are supplied with compressed air from the main engine house.

During the past year old No. 3 engine house has been torn down, and in its stead a solid stone structure erected, supplied with a new pumping engine and machinery, that raises all the water from No. 3 and the Incline Mines. This is found to be a great improvement.

Still further important changes are in process of making. The ground is excavated for an addition to No. 1 engine house, the addition to be equal in dimensions to the main portion of the present structure. In it will be placed the machinery for operating the new mine, compressor, hoisting gear, etc. Also will be built, on the north side of main street, on the corner opposite the office, and on the west side of the cross street, and opposite the No. 1 engine house a large stone building for machine, blacksmith, and carpenter shops, etc. This structure will be 147 feet by 106 feet, and will be fully supplied with the requisite machinery for accomplishing every variety of repairs incidental to the work of a large mine.

No. 10, a mile to the east, near the east line of the company's land, has been abandoned. After several years unsuccessful effort to make it a paying mine it was finally concluded, late in the summer, to permanently discontinue the work. The machinery was removed and the mine allowed to fill with water. The ore obtained in this mine is of an excellent quality, but too much mixed to be satisfactorily or profitably mined.

The Cleveland Hematite Mine, situated in the northwest corner of section 2, one mile north and a half of a mile west from the main mine, has been worked by the company since May 14, 1881, at which time it came into the company's possession, having been opened and previously worked on a lease by Mr. R. Nelson, of Ishpeming. The company shipped from the mine 9,000 tons of ore during the year, and have done a good deal of exploring work. Three shafts were sunk to respective depths of 90 feet, 165 feet, and 190 feet; in the last two good ore was found. The estimated yield of the mine for the ensuing year is between 5,000 and 10,000 tons.

The Cleveland owns 2,200 acres of land in one body, and in all portions of its territory there are indications of ore, and it is not unlikely that valuable deposits of this mineral may be found in other portions of the property than those which have been indicated. The company was incorporated first in March, 1852, and subsequently reincorporated as the Cleveland Iron Mining Company, with principal office in Cleveland.

The officers are: S. G. Mather, President; Jay C. Morse, Agent, Marquette, Michigan; D. H. Bacon, Superintendent, Ishpeming, Mich.

THE NEW YORK MINE.—(MAY, 1882).

The New York Mine is situated in the southeast corner Sec. 3, T. 47, R. 27. Its old openings begin near the section corner and extend west along the south line of the property about 1,160 feet, 200 feet west beyond the Cleveland workings. The main lens or deposit of ore is the same as No. 3 pit of the Cleveland, and is 150 feet to 180 feet below the surface. The ore dips to the south and to the west; heretofore it has been almost wholly to the south, passing the line at but a few hundred feet from the outcrop on the surface, and were it not for a curvature to the north, which the formation assumes, not far east from the present workings, the mine would, ere this, have been exhausted. This bend, giving the mine somewhat of a horse shoe shape, has prolonged its existence. The mine, as now worked, occupies but a limited space. There are four pits, and the skip roads descending into them are not far apart. The pits, however, are in different lenses of ore; Nos. 2 and 3 are in the upper deposit of the main mine, adjoining the Cleveland line, and Nos. 4 and 5 are in a deposit underlying the former, about 40 feet below it.

A skip road into No. 3 descends through the open pit to the south, but in approaching the line bends to the north, and now has a direction toward the southwest corner of the property, which is only 190 feet distant from the limit of the workings. No. 2 skip descends into the mine, making an angle of about 70° with No. 3, but below, within the mine, owing to the change in the direction of No. 3 skip, the roads are now nearly parallel. Each of these skip roads follows the foot wall in its descent, but the change in the direction of No. 3 is made of necessity to avoid getting nearer the line. The bottom of No. 2 is about 160 feet from the west line of the property, and the pit is not showing well in that direction; the hanging wall comes down and cuts off

the ore. The opening, however, will be pushed through this wall with the hopes of recovering the vein further on. The prospect is none too encouraging, since a boring made with the diamond drill, west of this, near the line, to a depth of 400 feet, discovered no ore. No. 3 pit is of course all right; it is the main stay of the mine; but, unfortunately, its progress is stayed by its boundary line. Along the line of the property at this point is exposed a wall of ore 30 feet high.

The skip roads in Nos. 4 and 5 pits start from the surface to the north of those in Nos. 2 and 3, and go down in about the same way, No. 4 descending to the south and No. 5 to the west, both following the foot wall of the lower vein. These pits are separated from those above by about 40 feet of chloritic schist. A year ago No. 4 was looking finely; hopes were entertained that it would prove as good as No. 3, in which case the mine would have a long lease of life; but the vein has since greatly narrowed, and, from affording a stope 20 feet high, it is now scarcely one-half that amount, and from giving a product of 15,000 tons, the amount which it afforded last year, the pit will scarcely yield 8,000 tons the ensuing year. No. 4 has been extended to the west to within 150 feet of the line, and, to the south, it seems likely to play out altogether. No. 5 is a sort of scrambling pit, made up a good deal by seams of ore, separated by seams of soapstone; still there are some fine stopes in the pit, in the direction of No. 4.

All the pits are pushed forward together, making each furnish its quota of the product, as far as possible.

If no further discoveries are made the life of the mine will depend somewhat on the dip of the ore; the greater the dip the longer the deposit will continue; but the dip remaining as now, with the present rate of exhaustion the mine cannot continue as a large producer beyond three or four years; but in any event it won't die in debt to its owners. No mine in the district, of its size, has probably made as much money as the New York. It has produced an aggregate of 974,840 tons of ore, all of it first-class ore, which has sold in the market at the highest price and has been very cheaply mined. Subsequent to the war, when ore sold at enormous figures, this mine must have been worked at great profit. The output for 1881 was 50,074 gross tons.

The property comprises only 40 acres of land, owned in fee by Mr. A. R. Harlow, of Marquette, but the mine has, since the organization of the company in 1865, been mainly controlled by Mr. Samuel J. Tilden, of New York. The company have paid Mr. Harlow 25 cents per ton royalty. The lease having recently expired has, it is said, been renewed for an additional period of twelve years. The property ought to be owned, or controlled by the Cleveland Iron Company. It would be very convenient for the Cleveland Company, in working the farther extension of their No. 3 pit, to have the New York shafts and openings.

Captain Beering is driving from No. 4 pit, a drift to the north, to explore the ground; and is in now 50 feet, but has not yet reached the limit of the foot wall. In the ore are sometimes found small deposits of bright red banded jasper, inclosed in the best of ore; also occasionally occur limited deposits of "mundic," sulphuret of iron. All such are, of course, thrown out.

The general office of the company is in New York. S. J. Tilden, President; J. H. McCloskey, Agent; August Beering, Mining Captain; John C. Cutter, Cashier, etc., Ishpeming, Mich.

