

ore the current year than any other mine in the State. In fact its product will doubtless exceed that of any mine in any previous year. There are other mines in this range from which, though not so large an amount of ore can be gotten out immediately, are, perhaps, equally as valuable and seem likely to prove so in the long run.

Between the Montreal—which forms the boundary between Michigan and Wisconsin—and the Black rivers, a distance of 8½ miles, occur the best mines found in this range. In this space the formation is remarkably uniform in the occurrence of the rocks, and in their strike and dip. Nowhere in the iron region is there a succession of mines showing so much regularity. Standing upon the high ground at the Puritan, we look east, over the Ironton, Tontine, Valley, Colby, all apparently in a straight line. And at the Germania, also, we note in the same way, the occurrence of the Ashland, Norris, Aurora, Pabst, Iron King, etc. All the mines within the limits above given, are opened against the quartzite foot wall, which underlies the ore formation and extends uninterruptedly from the Montreal to the Black, but disappears after crossing the latter stream and going east. This belt of quartzite is an admirable feature of the range. It is an important guide in the work, and moreover it may be remarked that nothing of conspicuous value has as yet been found except where the quartzite occurs and in the high ground. Generally, but poor success has attended the efforts to find ore in the valleys; still, it may at any time prove otherwise, and the low ground may prove equally productive in ore.

East from the Black River greater irregularity is manifest; there is an ore formation but quite different. The belt of quartzite has disappeared, and notwithstanding that a vast amount of exploration has been carried on, no deposits of ore have been found, except to a limited extent at Sunday Lake, that have, as yet, any commercial value.

I have examined the explorations through east from the Black River, to Lake Gogebic, a distance of more than 20 miles, and I find at the present writing, that with the exception of the mines at Wakefield, there is no development which we can assume with certainty will make a shipping mine. There are some that are promising, a few have ore, but none have ore of a quality and in quantity to assure a mine.

West of the Montreal, the mines are all in the State of Wisconsin, but there are none among them that will compare in value with the best mines on the Michigan side of the line.

Commencing at this line, the liquid boundary between the two States I will describe in succession to the east all the mines that are worthy of note or of which I have any knowledge. Of course no mine will be omitted which has any ore, or where there is any good promise of ore.

The first of these mines is the

## ASHLAND,

and it is also one of the largest, being second in magnitude only to the Colby. The Ashland mine has improved greatly within the past few months, until now it has developed one of the finest deposits of ore in the State. The estate comprises the S. ½ of the S. W. ¼ of Sec. 22, and the N. ½ N. W. ¼ Sec. 27, T. 47, R. 47 W. The land in section 22 belongs to the Ayers estate, and that in 27 to the L. S. S. Canal Company. Adjoining the mine on the north is the flourishing village of Ironwood, and west of it on the opposite side of the river, is the village of Hurley.

No. 1 shaft is 250 feet east of the river, near the line between the sections. The shafts are all near this line, but as the trend of the ore is about N. 80° E., and as the dip is north it carries all the ore on the north side of the line—on section 22. The surface rises from the river somewhat gradually, about 40-feet to No. 2 shaft, and thence it is moderately level for some distance, again descending, and becoming what was, until recently, a cedar swamp, in which are shafts 6 and 7, and a little beyond the latter is the east line of the property. South of the mine is a level plat on which the company designs laying out building lots for the men. The seven shafts, with the intermediate test pits, prove the ground pretty well for the ½ mile of the length of the vein. No. 1 shaft is 200 feet deep. They have drifted from it at depths respectively of 150 feet, and one at 175 feet. The deposit of ore has increased in magnitude with increase of depth, until now, at the bottom, there is a maximum width of 40 feet of ore. They were opening the mine, making ready for stoping and hoisting work.

From No. 1 to No. 2 is 285 feet, and a surface rise of 40 feet. The shaft—No. 2—is only 100 feet deep. It is connected with No. 3 by a drift in the first level through ore 40 to 150 feet in width.

It will not be sunk any deeper at present, but used for hoisting the ore in the levels already opened. Probably 10,000 tons will be taken from No. 2 before the close of navigation.

The great showing of ore is the No. 3 shaft, which is 225 feet east of No. 2, and is 300 feet deep to the fourth level. It descends vertically to the second, and thence follows in the foot wall. The ore is remarkably wide. They are "opening out in rooms," after the manner elsewhere described in other hematite mines. East of the shaft, in No. 3 room, they have a width of clean ore upwards of 200 feet, and still no hanging wall. The ore is scarcely in one body, being divided by about 20 feet of soft chlorite, between which and the foot wall is 145 feet of ore. They went through this and came again into ore, in which they are still cross-cutting. At the time of my visit, May 17, they were opening No. 8 room, 218 feet east of the shaft. The rooms are three "sets" wide, 21 feet each.

The first level is 93 feet from collar of shaft. The second level 150 feet down, third, 200 feet, fourth level, 300 feet.

In all the levels the ore has proved of great width, and nowhere has any definite hanging wall been found. While the ore is very wide it is also very clean—free of rock.

The deposit is of immense magnitude. I examined it sufficiently to satisfy myself on this point. How large it is cannot be stated, as it is only partially opened. Notwithstanding 65,000 tons of ore were taken from this shaft last year, there has been no great impression made in the deposit. There is an abundance of ore in all the levels. No. 4 is 265 feet east of No. 3. It is a new shaft, sunk downright in the foot wall 200 feet. In the third level the shaft is 20 feet south of the ore. It is connected with No. 3 by drift. They were getting ready to hoist ore from this shaft at the time of my visit. A cross-cut north 100 feet was all in ore. Enough had been determined to insure a season's product equal to their best efforts to mine and hoist. At the time of my visit not much hoisting was doing. They were making every effort to complete the tracks of the Wisconsin Central railroad, which are run along by the shafts, so that the ore will go directly into the cars from the skips, or into the ore pockets, placed over the track by the shafts. The railroad tracks are built and owned by the mining company, and extend to all the shafts.