THE IRON CLIFF COMPANY.—(MAY, 1882).

The Iron Cliff Company has a large landed estate comprising some 38,000 acres of land, which were purchased in 1864 of the St. Mary's Canal Company, and which constitute a portion of the land which that company received from the government for building the original canal at the Sault de St. Marie in 1855. The company was organized in 1864, with a capital stock of \$1,000,000, divided into 40,000 shares of \$25.

W. H. Barnum, President, Lime Rock, Connecticut; A. W. Maitland, General Manager, Negaunee, Mich.

On this immense mineral property the company is working four iron mines, to wit: the Barnum, Salisbury, Foster, and the Section 12 Mine, and in addition the company also owns and operates the Pioneer furnaces at Negaunee.

Of its mines the most important is the Barnum, lying within the corporate limits of the city of Ishpeming, west of the New York and north of the Lake Superior Mines, but lying close to the latter, so that in the underground openings one may pass from one mine into the other. As the deposit of ore, which has heretofore been mined in the Barnum, lies so nearly adjacent to the Lake Superior Iron Company's line, and dips to the south, that portion of it on the Barnum side of the line is rapidly approaching exhaustion. The two most westerly pits are all that remain to be worked, and of these, the east pit will not last beyond the present season, and probably the succeeding year will finish the entire mine on this part of the location. This mine has no compressor; only hand drills are employed. The company realize the value of air drills in pushing and economizing mining work; but the mine is so nearly worked out that it has not been deemed advisable to add any new plant to the old mine, reserving all new machinery and improvements for the new mine.

The mine produced the past year 27,883 tons of ore, and its total product since 1868, the period of its opening, is 487,906 tons. The mine was quite fully described in the last annual report, and is now very similar in its appearance as at that time. Another lift has been sunk, and consequently a nearer approach to its boundary attained. Its loss is its neighbors gain; but the exhaustion of this mine by no means numbers the days of the Barnum. It has a future that is certain to very far surpass the record of its past. Across the intervening swamp, a few hundred feet to the north, a new mine is being opened that will undoubtedly become one of the largest producing mines in the district. The existence of an immense body of ore has been proven by a succession of diamond drill holes, for a distance, east and west, of 2,000 feet, and for several hundred feet north and south mine borings have been made, all of which passed through No. 1 ore, from 20 feet to 50 feet in thickness. The ore, in the holes, was struck at a distance below the surface, of from 350 to 585 feet. The ore occupies a synclinal, and to the bottom of the trough one shaft has been sunk and a second one attempted.

A shaft, the most easterly of the two, has been sunk down through the ore, a total depth of 485 feet. It is a vertical shaft, 10x14 feet inside, and lined up with 12-inch square pine timbers, and is divided into two compartments. From the bottom about 100 feet of drifting have been done in the ore, 50 feet each way from the shaft. The ore bed has a perpendicular thickness of about 30 feet, as shown in this opening, and the product is a very fine grained hard, steady specular ore. In this mine air drills are used, and the new hoisting machinery will soon be ready to work. Some difficulty is already experi-

enced from lack of ventilation, to obviate which a fan has been procured and is now making ready to work. The plan of opening the mine will be by a succession of parallel drifts connected at proper distances by laterals, and as the main drifts will be in the bottom of the fold, the ore deposit will rise to the north and to the south from it. Two east and west drifts, 12x16 feet, have been started, and with proper ventilation there should be no difficulty in mining all the ore that can be hoisted in this single shaft. Already 1,500 tons per month are taken out.

B shaft is 750 feet to the west, and the endeavors to sink it have thus far proved abortive. From the surface to the ledge is 104 feet, but after passing through 36 feet, from the surface down, quicksand is encountered, of a kind very difficult to overcome. It pours into the shaft at the rate of 700 gallons per minute. However it is not the intention of the company to abandon the attempt. Mr. W. H. Barnum, the President of the company, declares that the shaft must go down, cost what it may, and Capt. Sedgwick is again making preparations to again renew the struggle—human ingenuity versus quicksand. The new engine house machinery to operate this new mine is very complete, and will suffice for a long time to come. In exploring, plant, and mine work, etc., on this new location, nearly a quarter of a million of dollars have been expended. The old mine is in the southeast part of the N. $\frac{1}{2}$ of Sec. 9, T. 47, R. 27, commencing close to the quarter-post corner. The new mine is in the N. $\frac{1}{2}$ N. W. $\frac{1}{4}$ Sec. 10.

The Superintendent remains as heretofore, Capt. Wm. Sedgwick.

THE SALISBURY.

The Salisbury, the second in importance of the Iron Cliffs Company's mines, has done extremely well the past year, having made an output of 43,690 tons, more than double its product of the preceding year, and the prospect for the coming year is such that it is exceedingly probable that the yield of the mine in 1882 will be in excess of its recent output, if not greater than any annual product it has ever afforded. The mine was opened in 1872, and has thus been worked ten years, during which time it has shipped 239,249 tons. Its greatest product was made in 1878: 52,155 tons.

The ore is a very soft hematite, and is mined from three open pits, and from an underground drift, which has been opened beneath the bottoms of these pits, and which extends east and west as far as the limits of the pits. In this underground drift the principal mining that has been done is in the portion beneath No. 1—the easterly pit. A drift to the south 50 feet, passed through a body of excellent ore upon the development of which considerable hopes are based.

In addition to the three pits described in our last annual report, and to which description there is little to add that will be of interest, the company has opened another pit to the east across the ravine, 1,200 feet distant, and which is thus far proving very valuable. Exploring had been previously done here, but attended with little success until within the past year. Capt. Bortle, in continuing the exploration, hit, fortunately, upon the ore. The ore runs east and west, with a jasper foot wall and a quartzite hanging, and has a width of about 14 feet. The ore is apparently of better quality than that obtained from the old pits; 5,000 tons of it were taken out last year.

The Salisbury is in the N. $\frac{1}{2}$ of Sec. 15, T. 47, R. 27, and is but a short

distance south of Lake Angeline, being in the south part of the high ridge that separates it from the lake.

Capt. Bortle, the Superintendent, is an energetic, capable mining man, and finds ample exercise for all his experience and capacity in surmounting the many difficulties which are met with in prosecuting work in this mine. He has had four years experience in working in the mines in Nevada, and has familiarized himself with the system of timbering practiced in that country, which knowledge comes into play in the underground workings of the Salisbury.