From No. 4, east to No. 6, is a long stretch of ground, 820 feet. This ground, however, has not been wholly explored; a number of test pits have been bottomed in ore. Even No. 6 and No. 7 shafts are new work, sunk within a few months past and are even now getting in readiness for hoisting. As they are in low ground they were flooded with water when the snow melted in April. Heavy ditching to the south, to the river, will be required to secure immunity from this danger. These shafts are 300 feet apart, each is 129 feet deep, and No. 7 is 465 feet west of the east boundary.

They are sunk in a large body of ore; the best ore found in the mine. A cross-cut 80 feet north is all the way in clean ore, and the rock encountered at the end is chlorite, so that I think that the ore will be found to continue north after the soap rock is cut. The shafts are connected, all in ore; in fact, the length of opening in the 2d—the bottom level—is 600 feet east and west, and they are still driving both ways, in ore. So that I was enabled to pass through a length of 600 feet of ore, and a width of 80 feet, and a depth of more than 100 feet, in this end of the mine.

They will hoist this year from six shafts. Last season but three were used, but most of the product was taken from No. 3. The company has sold 180,000 tons of ore, but if the mine is pushed and they have the lake transportation, a much larger product than that can be mined; 500 men are employed. The rate contracted from Ashland to Cleveland is \$1.75 per ton. Since the mine was opened four men have been killed.

A change house has been built, and is about ready to use. Everything is new and somewhat in a confused arrangement. The mine has developed beyond their

expectations, probably, and after a little time things will be made adequate to the requirements. A new engine house has just been built at the east end for the machinery to operate 6 and 7. The two drums are 6 feet diameter, made at Marietta. The mine is dry. There is very little trouble with water, ordinarily. The ore is soft hematite, mines very easy, requiring very little blasting. It also stands well in the stopes. It is uniformly good ore, equal to any found in any mine in the range. The average of the ore shipped last year was 64% in iron and .042% phosphorus. It is possible that it will average some better in 1887, owing to the superior quality of the ore found in the east end. Some of the ore runs very high in iron and equally low in phosphorus, as shown by analyses.

The officers are Chas. C. Colby, President, Milwaukee; W. H. Abbott, Secretary, Milwaukee; E. A. Hayes, General Manager, Huey, Wisconsin; John A. Taylor, Superintendent of mine; W. J. Olcott, Managing Engineer and Chemist.

At the east end it is the plan to mine out all the ore, carrying the stope on top of the ore body towards the shafts. The only criticism I have to offer is that the main drift is in the center of the ore body, instead of along the walls. It seems to me better in this plan of mining, to follow the method of the Cleveland Hematite. That is safe and expeditious.

The mine shipped in

Year.	Tons.	Year.	Tons.
1885.....	6,471	1886.....	74,015
Total.....		80,486	

It is not probable that there is a continuous run of ore the entire length of the property, but is probably a succession of lenses that closely lap each other, dipping north and "pitching" to the west. These may be equivalent to a single body, reaching the whole length of the land.

Adjoining the Ashland on the east is

### THE NORRIE MINE,

which is the property of the Metropolitan Iron and Land Co. The mine is in the S. ½ S. E. ¼, Sec. 22, T. 47, R. 47, the fee of which is owned by the estate of J. C. Ayer, from whom the mining company holds a lease with the usual royalty for the ore. The ore formation runs the long way of the 80—one half mile, and as this company also holds the W. ½ of the S. W. ¼, Sec. 23, which adjoins on the east, it really has a length of ore formation of three-fourths of a mile—N. 80° E. The Norrie is one of the four chief mines of the range and is, perhaps, thus far, the most systematically worked of any.

There are seven shafts in all but the best ones—those affording the larger portion of the ore are at the west part of the mine. No. 1 shaft is a new one, at which they are just now erecting a plant of machinery to operate it. It is

180 feet east from the west line, and is 100 feet deep, and they have drifted each way to east and to west at the bottom, 26 feet, and have cross-cutted to north 20 feet, in the west side of the shaft. These drifts are all in ore, so there is no doubt of having a good lense of ore in this shaft. The Norrie ranks second only to the Colby in the matter of shipments. The mine is wholly underground and systematically arranged in "rooms" and pillars, and timbered in good shape after the Nevada system.

The maximum length of the main pit is about 850 feet, and the width at the east end in the bottom is more than 110 feet. They have a cross-cut 110 feet, all in ore with no rock yet. The maximum width of ore in the second level, 175 feet down, was 160 feet. The west shaft in the main working pit is No. 3, which is about 700 feet east of No. 1, and is 250 feet deep. It was started in ore on the foot wall at the surface, but at the second level the foot wall "makes" north 20 feet from the shaft; and at the third level it is 50 feet north. East of the shaft it is 100 feet, as is shown by a winze that starts in the second level 100 feet north of the foot, but in sinking it vertically the foot is struck in the third level, showing that in this distance down the foot wall has flattened and gone north 100 feet. However, further on east, at No. 5, the foot wall is back to the south, the excessive flattening being confined to the west end.

It is probable that No. 3 is at the upper end of the ore lense that dips north with the formation, and inclines to the east in the same manner, as may be seen at the Colby.

A peculiarity of the foot wall in the west end of this pit is the sand. The quartzite is changed to sand; and there are also bunches of sand—disintegrated quartz boulders—in the ore. The occurrence of sand in the ore, of sand in the walls, of quartz boulders in the ore is common in the mines in this range. It is found to some extent in all of them, and sometimes there is too much sand, or, of its equivalent, rock.

No. 4 shaft is 350 feet east from No. 3, and No. 5 is 195 feet east of No. 4. Each is 250 feet deep, down to the third level.

In No. 4 no opening work has been done in the bottom. It is pretty wet. It is better to get a level beneath the one that is opening, to take the drainage. The ore that is worked in can be thus made dry. In the second level, in No. 4, the ore, except the pillars, is all worked out, and it is possible that below the third level the ore is cut out by the underlay of the foot wall and the easterly pitch of the lense.