Below the east, open pit, 70 feet, is an underground level that extends several hundred feet to the east, from which a large proportion of the product is now being raised, through the pumping shaft. The roof of this subterranean level is entirely supported by timbers. These timbers are 9 feet long, placed upright, 4 feet apart, in rows, stayed from the top by cross timbers and blocks. They reach to the roof, and in taking out the "back" these cross timbers are covered with lagging, which forms a floor, and a chamber above is thus taken out to the height of another set of uprights, and the spaces below, in between the timbers, is filled with rock and dirt. The filling in is important, to stay the timbers laterally, to prevent them from knuckling down, which they would be nearly sure to do from the great weight upon them, after several successive tiers had been carried up. If the mine does not furnish debris sufficient for the purpose the material should be taken in from the surface.

SECTION TWELVE MINE.

Section 12 Mine, as it is called, consists of open pit workings situated in the northeast corner Sec. 12, in the city of Negaunee. The McComber Mine workings, in the northwest corner Sec. 7, and the Jackson Iron Company's east pit, and the Cliffs Company's northeasterly pit, are close together. The mine has been worked for three years, and has produced an aggregate of 18,600 tons, 13,243 of which were taken out last year. It is doubtful if the output will exceed one-half that amount the coming year. Some further exploration is contemplated to the east, which may lead to the discovery of further deposits between the ground now opened and the east line, otherwise the mine is likely to be ere long exhausted. They are cut off on the east by McComber, and on the north and west by the Jackson Company, and on the south they are limited by the greenstone. Their main cut is crossed by the line, east and west, leaving the northwest part of the main pit to the Jackson Company. The direction of the pit varies about 10° from the east and west line, which crosses it, and as the ore lens dips to the north, it has already mainly passed to the Jackson side of the line. However, there is still considerable ore to be got out, but it is now covered by a heavy fall of rock from the Jackson north wall. This debris is now being removed; when cleared a party will go in and mine out the ore to the line. The ore should dip to the south, and it is possible that it may turn, at greater depth, and be again found in the Cliff land. A short distance to the south and east of the main pit is another long, narrow, open cut, 50 feet deep, separated by an arch of ground from the other. In the bottom of this a narrow vein is now working by some scammers. The same party have started a shaft fifty feet south toward the greenstone, and have struck some good hard ore, but come again to broken jasper and ore. They are now stripping to the west and throwing the dirt into

the shaft. In this corner there is considerable space to explore, between the openings and the greenstone, and it may be worth the company's while to prove it. A shaft could be sunk and a drift to the south to the greenstone, and also east and west, or a diamond drill might be employed boring south from the openings across the formation.

THE FOSTER.

The Foster was the first mine opened by the Iron Cliffs Company, and was one of the earliest worked hematite mines in the district. It was opened in 1865, and down to 1873 was vigorously worked, since which time its annual output, as will be seen in the table, has been high. The ore is of an excellent quality, but is a good deal mixed. The mine consists of open pits 50 feet to 100 feet in depth; the ore occurring in pockets requires careful sorting. It lies in Secs. 22 and 23, T. 47, R. 27.

In December last work at this mine was renewed by the company with the determination to try and make a success of it.

THE LAKE ANGELINE MINE.

The Lake Angeline Mine, belonging to the Pittsburgh and Lake Angeline Company, is situated south of the Lake Superior Mine, about three-fifths of a mile, and directly beneath the high greenstone bluff that rises abruptly near the west end, and on the south side of Lake Angeline. The formation dips to the north, and the ore lenses pitch to the west. The overlying rock is a friable hematite schist, through which the water of the lake does not find its way into the mine; the bottom of the mine lies 150 feet below the surface of the water. The mine, as worked out, consists of two large, open pits, that have now reached to a depth of 160 feet, having a length of 1,000 feet. The east pit has the appearance of being nearly worked out; it has been gradually narrowing, all the sides sloping to the center of the bottom, so that now the workable deposit in the bottom is small. In the west pit the workable ground has diminished, in the bottom, but a leader has led to the taking down of the southwest corner of the pit, discovering a good but narrow vein of ore leading off to the west. It is a matter of surprise that the company has not heretofore explored the ground to the southwest. A small shaft was sunk, situated about 200 feet in that direction from No. 2 pit, and struck good ore, though somewhat mixed; but the shaft was too small to admit of boring extended to sufficient depth as to allow of drifts being run from it to any great extent.

It is the intention to enlarge this shaft and explore this ground. A drift would readily run from No. 2 pit to it.

The officers are: John Outhwaite, President; L. E. Holden, Secretary and Treasurer; A. Kidder, General Agent; Capt. Harvey Diamond, Superintendent.

The shipments for 1881 were 18,060 gross tons, and its total shipments to date are 525,697 gross tons.

THE NATIONAL MINING COMPANY.

The National Mining Company holds on a lease from the Lake Superior Company 240 acres of land, embraced in the south part of the E. $\frac{1}{2}$ of Sec.

16, T. 47, R. 27. The mine was quite fully described in the last annual report, and in visiting the mine this year nothing of additional interest was observed. The last mine, which heretofore was worked in an open pit, is now wholly underground, having reached to the 4th level. The vein is not large and affords, as appears from the stock pits, considerable second-class ore. The product is nearly a hard, blue hematite, but sells for hard ore.

The west mine, 1,200 feet distant from No. 5, so called, is also wholly underground, entered by a single skip, which descends to the north having a length of between 400 and 500 feet. The vein is about 12 feet wide, and the length of the stope now being worked is about 100 feet, somewhat mixed in character. The product is a hard, specular ore. The two mines shipped the last year 24,833 tons, and their aggregate product to date is 91,836 gross tons. About 400 feet to the west of the mine a diamond drill is at work, and is now down 150 feet; is in chloritic schist. The inclination is to the southeast, at an angle of 45°.

The mine is under the management of Capt. Samuel Mitchell, Agent of the Saginaw Mining Company, and the local Superintendent is now as heretofore, Capt. Williams.

THE MITCHELL MINING COMPANY—(MAY, 1882).

One-half mile south of the National are the Mitchell and the Wintrop Mines, and directly west of them, a half of a mile, is the Lowthian, and adjoining this latter on the west, the New England Mine. All these are soft hematite mines, and very good ones, having large workable deposits, but somewhat difficult to mine, owing to the trouble in supporting the roof.

The Mitchell, formerly known as the Shenango, was first opened in 1872, and worked for five years, when a new company was formed, with Capt. Sam. Mitchell as President. The mine now is wholly underground, and worked in two pits, the shafts of which are about 300 feet east and west of each other. The west one is 160 feet deep, and the east one 200 feet. In the west pit they are working a fine lens of ore 30 feet wide.

The east pit is looking equally well. The formation dips to the north and the ore lenses pitch to the west. The ground is cut up so as to leave blocks for pillars, which are lagged up with timbers, otherwise the ore pillars, left to themselves, have little sustaining power. The ore, when mined, becomes friable, and shovels like dirt. The mine is in good condition, and promises well for the future. The product for the ensuing year is estimated at 33,000 tons. In 1881 the amount shipped was 24,146 tons, and the total product to date 75,731 gross tons. The estate comprises 200 acres of land, being the S. E. $\frac{1}{4}$ of Sec. 21, and the N. W. $\frac{1}{4}$ N. E. $\frac{1}{4}$ of Sec. 28, T. 47, R. 27, held on a lease from the Pittsburgh and Lake Angeline Mining Company, who owns the land in fee. Both the C. & N. W. and the M. H. & O. railroads have tracks into this and the other locations on this range.

The present officers are: Capt. Sam. Mitchell, President, Stoneville, Mich.; Chas. Merrywether, Secretary and Treasurer, Ishpeming, Mich.; Capt. James Walter, Superintendent of the mine, Ishpeming, Mich.

THE WINTHROP IRON MINING COMPANY.

The Wintrop Mine adjoins the Mitchell on the west. The mine is in the northeast corner of this property. The company hold the S. W. $\frac{1}{4}$ of Sec. 21,

T. 47, R. 27, and the center of the section, being the northeast corner of the quarter section, is under the engine house, and they have mined close to the line to the south and to the west. In this corner, a few feet south of the engine house, is a very deep, open pit, in the bottom of which nearly all the ore now being raised is obtained. Last October the west end of this pit fell in, burying the bottom to a great depth beneath the earth and rock; in this ruin was also involved the underground openings, which extended west from below the pit. The timbers, upon which the roof mainly rested, were inadequate to support the incumbent weight, and giving way, precipitated the whole west end of the mine; fortunately no one was killed in the catastrophe, though a number of men were temporarily cut off from exit, but were speedily relieved, somewhat frightened, but not otherwise injured.

The removal of all this debris has been a serious matter, involving much labor and expense, and the work is not yet completed. A long skip road has been run up from the bottom, extending to considerable height above the surface to the south of the pit, and up this track the refuse is drawn and dumped from the upper end. A large dump pile has already thus been made and is continually increasing in size. The hoisting rope, which works this skip, has a long run, from the engine house away around the west end of the pit to the south end of the skip road.

West of the engine house about 600 feet the company is now sinking a vertical shaft, which is down to a depth of 200 feet; it will be continued 200 feet further. The shaft is close to the line, and is 13x17 feet inside the timbers, and will suffice for a double skip and pumping shaft. It is precisely what is needed, and is a work that has for some time been contemplated by the company. When the shaft is completed the mine will be opened to the east, and below the old mine, and the ore taken out above. The previous workings to the west, in the direction of the shaft, have shown the existence of an abundance of ore to which the shaft will afford access. The only underground mining doing at the Winthrop at present is in a small pit about 200 feet a little south of west from the new vertical shaft, which runs down on an incline to the north 150 feet. The ore lens does not appear to be large, and the ore is of but medium quality.

Further to the southwest, toward the center of the quarter section, a deposit of fine, hard blue hematite ore was discovered, which opened so promisingly that the company felt about certain of having another mine. A small hoisting and pumping engine was erected, and the Northwestern Railway Company surveyed a line for a track to it, but after taking out about a 1,000 tons of ore, the deposit was worked out. Some further work will be done with the hope of recovering the vein. The ore that has been mined will be hauled with teams to the cars.

Both the Winthrop and the Mitchell Mines make a great deal of water; few mines in the district require a greater amount of pumping. The ravine, which ascends rapidly to the west, is swampy, and furnishes considerable water, which finds its way into the mines. So much water in soft hematite mines is a serious inconvenience, but here there does not seem to be any way of avoiding it; the only alternative is to pump it out.

Besides the quarter section of which the company has the lease, it also controls the surface right to eighty acres adjoining on the north, the two forties cornering at the center. On these most of the houses and surface improvements are built, among which are included a fine, large school-house, and a new Methodist church, etc. The Winthrop produced in 1881 43,630 tons of

ore, and the aggregate product is 256,300 tons. Both the Chicago & Northwestern and the M. H. & O. railroads have branches into the location; about 100 men are employed at present, and a sufficient number of comfortable houses are provided for their accommodation. The location is three miles from Ishpeming, in a southwest direction, and is connected therewith by an excellent wagon road.

The officers are: J. O. St. Clair, President; E. G. St. Clair, Secretary and Treasurer; G. A. St. Clair, Superintendent. Office, Ishpeming, Mich.

THE SAGINAW MINE.

The Saginaw Mine has not been very prosperous for the past few years. No. 2 pit is the only one now working to any extent, and that has attained to a depth of 540 feet, but still has a somewhat narrow vein of ore in the bottom. Some borings have been made with the diamond drill, but have discovered nothing of value with the exception of a new "find" on the east line of the west $\frac{1}{2}$ of the N. E. $\frac{1}{4}$ of Sec. 20, leased from the Lake Superior Iron Company; here 25 feet of No. 1 ore is said to have been found in one of the holes; 12 feet in another, 140 feet west from the former, and 9 $\frac{1}{2}$ feet of ore in a thick hole, 100 feet east from the first one. The distance between the borings make a length of 240 feet, and show a considerable body of ore. The distance to reach it is 85 feet; a shaft is now sinking for this purpose. The mine has been a large producer, and even now, when it is said to be nearly exhausted, it affords a good deal of ore. The output for 1881 was 30,793 tons, and the aggregate product for the ten years since the mine was opened is 420,774 tons. Saginaw is a station on the M. H. & O. railroad between Ishpeming and Clarksburgh.

The property held under a lease by the company consists of the N. W. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ of Sec. 19, and the N. E. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ of Sec. 19, T. 47, R. 27. As heretofore the mine, etc., remains in charge of Capt. Samuel Mitchell, Agent and Superintendent.

THE GOODRICH MINE.

The Goodrich Mine is very conservatively managed. In the opinion of some mining men who have examined the location, it might be a larger and more productive mine than it is. A great gain has been made in the two last years, however. The mine has been worked since 1873, and the total output in the eight years is 41,606 gross tons, 21,426 tons of which have been obtained in these two years. The yield is likely to be still further increased the ensuing year. A new shaft has been added 230 feet to the west of No. 2 shaft, and is sunk 100 feet. This new pit is yielding a very good quality of slate ore, which is thought to be first class.

The description of the mine is the W. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of Sec. 19, T. 47, R. 27. It was first opened by the St. Clair brothers, and is owned by Capt. Goodrich, of Chicago.

The Superintendent is Capt. Henry Davis, who enjoys the reputation of being a very capable mining man.

THE TEAL LAKE RANGE.

THE CAMBRIA MINE.—(MAY, 1882).

The Cambria Mine, worked by the Cambria Iron Company, lies one and a half miles southwest from the city of Negaunee and two and a half miles from Ishpeming. It is connected by rail with the former place.