No. 5 is opened pretty well in the third level, and is looking finely. The drift from the shaft east is 150 feet, and still in good ore. Possibly the ore will continue to No. 6 shaft 300 feet from No. 5. Certainly it has lengthened east, since in the second level it only extended east 140 feet. The shaft is in the foot wall, and they cross-cut north to the ore. A cross-cut in the ore is

in 110 feet, but not yet through it as I have previously stated. The ore is clean and first-class.

No. 6 shaft is 300 feet east from No. 5. It is sunk on the hanging wall side, inclining to the north at an angle of 60°. It is now, May 15, 175 feet deep. They will reach the ore by cross-cuts south.

No. 7 shaft is 350 feet east from No. 6, and is 150 feet deep, and shows a deposit of ore about 5 feet wide. It is idle at present. The Norrie ore averages about 62% in metallic iron, and about .042% in phosphorus.

The mine is well provided with machinery, adequate to present needs. Unfortunately there is a good deal of burden on the surface over the mine, and experience has shown the instability of mines upheld by timbers. Ultimately to extract the pillars, the mine must be filled, and it would be cheaper to do that on the start. There are 35,000 tons of ore in stock.

The mine produced in

Year.	Tons.	Year.	Tons.
1885.....	15,420	1886.....	124,835
Total.....		140,255	

The officers are S. S. Curry, President, Ishpeming, Michigan; H. S. Hazelton, Secretary, Milwaukee, Wisconsin; R. H. Hanna, Treasurer; Jeff. D. Day, Superintendent; Win. Treblecock, Mining Captain, Ironwood, Michigan.

## THE EAST NORRIE,

owned and operated by the same company, is situated in the N. W.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  Sec. 23, adjoining the Norrie. They are working one shaft, and are opening another one. The total length of opening east and west is about 250 feet, and the depth is 150 feet, and the greatest width of ore is about 40 feet. Are working 30 men, and will get out about 10,000 tons the coming year, it is estimated. The mine has been changed from open pit to underground. The ore is the same as at the Norrie. The mine yielded in 1886, 10,160 tons of ore.

D. E. Southerland, Mining Captain.

## THE AURORA,

the property of the Aurora Iron Mining Company, is one of the chief mines of the Gogebic range. Its owners claim it to be second only to the Colby in magnitude. The mine lies east of the Norrie and southwest of the Pabst, the estate being the N.  $\frac{1}{2}$  of S. E.  $\frac{1}{4}$  Sec. and the E.  $\frac{1}{2}$  of the S. W.  $\frac{1}{4}$  of Sec. 23, 47, 47; the former belongs in fee to the L. S. S. Canal & Iron Co., and the latter, E. W. Sparrow. They are held on 20 years' leases by the company, the consideration being that the company shall mine, or pay royalty of 60 cents per ton on at least 10,000 tons of ore annually. For all amount in excess of 10,000 tons the royalty is 50 cents.

The two 80's form an L shaped figure, the east 80 being south of the Pabst and formerly known as the Vaughn.

The first exploring work was done on this property by the Cambria Iron & Steel Co., in 1882 that relinquished its option, after which the property was held by Capt. N. D. Moore.

As with the others, systematic mining work has been in progress scarcely two years, but here it has resulted in important results, to wit, the development of a very large amount of most excellent ore.

The Aurora, unlike its neighbors, was first worked open cut at the west end, and they are preparing to "strip" the ore at the east end, preparatory to proceeding here on the same method.

The open pit at the west end—the original Aurora mine—is about 400 feet in length, with a surface width of 150 feet. The ore is covered with an average depth of dirt and rock of 20 feet. In the work of stripping, one of Fayette Brown's patent conveyors is used; it comprises an iron bucket holding one and a half cubic yards of earth attached to a wire rope; when filled the signal is given, the bucket quickly ascends vertically up to the horizontally suspended rope, which answers as the track for the shieve, that runs the load away over to the north of the mine, where it is dumped, and then as speedily returns and is lowered into the mine; the rope is attached to another bucket that has been filled during the absence of the first one, which is in the same manner taken to the dumping pile. So the work of stripping goes on uninterruptedly, night and day.

In this west end mine are two shafts, 1 and 2. The former is 950 feet east from the west line of the property, and is 120 feet deep. At 60 feet down, a drift north gave a width of ore 140 feet.

No. 2 shaft is east from No. 1, 145 feet, and is 140 feet deep—15 feet stripping, 125 feet of ore. Sixty-five feet down a cross-cut north found 146 feet of ore. The ore is entirely free of rock, and of the best quality.

No. 3 shaft is 480 feet east of No. 2, and they are nearly connected by drift at 100 feet below the surface. The drift is all the way in ore. The shaft is 145 feet deep, and all in ore below the stripping. Several cross-cuts have been made to the north at different depths, showing a width of ore of from 20 feet to 30 feet. All the ore taken from the shaft has come from the openings.

No. 4 shaft is 285 feet east of No. 3, and in sinking it passed through 10 feet of dirt and 13 feet of rock, when the ore was reached, which has been penetrated by the shaft 167 feet.

In the first and second levels, 50 feet and 110 feet down respectively, the ore was found to be about 10 feet wide, while in the third level, 150 feet down, it had increased to a width of 30 feet.

The shaft is connected by drifts with No. 3 and with No 5, and is used for pump and timber shaft.

No. 5 shaft is 140 feet east of No. 4. Two drifts have been cut to the east, one at 60 feet down and one at 110 feet. The first showed six feet of ore, the lower one about 10 feet, and at the bottom, 150 feet below the surface, the ore is 30 feet wide.

No. 6 is 300 feet east of No. 5, and No. 7 is located 300 feet east from No. 6. They are only to the ledge, but both in ore. A summary of the work shows a total of 770 feet of length of shafts, 200 feet of winzes, and 2,350 of drifts.

The length of deposit tested is about 1,500 feet.

The railroad track extends along by the shafts, and the pockets receive the ore direct from the skips.

I was informed that about 30,000 tons of ore had been sent to the Joliet steel works by rail. It is estimated that a product of 200,000 tons will be shipped during 1887.