The land held in lease from the Teal Lake Iron Company comprises the S. E. $\frac{1}{4}$ of S. E. $\frac{1}{4}$ Sec. 35, and the west fractional half of Sec. 36, T. 48, R. 27.

The company was organized in 1875 with a capital stock of \$500,000, divided into 20,000 shares.

The mine openings extend about 1,000 feet east and west, and at present the mining is nearly all doing in the two extreme pits, to wit: No. 1 and No. 5. The first named is the most easterly pit, and is worked underground. The length of the skip that goes down on the foot wall to the south at an angle of 45°, is 200 feet. It is in about the middle of the pit, and the stope 75 feet each way from it. The vein has here an average width of about 20 feet. The old skip road has been abandoned, and the one now used is new, going up into an ore pocket, also new. No. 2, to the west of the former, is a long, comparatively shallow, open pit, which has been worked in a series of pockets; it is possibly too much in the foot wall, judging from the experience of the company in No. 1, for No. 1 pit had formerly a very similar appearance as No. 2 now has, but pushing further to the south into what seemed to be the hanging wall, developed the ore in body. At present No. 2 is only worked by scammers. No. 3 is a large open pit that for some reason has not lately been worked. There is too much water and dirt in the bottom to form any judgment of its real character. Mr. Maitland states that he will soon sink a shaft from the bottom near the west end of the pit, and feels confident that he will strike the blue ore found in No. 5, though it may require going to a considerable depth, as No. 5 ore lense pitches to the east and south.

No. 5 pit is the most valuable part of the mine; it is opened to the west line of the property. The east pit of the Bessemer Company and No. 5 are one and the same pit, the north and south line, dividing the properties, crosses the pit, leaving about two-thirds of it to the Cambria and the remainder to the Bessemer. From the line to the west end of the pit is about 100 feet, and the width is about 80 feet, and depth 60 feet. The Cambria have a new skip road going down to the south, to the bottom, and extending up into a new ore pocket that stands over the railroad to discharge into the ore cars.

The whole bottom of the pit is a dark, blue, slaty hematite ore yielding 66 $\frac{1}{2}$ % in metallic iron and 2% of silica, .045% phosphorous, and sells in the market at the same price of hard ore. About one-third of the total product of the

mine is first-class. A drift to the south, from the southeast corner of the pit, 65 feet, was all the way in ore. They are stripping the ground in this direction preparatory to sinking near the end of the drift; also they are sinking in the center of the pit sufficient for a stope to extend over the whole bottom. To the southeast the drift is about 8 to 10 feet thick, where ore is reached, slightly mixed, but is taken to the stock pile. It is the same here as it was in the main pit. For a considerable distance down the ore was variable and mixed, and did not, at first, attain the settled character which it required and preserved after reaching a depth of 20 to 30 feet.

The company has contracted to furnish 35,000 tons of ore the coming season, and will have no trouble in filling the contract. At present the ore is being very cheaply mined. Some new machinery is now being added, consisting of four hoisting drums, 4 feet diameter each, also new engine and boiler. The old machinery was inadequate, and when the new is working the mine will be much better provided with the necessary power.

A half dozen new log dwelling houses have been built down near the lake, and a new change and warehouse has been added also.

The location is upon high ground, overlooking Teal Lake, a very beautiful sheet of water, and has a natural drainage that thus far keeps the mine quite free of water. The company now employ 60 men, under the immediate charge of Capt. Gordon Murray.

The General Manager is Mr. A. W. Maitland, manager of the Iron Cliff Company, Negaunee, Michigan.

The Cambria produced, last year, 19,245 tons, and the total to date is 55,703 tons.

THE BESSEMER MINE.

The Bessemer Mine joins the Cambria on the west. The estate comprises 80 acres of land, being the W. $\frac{1}{2}$ S. E. $\frac{1}{4}$ Sec 35, and notwithstanding some unfortunate mishaps which the mine has met with of late, it is, on the whole, looking as favorable as ever. The large open pits which formerly constituted the mine, and which have been fully described in the preceding report, have both fallen in from the sides, burying the bottom beneath fifty feet of earth and rock. The last and most serious fall occurred in February, 1882, since which time no ore has been obtained from these pits.

The only alternative is to sink below the ore and resort to underground mining, supporting the roof with timbers. With the view of carrying out this plan, the company is now sinking a shaft between the two pits. The shaft is down 100 feet, and will have to go about 50 feet further to reach the old level.

The new find, mentioned in the last report, has been developed, and proves to be in value everything that it promised. This new pit, as stated in describing the Cambria, is close to the east line, forming one and the same pit with the No. 5 of the Cambria.

The pit is somewhat elongated, with the long axis northeast and southwest, 75 or 80 feet, and with a width of 40 or 50 feet. The west end is worked out to the bottom of the Cambria pit, and they are now stoping in the southwest, and here they have a stope the full width of the vein between 40 and 50 feet in height, with a length of about 50 feet, of the very best quality of ore, 66 to 68% in metallic iron and very low in silica and phosphorus. It is a loose, dark colored hematite, looking, at a little distance, like rich vegetable mould, and is shoveled with the same ease as ordinary dirt. Just at present, in this

pit, the ore is obtained with little cost. They are now mining here 200 tons per day. A new hoisting engine, boiler, and two 4-foot drums are on the ground and getting ready as rapidly as possible to operate this pit. The hoisting is now done with a derrick and buckets, but a skip road terminating in an ore pocket is constructing and both are nearly completed, when the skip road will be operated with the new hoisting machinery.

The land is owned by the Teal Lake Iron Co., and is held on a lease by the Bessemer Iron Co., in which Mr. C. M. Wheeler, of Marquette, is largely interested, and who is also Manager of the mine.

The last year's product was 16,718 tons, and the aggregate to date is 87,023 gross tons.

Adjacent to the Bessemer on the west, between it and the Forest City Mine, is a tract of thirty acres, which has been leased by Mr. D. F. Wadsworth of Ishpeming. This gentleman has a party of men now at work on the property, exploring for ore, with thus far favorable indications.

THE FOREST CITY MINE.

This mine, lying next on the west, is now substantially idle. The mine openings, as described in the last year's report, are close to the line of the Cleveland Iron Company's land, on the south, and as the ore deposits dipped in that direction, it soon pressed beyond the limit of the property. No other workable deposit having been discovered, the mine was shut down.

The only thing doing is by a small party of men exploring to the east of the former workings with a churn drill, with as yet no very favorable results. The property, comprising 60 acres, is held on a lease by the Forest City Iron Co., the officers of which are residents of Cleveland, Ohio. F. A. Bates, Secretary.

The shipment in 1881 was 1,895 tons.

CLEVELAND HEMATITE.

Adjoining the Forest City is the Cleveland Hematite, which is described with the Cleveland Company's mine.