The machinery consists of two steam boilers, each 60"x18', 6 pumps and 5 winding drums. Four of the shafts are provided with skips, and ore pockets are at shafts 1 and 2, and they are also building pockets at Nos. 3 and 5.

The buildings comprise office, shops, three engine houses and one boiler house; also dwelling houses.

The Aurora is one of the series of mines controlled by Messrs. Moore, Benjamin & Co.

N. D. Moore, President, Milwaukee, Wisconsin; H. S. Benjamin, Secretary, Milwaukee, Wisconsin; C. F. Rand, Treasurer, Milwaukee, Wisconsin; Richard A. Parker, General Manager, Hurley, Wisconsin; N. Hibbert, Superintendent, Ironwood, Michigan.

The product of the mine in 1886 was 97,659 tons, which sold at an average price in Cleveland of \$5.05. The railroad freight to Ashland was 80c., and the average lake freight to Cleveland was \$1.68.

The ore averages in metallic iron 62% to 64% and .035% to .040% in phosphorus, 3.20% silica.

## **THE NORTH AURORA MINING CO.**

The North Aurora, so called, is a new undertaking, lying north of the Aurora in the S.  $\frac{1}{2}$  N. W.  $\frac{1}{4}$ , Sec. 23. A shaft is sinking near the Aurora line to find what is called the north vein. At the time of my visit there were no indications of ore in the shaft. The projectors claim to expect to find the main ore bodies on this property, and ultimately to catch the Aurora ore in the underlay to the north, as the Aurora shafts are not very far from the north line of the property.

The officers are, John Paulson, Minneapolis; O. J. Nevitt, Minneapolis; Matt Fitzsimmons, Ironwood, Mich.

Directly east from this is

## THE PABST MINE,

in the S. ½ N. E. ¼, Sec. 23. It is one of the best equipped mines in the range. The drums, new ones, are six feet diameter, besides four, not used, three and a half feet diameter; two cupola boilers 125 horse power each, and two locomotive boilers, National Compressor, with capacity of 12 drills, of which number eight are used; Rand's three skip, two tons capacity each, and two of one-half tons each; seven tram cars, good ones, each one and a half tons capacity and full equipment of pumps.

The engine house is large and substantial. The structure over the shafts for ore pockets, elevated tramway, etc., are strong and substantial. There are also the other necessary buildings.

The property has a full half mile in length of the ore formation, and the full width of the portion that has proved productive in the mines to the west, that is, it holds what are called both the north and the south veins.

But the ore deposits, so far as shown, are by no means as large as are found at the other mines in this vicinity, that is, at the Aurora and at the Iron King. The Pabst has four working shafts. No 1 is 45 feet west and 360 feet north of the southeast corner of the property. It is sunk vertically, 124 feet deep, and is 8'x 18' outside measurement, divided into three compartments. They are now sinking in it for another level. The ore body is 15 to 20 feet wide and 75 feet long; there has been taken of it from the shaft 7,500 tons. They are also exploring north with a drift, are in mixed ore and rock. The drift is in 12 feet only.

No. 2 shaft is 330 feet west from No. 1, and 100 feet deep, inclining to the north at an angle of 60°. It is sunk in the foot wall. They have drifted west 80 feet and east 70 feet, and have ore 30 feet wide; but it is not first-class, that is, there is more or less rock in it. There is only one level, the ore body extends down from 26 feet below the surface.

No. 3 shaft is 202 feet west of No. 2, and it has an equal depth; it is the main shaft of the company, is in the foot wall and reaches the ore by cross-cuts. A singular occurrence in driving this cross-cut in the bottom, illustrates one of the peculiarities of this formation—the finding of sand in the foot wall in place of the solid quartzite. In this instance the cross-cut, 50 feet long, in the bottom, proved to be in sand and being saturated with water, it was nearly impossible to keep a drift through it. They succeeded only by drawing out the sand until it became exhausted and by filling in with rock from the surface.

In the bottom level in this shaft they have gone east 17 feet—to the rock—and west 70 feet. The ore is about 40 feet wide. They are still scoping west. In this breast stope there is some sand mixed with the ore, and on the foot wall side are concretions—iron nodules, etc., in the ore. The pit is pretty wet—"droppy." In the level above

the length of ore west was 117 feet. The shaft is 127 feet north of the south line of the land.

No. 4 shaft is 232 feet west of No. 3. It is sunk in the hanging wall and is vertical, 145 feet deep, 7'x 9' inside of the timbers. The plan is to sink 40 feet more and then open another stope. The shaft has cost \$30 per foot, including the timbers. The ore is harder than in some of the mines here, and in sinking the shafts considerable rock is penetrated, so that the power drills are quite an advantage in pushing the work.

They are sinking a shaft for the north vein, 450 feet west of No. 3. It is now clean 55 feet, with no signs of ore as yet. They hope for better results when twice the present depth is attained. At this date—May 18—the company has shipped 3,000 tons of ore, and has 14,000 tons in stock at the mine. They expect to reach a product of 50,000 tons and upwards. I doubt if they exceed that amount very much.

Southeast from the mine, on the S. W. ¼ of Sec. 24, a village has been platted—Jessyville—where is already a postoffice and half a dozen saloons, etc.

The property is favorably situated. I can see no reason why as much ore should not be found on it as on any land in the range.

The officers are, Fred Pabst, President; Chas. Best, Jr., Vice President and Treasurer, Milwaukee; Henry Baest, Secretary and General Agent, Ironwood; Richard Kitto, Superintendent.

The average selling price of the ore in Cleveland, in 1886, was \$4.51. Railroad freight to Ashland, 80 cents per ton. Lake freight, \$1.73.

The mine produced in

Year.	Tons.	Year.	Tons.
1885	1,153	1886	17,925
Total		19,078	

The following are some analyses of ore from the different shafts, made by Mr. C. E. Wright and others:

Metallic Iron	64.37%	Phosphorus	.047 %
" "	66.17%	" "	.024 %
" "	62.75%	" "	.023 %
" "	59.92%	" "	.0215%
" "	65.17%	" "	.038 %
" "	60.55%	" "	.026 %

## NORTH PABST MINING COMPANY

is the title of an organization engaged in exploring in the land north, of the Pabst, to wit: the N. ½ N. E. ¼, Sec. 23. So far the work done is sinking test pits, etc.