THE NORWICH.

Cornering on the Cleveland and Forest City, to wit.: the N. E. $\frac{1}{4}$ N. E. $\frac{1}{4}$ Sec 3, T. 47, R. 27, is the Norwich, a new undertaking which promises to be a mine of some value. A shaft has been sunk on the south side of the highway, not far from the northeast corner of the forty, which is down 38 feet. From the bottom of the shaft a drift has been made to the south 67 feet, on a narrow cross course of soft ore. North of the road, 145 feet west of their boundary line, a shaft has been sunk 25 feet, and from the bottom of it is a drift leading 30 feet to the north, all in ore, with ore still in the end of the drift. The ore is a yellowish, soft hematite, similar to that of the Cleveland. The location of the shaft is in a cedar swamp, and they are likely to find much trouble with water.

The local Superintendent is Capt. Frank Treblecock.

THE NORTH RANGE.

Within the past few years a good deal of exploring has been done on what is called the North Range, resulting in the discovery of several important mines, among which are the Boston, Sterling, Dalliba, Northampton, Jim Pascoe, Marine, Webster, etc.

THE BOSTON.

This range of mines lies north of the M. H. & O. Railroad, and the mines above mentioned, and in some respects the most important, is the Boston, situated about two miles north of the village of Clarksburgh, a station on the Marquette, Houghton, and Ontonagon Railroad. The Boston Mine Company was organized in the latter part of the year 1879, by some Marquette gentlemen who had purchased of the railroad company the eighty-acre tract on which the ore had been discovered, and where the mine was immediately opened and has since been worked. The land comprises the S. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$, and the S. W. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Sec. 32, T. 48, N. R. 28.

The mine proper has a length of about 400 feet and a depth of 140 feet. It is really an open pit, but floors have been made by placing cross stulls from foot to hanging, and lagging them over, leaving openings for the hoisting bucket. The strike of the vein is N. 75° W., and the dip is, with almost perfect regularity, 80° to the south. The hanging wall is a firm gray quartzite, and the foot a banded jasper. The rocks here are found to be identical with those at the Champion and at other leading hard ore mines of the Marquette iron district. The mine is situated upon an elevation of land close to the west line of the property, and the mine is opened through into the Sterling, which joins it on the west.

This high ground is of limited extent, the remainder of the company's land being a level plain, terminating in a small lake, Lake Boston, in the southeast corner.

The owners have undertaken to determine the extent of their ore deposit, in some degree, during the past year, and the result has proven very satisfactory to their interests. These explorations have been made with a diamond drill; four borings have been made across the formation, and cutting through the ore vein, several hundred feet below the surface. They have thus proved the vein for a distance east and west, of 1,140 feet.

No. 1, the west hole, is 300 feet east of the line, and cut the vein at 225 feet below the surface, passing through a width of No. 1 ore 10½ feet, measured at right angles with the walls, and subsequently perforating a

hematite belt 12 feet in thickness, of good ore. An analysis of the ore of the former gave, metallic iron, 67.12; silica, 1.62; phosphorus, .006. Analysis of the hematite gave, iron, 59; phosphorus, a trace only.

Three hundred feet to the east No. 2 drill hole was bored, passing directly beneath what is called the wet shaft. This shaft was sunk soon after the organization of the company, and has, until recently, been used to furnish the water for the boilers and for the use of the location. In No. 2 was found, at a depth of 189 feet, 13½ feet of specular ore, and the drill subsequently penetrated, after passing through a belt of jasper, 27 feet of hematite ore.

No. 3 hole is 500 feet east of No. 2, and at a depth of 192 feet, vertical, a thickness of 13½ feet of hard ore was found.

From the west line to No. 3 hole is 1,140 feet, and it is thus reasonably certain that the company has a continuous run of ore the entire distance. The value of the Boston rests upon the fact of the great regularity and steepness of the vein, and the almost phenomenal richness and purity of the ore. An average of five analyses, made by different chemists, at different times, and from average samples collected by different persons, gives, metallic iron, 67.79; phosphorus, .018; silica, 1.27.

Each of the analyses gave above 67 % in metallic iron, and all but one as low as the average above given, in phosphorus. Other analyses since made, of the drill cores, gave, phosphorus, .006, and equally high in metallic iron. These analyses show, and the working of the ore has practically proven that the ore is valuable for Bessemer steel pig iron. It is sure to be in demand however dull the times may be. As some one remarked, it is a good "panicky" ore, finding a market even in time of panic. Added to this the company owns the fee simple of the land, and thus has no royalty to pay, and otherwise is not restricted. A branch from the M. H. & O. Railroad connects the mine with the main line. The shipment from the mine in 1881 was 14,824 gross tons, and will probably be increased to 20,000 tons for 1882. The total to the close of the year is 21,302 tons. The mine is provided with hoisting and pumping engine, and four 4 feet winding drums; also with a suitable number of dwelling houses and other buildings.

Mr. Fred. A. Wright, the Agent of the Boston, is a new comer in the iron region, but is a very competent, genial gentleman, and is devoting his energy and excellent business qualities to bringing the affairs of the company and the mine into the shape they are entitled to assume. Two changes have been made in the local management within the year, resulting in leaving Capt. P. T. Tracy as Captain of the mine. Sixty to 80 men are employed.

The Jasper shaft, described in the statistical report for 1880 as 387 feet east of the boundary line, was sunk 80 feet and then discontinued, has recently been sunk to 140 feet, intersecting an 8-foot vein of hard ore, 5½ feet of which is first-class specular slate ore. This new find is widening, and is no doubt a continuation of the same lens upon which they are now mining in the main workings, 75 feet to the west.

The method of mining now pursued is to sink No. 2 shaft and the jasper, continuously, and to stope each way from those shafts. No. 2 is 131 feet east from the west line. They will thus always have stopes to work. The sinking and stoping will go on simultaneously. Among the notable improvements are an ore pocket over the railroad track, and an elevated water tank, ingeniously contrived to wash the ore.

THE STERLING MINE.

The Sterling Mine lies adjacent to the Boston on the west. The land is owned by Prof. R. Pumpelly and Major T. B. Brooks, from whom it is leased by the company, and comprises the W. ½ of the S. W. ¼ Sec. 32, T. 48, R. 28. The character of the ore is the same as that of the Boston, and the two mines, which are contiguous, are entirely similar, except that the Boston is the larger opening. At the east end of the Sterling pit, next to the Boston, the ore in the bottom has a width of 12 feet. The mine, as now worked, is a small one; the hoisting is all done in a single bucket shaft, and the product of the mine for the last year was only 4,702 tons; but some explorations have been made to the west in the vein, with a diamond drill, which resulted in developments that greatly enhance the value of the property. No. 1 drill hole, 490 feet to the west, was bored on an angle of 66° with the horizon. Its location is in the swamp, and 57 feet of stand pipe was first sunk, from below which the drill passed 145 feet of quartzite, and then penetrated 5 feet 9 inches of No. 1 ore, and then after penetrating 18 feet of jasper and soapstone, 16 feet 10 inches of ore were struck, measured on the line of the hole, and 15 feet of hematite. No. 2 drill hole was located 500 feet still further west, and was bored on an angle of 58°. Here 88 feet of stand pipe was first sunk through the drift to the ledge, and the drill penetrated first, 15 feet of quartzite, then 5 feet 9 inches No. 1 ore; then 30 feet of jasper, then 8 feet 3 inches of No. 1 ore, after which only mixed ore and jasper was found.

These borings substantially prove the vein for a distance of 1,000 feet, showing the existence of possibly two lenses of ore.

Analyses of the Sterling ore, from the stock pile and of the drill cases, show it to be of the same uniform high value as that indicated in the Boston, being very high in metallic iron and low in phosphorus and silica. In the mine a drift was run to the north, in the foot wall, 36 feet, which crossed 2 feet only of ore. A drawback to sinking shafts to the west to mine the ore discovered by the diamond drill arises from the wet character of the ground and the depth of the drift; difficulties, however, which can be met and overcome.

A change in the management has resulted in putting Mr. G. W. Reed in charge of the mine, as Agent, and making J. R. Reed Mining Captain.

THE JIM PASCOE IRON MINING COMPANY.—(JUNE, 1882).

This Company was organized in the fall of 1881. No recent discovery in the Marquette iron region has attracted so much attention as this still celebrated "find." It certainly gives promise of becoming a very large producer of medium quality hematite ore, averaging 60 % in metallic, 2 % silica, and 0.18 % phosphorus. The samples were taken along the vein the length of the property.

The mine is on the north side of the bluff, north of the Dalliba about half a mile, and has been pretty thoroughly explored so far as can be determined by test pits, etc. These extend east and west the length of the property, and by pits and cuts the width of the ore is shown to be, from the hanging slate wall to the jasper foot, 30 feet, and perhaps upwards. At the time of my visit they were working only one pit near the west line, where they have stripped the ledge, east and west, for a length of 200 feet, and have sunk below the top, for a stope, a lift, of 40 feet. The men are now stoping down the east and

west ends of the sink, which is 40 feet high and 30 feet wide. The skip road goes down from the north side, and a small engine to the north furnishes the present power for hoisting. About 100 tons daily are taken out, with very little cost, scarcely more expense than to mine a clay bank.

Other pits have been started further to the east. At all these points considerable preliminary work has been done. The machinery has been contracted for, two boilers, two engines, 12x13 inches, with hoisting gear, including 4 30-inch drums. It will be some time before the railroad is completed in to the mine. The line has been surveyed, and the road is building.

No skip roads have been made; the only one in use is a temporary affair in the pit, which is now working; possibly the matter is dropped, waiting for the railroad company to fix finally the line of the track, etc. The mine will possess great advantage in the matter of drainage, since the descent to the north is a hundred feet or more to the bottom of the valley, which in itself descends to the west to the level of Lake Michigan.

About 30 men are working for the company under the supervision of Capt. John Foley.

THE MESNARD MINE.

East of the Pascoe and joining it is the Mesnard Mine, a still more recent opening, on what appears to be the same vein. The property is the N. W. $\frac{1}{4}$ of N. W. $\frac{1}{4}$ Sec. 28, T. 48, R. 29. The showing so far is remarkably good, affording every indication of having a large deposit of ore. They have explored it with test pits, and are now sinking a shaft for regular mining. The shaft is down 50 feet. The property is held on a lease from the Atlantic Mining Company.

The officers are: A. M. Byers, President, Pittsburg, Pa.; W. H. McCurdy, Vice President; J. H. Outhwaite, Secretary and Treasurer.

THE DALLIBA IRON MINING COMPANY.—(JUNE, 1882).

The Dalliba Iron Mining Company owns the S. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ and N. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ of Sec. 29, R. 29, T. 48. The mine is directly west of Champion, and at a considerable elevation above the depot at that station, probably 150 feet. Active mining work was begun early in 1881, and the result was the shipment during the season of 10,986 tons of ore. This product has been taken from a pit 160 feet long, east and west, by about 75 feet across. The ground rises to the north and to the south, making a wide, shallow ravine, sloping down to the west toward Lake Michigan. The strike of the formation is in this direction, and the dip is to the north.

The main pit has been worked to the depth of about 50 feet. The north wall is a face of rock beneath which the ore seems to extend to the north. It is thought that the work is against the foot wall, and that the body of the ore is still to the north. To the east of the pit the earth has been removed for upward of a 100 feet, and at 87 feet from the pit, east, a shaft was sunk 25 feet, striking the foot wall; from the bottom of this shaft a drift to the north 17 feet came into the ore, what is believed to be the true lens. An ore pocket has been built and a skip road extended down to this point of the mine, which will soon be in readiness for hoisting ore. Two skip roads go down into the main pit, conveying the product up into substantial ore pockets above the railroad tracks. They are now hoisting about 140 tons per day, which amount

it is expected to more than double as soon as the other pits are ready to produce, and they have enlarged the productive capacity of the present working pit.

About 100 feet to the west beyond this main pit they are stripping for another pit; it is a harder ore and apparently another lens. The M. H. & O. Railroad have a branch running along the south side of the mine openings. The engine house and hoisting, etc., are located to the south 200 feet, and the working shafts are operated from thence with wire ropes.

Over on the north side of the bluff, which separates them, the company has made extensive explorations, upon the westerly extension of the Jim Pascoe deposit. Everything is in readiness to open a new mine here as soon as the railroad is built to the location. The product of these mines is mostly a hard hematite. Much of it of a bright ocher, and a light or dark umber color. It is not adapted to the manufacture of Bessemer steel, and requires picking over. The company is working about 100 men, and Capt. Pascoe declares that if they can have the cars they will ship 50,000 tons of ore the present season.

The officers are: James H. Dalliba, President, Cleveland, O.; W. S. Pollock, Treasurer; Walter Fitch, Agent; John Foley, Superintendent.

THE NORTHAMPTON MINE.

The Northampton Mine is about one-half or three-fourths of a mile west from the south Dalliba. It is owned by the Champion Iron Company, and the estate comprises the S. E. $\frac{1}{4}$ of Sec. 30, R. 29, T. 48, in about the center of which quarter section the mine is situated. North of the old mine the company has just begun the work of opening another mine, designated as the West Northampton.