## THE IRON KING MINING COMPANY

is to be congratulated on the fact that its mine is proving so valuable. Few mines on the range have changed for the better, recently, so greatly as has the Iron King.

From being property of doubtful value, it has advanced into the front rank, and promises to be a first-class mine. The property joins the Pabst, being the N. W.  $\frac{1}{4}$  of section 24—160 acres. Thus there is a full half of a mile of the ore formation in length, in the property. The line of the foot wall at the west side of the land is but 400 feet north of the S. W. corner, so that there is more than 2,000 feet at this end for width of ore formation on the property. The bearing of the foot wall is about N.  $45^{\circ}$  E., and thus it crosses the west line at about the same distance from the N. E. corner as on the west side it is from the S. W. corner. There are three shafts in the so-called north vein, the most westerly one of which is No. 1, which until lately was an open pit. The shaft is now 225 feet deep, dipping north at an angle of  $65^{\circ}$ . It is opened in two levels. In the bottom they had gone 65 feet east and 50 feet west, all in ore, and the ore still continuing both ways. This level is 207 feet below the surface; a cross-cut north shows the ore to be 56 feet wide. It is nearly all clean. There is rock found at only one point in the cross-cut. They commenced stoping in this level last April. The first level is 60 feet below the bottom of the open pit, and they have drifted west in it 60 feet from the shaft, and east 209 feet, to connect with No. 2 shaft. The average width of the ore has been about 20 feet. Fifty feet below the ore was drifted in, east of the shaft, 35 feet, and cross-cutted north, 36 feet, all good ore, giving by analysis 64% of metallic iron, and .035% phosphorus.

The shaft is in good shape, well timbered, they operate in it a two ton skip. Thus No. 1 affords ample assurance that it will furnish a good quantity of ore.

No. 2 shaft is 209 feet east, and, as above stated, is connected with No. 1 in the first level. The latter is 115 feet below the surface, being 50 feet beneath the bottom of the old open pit. The ore has been stoped away between it and No. 1, and to the east for about 100 feet, the average width being 10 or 15 feet. The end of the drift east 25 feet is rock. The second level is 65 feet below the first, and at 36 feet west of the shaft further connection is made between them by means of a winze. A cross-cut north went through 36 feet in width of ore. The third level is 80 feet below the second—260 feet below the surface. In it they have driven west nearly to No. 1 shaft, all the way in ore, after cross-cutting through 22 feet of rock at the shaft. The drift east from the shaft in the third level is 30 feet long, ends in rock, but a cross-cut north from the shaft 40 feet in length, is all in ore. The ore runs at about 62% in metallic iron and .030% in phosphorus.

The open pits, through which these shafts are sunk, comprised the working portion of the mine in 1886.

In the two shafts is now opened a length of ore of 360 feet, showing a maximum width of 50 feet.

There is a new shaft house at No. 2, with plant of machinery that operates a two ton skip in the shaft.

No. 5 is the third of this line of shafts. It is 800 feet east of No. 2, and at this date—May 18—is 85 feet deep.

The shaft passes through 75 feet of earth and rock capping, and then comes into fine ore. The ore body at No. 5 has been tested by means of a test pit, which is north of the line of the shafts, and which they sunk 65 feet when ore was reached, in which they cross-cutted south, 62 feet in ore. They are now sinking in this ore to test its depth. They have drifted west in it 30 feet in ore.

In the south vein, so called—the ore that lies on the quartzite belt—the company has two shafts, Nos. 3 and 4. The first named is near the Pabst boundary, about as near to it as it can be. It is about 55 feet east of the Pabst, No. 1 shaft, in which a good width of ore was found and stoped out up to the line between the properties.

But the Iron King people don't seem to find it on their property as yet. The shaft is down 100 feet, and a winze has tested the ground 20 feet still deeper; some cross-cutting and drifting has been done. They are sinking the shaft intending to go down about 150 feet, and then drift and cross-cut.

No. 4 shaft is affording far better results at present writing. The ore was first found in a test pit, sunk to a depth of 20 feet, and then cross-cutting in the ore 30 feet. After this the shaft was begun, which is now 150 feet deep. It is on the high ground south of Nos. 2 and 3 shafts. The first level is 70 feet from top, and the second 135 feet. The work was begun in Nov. last.

The ore has been found 60 feet wide in the first level and have drifted west in it 35 feet. No drifting east.

In the second level they have drifted west 90 feet and east 30 feet, both in ore, and ore in the breasts of the drifts. The ore has been crossed with a drift to the north, a distance of 55 feet, and still not to the hanging. Thus pretty well demonstrating the fact that there is a great body of ore to be opened in this shaft. The shaft is about 1,000 feet east from the west line. Altogether it is pretty certain that the Iron King is to be a great producer of first-class ore. It is an important feature that none of the other mines show, except the Colby, that at the Iron King are two series of ore deposits running with the formation, two veins they are called, which if they are found to continue across the property will give the mine great value. They are making surface preparations to render the machinery and other requirements adequate to the needs of a large output. An ore pocket is building at No. 4, and the railroad is extending to it. The ore pocket is to be a large one having a capacity of 1,000 tons of ore. It will have sufficient length to enable them to load half a dozen cars at one time. A similar pocket will be built at No. 1 and at No. 2 shafts. The railroad branches are connected with M., L. S. & Western main line. There are at the mine, it is stated, 780,000 feet of logs, 300,000 feet of square timber, and 100,000 feet of plank, all to be used in the mine and in surface work. There are a number of dwellings, a large boarding house for men, and other necessary buildings, among which is a good engine house containing a plant of hoisting machinery of W. C. & Lane manufacture—drums 6'

diameter. The force employed averages now 160 men. They expect to ship, the present season, 75,000 tons of ore.

The ore averages 61% to 63% in iron, and below .040% in phosphorus.

The officers are, John E. Burton, President, Milwaukee; J. G. Sherman, General Manager, Hurley, Wis.; E. J. Severson, Assistant General Manager; Chas. Whitford, Mining Captain, Hurley, Wis.

Shipments for 1886 amounted to 27,343 tons. Average price in Cleveland, \$5.00 per ton. Railroad freight, 80 cents; average lake freight, \$1.30.

## THE BONNIE IRON MINING COMPANY

is the proprietor of the quarter section of land which joins the Iron King on the east, being the N E.  $\frac{1}{4}$  of Sec. 24. The Bonnie is one of the series of what is known as the "Burton mines." This list comprises the Iron King, Bonnie, First National, Blue Jacket and the Valley. Of these the first mentioned is the only one that, at the present writing, affords absolute assurance of being a profitable mine, or of being a property that contains enough ore to make a mine of much magnitude or profit. Still, I can see no reason why ore may not exist at the Bonnie in as large quantity as at the Iron King, only so far, it has not been found. The ore is not clean. It is mixed, ore and jasper. A good deal of exploring work has been done in the way of sinking test pits, both in the north and south veins, as they designate them. In the latter, next to the quartzite, six shafts have been sunk, No. 1 of which is 250 feet from the east line of the west eighty. It inclines to the north with the foot wall, at an angle of 60°, and is 100 feet deep. At 50 feet down a cross-cut was made to the north 36 feet, through very good ore, and they drifted west along the foot wall 60 feet, and east 20 feet, all in ore. Analyses shown gave \$0% in iron and .030% in phosphorus. At the bottom they have not cross-cutted, but had drifted west about 40 feet in ore. They are rigged for making a stock pile at No. 1 east from the shaft to the railroad, which comes along at the east end of the bluff. The hoisting in the shaft is done with a bucket.

From No. 1 the ground rises to the west in the direction of No. 2, which is 190 feet distant. It is a skip shaft, but has been idle since last fall on account of the water. When connected with No. 1 the latter will take all the water. The shaft is 90 feet deep, and they have drifted west in the bottom 75 feet, in what is called ore. I did not see this, as the shaft held too much water. I only judged from the stock pile.

No. 3 is still further west 200 feet, and in still higher ground. It is 60 feet deep, and is worked with a windlass. The shaft shows mixed ore and rock. It is in what is called the "capping," the rock which overlies the ore.

No. 4 is 200 feet west of No. 3, and is 100 feet deep. It is idle. The shaft holds a small vein of manganiferous ore,

or very high in manganese. One analysis of this ore gave 27.50% manganese and 37% iron, .027% phosphorus. The deposit is two to four feet wide, and is not continuous. It gives way to rock. Cross-cuts in this shaft did not develop anything of value. The "ground" is hard and unpromising.

No. 5 is 175 feet west from No. 4, and is 65 feet deep. It is worked in open pit. They have mined here 700 tons, and will continue to take out ore, as the ore is five feet to 8 feet wide. The surface dirt is eight feet, resting on the ore. Gone east 35 feet, but west is rock.

No. 6 is 150 feet west of No. 5, and is 38 feet deep. It is in mixed ore and rock.

In the north vein is a shaft 75 feet deep, in which a little ore was found. It was worked last year, and it is the intention to work it again soon. They will sink it deeper and cross-cut the formation. There are many other pits on this north vein, but none containing good ore, so far as I know.

This formation—the quartzite foot wall—runs diagonally across the north end of the west "eighty," some work has been done on the east half of the property. Pits commencing 200 feet east of the line, which divides the  $\frac{1}{4}$  section north and south were, Capt. Jones tells me, "bottomed" in ore. Considerable difficulty attends exploring here, as the ground is wet, and the drift is 21 feet deep before reaching the ledge. It is the intention to wait for dry weather, in the latter part of summer, and then prosecute the work.

Just now all effort is making to complete the railroad track so as to get to shipping ore. The force employed was, at the time of my visit, May 15, 40 men.

The best outlook for the mine is at No. 1 shaft. Up to the present time no ore has been shipped, though there are several hundred tons in stock.

John E. Burton, President; John A. Kennedy, Secretary. General office 408 Milwaukee street, Milwaukee. J. G. Sherman, General Manager, Ironwood, Mich.; E. H. Jones, Mining Captain.

## THE FIRST NATIONAL IRON MINING COMPANY

is working in the N. W.  $\frac{1}{4}$  of Sec. 19, which lies next east of the Bonnie. The company, however, holds the quarter section adjacent on the north, to wit: the S. W.  $\frac{1}{4}$  of Sec. 18, thus making the total number of acres held 320.

Here, also, considerable exploring work has been done. The land was among the first to be tested for ore, but so far it cannot be said the result has been very encouraging.

It is reached by a branch from the main line of the M., L. S. & W. railroad, which latter runs through the north part of Sec. 18. The same branch passes first to the Blue Jacket, and then continues on to the First National.

Just now the work of the mine is concentrated in two shafts, No. 1 and the A shaft. The former is 110 feet deep, with a cross-cut at 55 feet down from the top and 32 feet north. They have drifted east 75 feet from the shaft in mixed ore and rock for 30 feet, and then for 45 feet it is pretty good ore. At the bottom, 55 feet below first level, they drifted west, but the ore disappeared. They are now drifting east, and are in ore; have also cross-cutted in 15 feet of ore east of the shaft.

Shaft A is 435 west of No. 1, and is 90 feet deep. The first level is 66 feet down, and in this they have drifted both east and west from the shaft—west 80 feet in a sort of second grade ore, that is, the drift is in ore, but it is not clean ore. At 60' in west is a raise 20 feet, also in the same ore, and the shaft itself continues down in ore.

The drift is east of this shaft 25 feet, with a cross-cut north 20 feet, both in ore; that is, there appears to be pretty good ore all along on the bottom of the drifts, and in the sides near the bottom. It seemed that they were on top of a deposit of ore.

Considerable money has been expended for surface improvements. There is a fine office building, Superintendent's house and other dwellings, good engine house, etc. The plant of machinery comprises two 5-foot drums, Lane pattern. Were working 35 men.