The workings at the old mine consist of two open pits, the east one of which is idle. The other, a little to the west, is a long narrow pit extending east and west, with sides nearly vertical, 40 feet deep. The skip road comes down to the bottom from the west end and terminates at the top in an ore pocket above the railroad track. At the time of my visit nine men were working in this pit, stoping at the east end and tramping to the skip. The stope at this east end is about 30 feet high and 10 feet or 12 feet wide. The bottom is also of ore. An engine house, 50 feet away, contains the machinery for operating the shaft, etc.

The north pit, now opening, is 400 feet to the northwest. The opening is in the hollow, and the new skip road runs up the side hill to the south, at an increased angle, so that it attains sufficient elevation at the top for an ore pocket above the railroad, which will come in beneath. They have uncovered the ledge 100 feet in length and to a width of 30 feet. This ledge shows some excellent hard ore, hard hematite, very different from that found in the other pits, but is much mixed with rock; in fact I am not sure but the ledge is mostly rock, with some good ore mixed with it. The hanging wall in this, as in the others of these mines, is a black slate, dipping here at a sharp angle to the north. They are sinking at the foot of the shaft and breaking down the ledge to the west, apparently sorting out and covering the ore. The shipping is over the branch of the M. H. & O. Railroad. The management is the same as that of the Champion Mine.

THE MARINE IRON MINING COMPANY.

The Marine Iron Mining Company is a still newer organization, formed to work the property lying next west from the Northampton. A skip road has been built, an engine house, supplied with two internal friction drums, and engine, etc., supplied by the Marquette Iron Bay Foundry works. The skip road is double; also the ore pocket, and an elevated track, 300 feet in length, extends to the northwest for a rock dump. The location is upon the hillside, northeast from Lake Michigamme, from which it is distant about one-half of a mile. Still nearer is the main track of the M. H. & O. Railroad. Several other buildings besides the engine house have been constructed, ready for occupancy.

As in the case at the Northampton, the skip road extends up the hillside at an angle greater than the slope, giving room for the cars below the ore pockets; but here the skip goes up to the north. At the foot of the skip track they are sinking a shaft, and are now down 20 feet. The drift has been removed from an area of 100 feet square, and some test pits made; one of a depth of 30 feet or more, to the south of where they are sinking, that shows more ore than is to be seen where the work is going on.

In the shaft they are digging up the bottom, which is a loose ledge and very wet; in this is a narrow vein of dark colored, soft hematite ore, which is removed by itself and saved. The rest is discarded. As in the others the hanging wall is a dark slate, but where the foot wall is, is not apparent; it is probably at considerable distance to the south. A large force of men is working, grading the railroad, which will extend through this and the Northampton, etc.

On this same range, eight or ten miles to the west, are several mines or explored properties, which bid fair to develop into mines that shall rival in importance any of those to the east of the lake, in the range, which we have just described.

THE FARM.

The most easterly of these new "finds," situated in the North Range west of Lake Michigamme, is The Farm, so called, though it is not, as yet, an organized company, but is controlled by Mr. Ed. Wetmore, of Marquette, who has conducted the explorations, and who holds the lease. The land comprises the N. W. $\frac{1}{4}$ of Sec. 25, T. 48, R. 31. It is about a mile southeast of the Spurr Mine, and three-fourths of a mile from Michigamme. The land has been cleared of trees and brush. The surface rises to a moderate elevation, making a ridge east and west through the center of the property, from which the land slopes to the north end and to the south. The exploration pits are made in this south slope. A few hundred feet to the south of the ore, as thus defined, the ground drops down suddenly a height of 50 feet to the level of the land below, through which rapidly runs the Spurr Mountain Creek, having a fall, on the property, of 20 feet, sufficient for a water power to compress air for working power drills, hoisting, etc.

The first pits are about 800 feet west from the east line; there are two of them, 25 feet deep, 30 feet apart, north and south. It is impossible to see the ledge, but the piles by the side of the pits show good ore, yellow, ocherous, light brown, and dark colored ores, occasionally with crystals of carbonate of iron, spathic ore.

Three hundred feet further west are two more pits, showing ore of the same character—yellow, friable, and hard, brown hematite, much of it showing a large amount of lime, but unmixed with rock, and no quartz.

To the west 500 feet further a series of pits are dug across the formation at a distance apart of about 20 feet. The length of this line of pits is 230 feet, and they seem to be all grounded in ore, judging from the material thrown out. It is claimed that the pits were dug as deep as could be done without blasting. It is also stated that the north pit is just at the foot wall, and the south one against the hanging, making the ore deposit 200 to 220 feet wide.

The south pit was sunk, it is said, 40 feet to the rock, and a drift 35 feet to the north made, on the ledge to determine the line of the ore and the hanging wall. In the southerly pits is found some fine, hard ore specimens that will analyze 65 % to 67 % metallic iron. Large pieces are found showing the hard, red, yellow, and brown ores mixed together or occurring side by side. One hundred feet further west is another large pit in good ore, and still to the west 100 feet are others close to the hanging, showing the same ore.

In all this line of pits extends 1,700 feet or 1,800 feet east and west, and near the west end of the explorations is a second line of pits 220 feet clear across the deposit. In this line is the deepest pit, 53 feet, 33 feet in the ore.

Altogether it is a remarkable showing, and would be much more satisfactory if some of the pits had been sunk with powder until the solid ledge were reached, and it had been found to be equally as good as now appears from the looser material already obtained. The strike of the formation is east and west, and the dip is to the south at an angle of about 45°. The foot wall is a narrow quartz bed on slate.

Several analyses have been made, showing the ore to be, uniformly, about 60 % in metallic iron, 2.28 % silica, and .25 % phosphorus, and 10 % water; the percentage of lime has not been determined. The percentage of phosphorus is found to diminish toward the hanging wall, and to be greatest near the foot.

The ground is admirably situated for economical working and drainage. The 50 feet drop from south of the mine to the lower ground where the railroad will come in, affords a fine opportunity for rock dumps and for ore pockets.

The mine has not yet been stocked, owing to the fact that a law suit is pending regarding some rival claims to the lease. As soon as this matter is settled it is expected to effect an organization. It is but reasonable to assume that it will be, for a time at least, a large producing mine.

THE WEBSTER MINE.

Still further to the west in this range, and showing ores identical with those found at the Farm, is the Webster Mine, the property of the Webster Iron Mining Company. The company's estate consists of the N. $\frac{1}{2}$ of the N. E. $\frac{1}{4}$ and the S. E. $\frac{1}{2}$ of the N. E. $\frac{1}{4}$, Sec. 26, T. 48, R. 31.

The company was lately organized. The officers are: Dr. G. J. Northrop, President; E. B. Palmer, Secretary and Treasurer; A. H. McConnell, Superintendent. The land is held by the company on a lease.

The mining work, recently begun, is in about the center of the eighty, and as the trend is east and west the company has a half mile in length of the ore deposit. The dip is to the south about 70°. On the location they have sunk