From A shaft the surface ascends quite steeply to the east, and in this hill, east from No. 1, the most of the mining work has been done. One shaft is 115 feet deep, but there is too much rock in the ore, also it carries a good deal of manganese.

The best out-look just now is in the A shaft, down under the hill to the west, but one cannot safely predict great things even of this shaft.

The First National has a capital stock of \$2,000,000—80,000 shares—which are quoted now as having a market value of \$7.50, which would give a cash value to the mine of \$600,000. This is for a property held on a lease for a limited period.

The Bonnie has a capital stock of 40,000 shares, par value of \$25 each. They are quoted as having a market value of \$13.00, \$520,000 for the mine, with the ore, or any considerable quantity of it yet to be found.

I merely call attention to this to show the extravagant estimate that is made of these properties, many of the mines, so-called, in this range. The Ashland, for instance, is quoted at \$40 per share, 40,000 shares, \$1,660,000. A large sum, certainly, but even then the stock is cheaper than the major portion of the stocks of the mines in the Gogebic Range would be at one hundredth of that figure. There has been a great deal of money made in manipulating the stocks of the Gogebic Range, and some of the stocks will prove a good investment. But on the other hand, there has been, no doubt, a good deal of misrepresentation and fraud, and some of the financial gains represent equal losses. Money acquired by the sale of stocks that are valueless, is to the same amount a loss to the unfortunate

purchasers, who had, perhaps, in good faith, acquired the stock. The Gogebic stocks have been scattered over the country, and many purchasers will suffer severely from their ultimate great depreciation in value. These remarks are not introduced here to apply to the First National, but with reference to their application to the over estimate of the value of the stocks of the most of the mines in this range.

President of First National Mining Company, John E. Burton; General Manager, J. G. Sherman; Joseph H. Johns, Mining Captain.

## **THE BLUE JACKET IRON CO.**

holds the quarter section of mineral land adjacent to the north half of the First National property, to wit, the S. E.  $\frac{1}{4}$  of Sec. 18. The land is in all respects favorable for the occurrence of ore, and for the prosecution of mining work; but unfortunately for the owners, very little ore has yet been found.

There are four shafts sunk on the foot wall, but at the time of my visit they were working in but two of them, the east one of which is 160 feet deep. In the bottom of this—No. 1—they are drifting west, and had just come into ore when an excess of water, which came in in the drift, interrupted the work. No. 4, the west shaft, is about 300 feet from No. 1. Nos. 2 and 3 are between these extreme ones. So that at present the work seems to be concentrated upon a short stretch of ground. No. 2 is about 60 feet deep, and is in ore; Capt. Harvey says, 15 feet to 20 feet in width. This is the body of ore that they wish to reach and mine from No. 1, when they have fully provided for disposing of the water. They are also busy building two ore pockets to receive the ore when hoisted. The pockets are over the railroad track, and are connected with the shafts by elevated tram roads. There is also a small amount of ore in stock. The engine house is furnished with two drums for hoisting, 4 $\frac{1}{2}$ ' diameter each, Bullock's pattern; one for No. 1, and the other for No. 4 shaft.

The other explorations on the property have not developed ore.

John B. Burton, President; J. G. Sherman, General Manager; J. H. Harvey, Mining Captain.

## **THE NEWBERRY**

is the title given to an exploration in progress, consisting of a shaft just north of the wagon road, that runs along the range. It is just north of the Bonnie in the S. E.  $\frac{1}{4}$  of Sec. 13, 47, 47. The shaft is 75 feet deep, the time I saw it—May 19—and in a quartzitic flag.

## **THE NORTH IRON KING**

is another exploration just begun in similar location as the above; but north of the Iron King mine, in the S. W.  $\frac{1}{4}$  of Sec. 13. Wm. Hockin has charge of the work and some Minneapolis men furnish the money.

## THE PURITAN MINING COMPANY

operates on the quarter section lying east of the Blue Jacket. The Puritan is in high ground, apparently as elevated as any in the range. It is on a level with the Colby, which is situated a mile to the east of it in the bluff on the opposite side of the valley that separates them. A spur from the Blue Jacket railroad branch runs east across the Puritan land, and gives a track along on the foot wall south of the shafts. Another track, the Ironton Mine branch, which comes in below the bluff to the east, is extended southwesterly, bending around the bluff, so as to afford a place for ore dock and pockets to receive and; transfer the ore taken from No. 1, the east end of the mine.

The description of the property is the S. W.  $\frac{1}{4}$  Sec. 17, T. 47, R. 46, and the mine is all in the east half of the property, adjacent to the quartzite foot wall to the north and west of the mine the ground has been a good deal explored with test pits, most of which were sunk to the ledge, and show in the debris about them a mixed ore and jasper. West of the mine, a few hundred feet, is a railroad cut about four feet deep, in the ledge, and 100 feet long, diagonally across from the quartzite foot wall, northwesterly. It cuts through a very rich jasper, that is, through ore which is too high in silica to be merchantable, but it affords excellent indications for finding ore, possibly at greater depth. Not unfrequently in this range, lean or mixed ore is succeeded in depth by that which is clean and marketable.

In the Puritan there is a full half mile of the ore formation—of the quartzite foot wall, against which, or lying on which, all the best ore deposits have been found, and north of this it is about 800 feet to the north boundary, a little beyond which an exploration, now in progress, develops a formation of black slate.

The mine was first opened at the east side of the property, where the land descends to the east. Here the most of the ore thus far mined has been found. This ore deposit is divided with the Ironton. The boundary crosses the ore and both companies mine to the line. This is a fine deposit of ore, and the product is cheaply secured. The bottom of this pit is now reached by two shafts; one on the foot wall, No. 1, called also the skip shaft, and another about 12 feet southeast of it, sunk vertically from the surface in the quartzite foot wall. It is called the rock shaft. Hoisting is done in it with a bucket. The ore has been mined out, both in this and in the Ironton, and the top allowed to fall in, so that there now appears a long open pit, which is 200 feet in length on the Puritan side, about 50 feet in depth, and a surface width of 100 feet.

The skip road is 132 feet west of the east end of the mine and the whole length of the underground opening in the first level, 90 feet down, is 220 feet. Eighty feet from the shaft, west, is a cross-cut north 45 feet in mixed ore and jasper. The length of the ore body is about 180 feet east and west.

Descending a winze, which is near the cross-cut, 27 feet, brings one to the bottom of the second level. It has been opened 132 feet east, to the line, and 136 feet west, in all 268 feet.

The breast of the drift west is looking well. There is a "leader" of ore which, if followed, may lead into a much larger body of it. The average width of the ore in this level is about 40 feet, for a length of 180 feet and a depth of 27 feet, substantially all standing in the mine. The drifts have been made along the walls, and timbered, and the work of removing the ore has begun. Commencing at the east line and working towards the shaft, stoping off the end of the ore, and letting the ground "run in" from above after the ore is removed. There is a level partially opened under this 23 feet further down, 140 feet from the surface. The drift west along the foot is 26 feet, and east 100 feet, and the cross-cut south from the face of the foot wall to the rock shaft is 27 feet long. The ore has not been cut through north, but in the Ironton, which is deeper than the Puritan, the ore has increased in width, so that there is no apprehension of any diminution in the Puritan. It is entirely clean ore, no rock to sort out. It is hoisted up both the shafts, and run down to the ore pockets, 600 feet south, on a gravity incline. The pockets are 40 feet above the railroad.

No. 4 shaft is the next most important one. It is 1,290 feet west from the east line, and is 115 feet deep, inclining  $65^\circ$  north on the foot wall. The first level is 65 feet down from the top. About the shaft it is mixed ore and rock, and so continues west 60 feet, where good ore is reached, 20 feet in width. The ore holds for 70 feet, and is followed up to the surface dirt on an incline of rock, which separates this ore from a body of equal length west of it. The partition wall is about ten feet thick, and dips east at about  $45^\circ$ . The westerly lense has a width of upwards of thirty feet, all in ore. East of the shaft the ore is mixed with rock, and requires picking. At about 50 feet east is a drift to south 10 feet, to the quartzite, and at 60 feet in is a cross-cut north 40 feet. Both these are in the same formation that is found in the main drift. Above the first level, about 20 feet, clean ore is found 10 feet in width, which has been drifted and stoped in 60 feet west and 70 feet east. I judge that it extends up to the surface dirt, and that it continues yet further both east and west. The end of each drift is ore.

The second level is fifty feet below the first, and is opened west about 50 feet, worked out to a width of from 10 to 20 feet. It is in not fully clean ore, but by careful picking the ore is saved. East of the shaft it is only opened far enough to make room for a No. 6 Knowles pump.

No. 3 shaft is 325 feet east of No. 4, and is but 80 feet deep. The ore is 25 feet in width, and the drift west in ore is 40 feet, where it runs up westerly on an incline of rock, showing, as in No. 4, that this ore pitches to the east. A short distance from the shaft west, a rise has been made 30 feet, and "holed" -through to the shaft for air, this rise, etc., is in ore.

East of the shaft is only a drift 15 feet in length, all in ore, not clean ore, some rock is mixed with it. It looks good enough to lead one to expect to find a body of ore in which the rock is left out.

No. 5 shaft is 300 feet west from No. 4, it is only about 30 feet deep, but it is in good ore and jasper. There is a good deal of clean ore in the shaft. Just now the shaft is idle. I think the diamond drill would be an economical machine to use in the exploring work at the Puritan; at No. 5 shaft and in the railroad cut west of it, especially. The railroad track cuts through the quartzite on the south side of the shafts, giving the proper elevation for loading cars, etc.

A new engine house has been built, and they are now placing in it a fine plant of machinery, consisting of steel boiler 60"x16' besides heater, two winding drums, each 5' diameter; Ingersoll Air Compressor, to operate seven Band drills. Engine house 48'x25' with L 24' x 35'—iron roof.

The machinery was made at the Iron Bay Foundry, Marquette. Besides are change house 36'x18', with wash room, etc., attached, large boarding house, fine residence for superintendent, and about 20 good miners' houses, etc.

For a Dew mine the Puritan is in good shape, and has a favorable outlook as & producer of first-class ore.

The yield in 1886 was 16,388 tons.

The officers are Geo. F. Jackson, President, Minneapolis; J. B. Oollins, Secretary and Treasurer, Chicago, Ill.; H. M. Peck, Superintendent; B. M. Moyle, Mining Captain, Bessemer, Mich.

## **THE IRONTON IRON MINING CO.**

As mentioned in describing the Puritan, the Ironton joins it on the east. The main opening, in fact the only point where ore is found, is adjacent to the Puritan. The Ironton looks well and the mine is in good hands. Captain Christopher, the General Manager, was for many years at the Michigamme mine, and is known in the Marquette range as a miner of more than ordinary skill.

The Ironton estate consists of 80 acres—a rectangle with the long dimension north and south, so that there is 80 rods in length of the ore formation—east and west.

From the west line the surface descends abruptly about 50 feet, where, more gradually, it inclines to the east margin, and thence on to the river, which courses through the valley to the north.

There is a shaft close to the east line, and they are mining against the west one; between these extremes are two or three shafts recently begun, but none very far advanced yet.

South of the line of the shafts, and about midway east and west, they have just completed a new engine house,

which is supplied with four 5-foot drums, two engines, two boilers, each 48" x 16'.

The main ore deposit at the west end is 135 feet long and 70 feet wide. The shaft is at the east end of the deposit and is 100 feet deep, and in the foot wall. Hoisting is done in it with a skip. The plan pursued in mining this ore is to take it all out, letting the surface follow down, leaving an open pit above. Drifts are opened along both the hanging and foot walls, and timbered for passage ways, and the ore is cut out from the west end up to the filling, allowing the filling to follow down as the mining progresses towards the shaft. They work on top of the ore, carrying a cross stope under the filling and run the ore down the winze into shutes in the main drifts where it is let out into cars and trammed to the shaft. The ore is clean, first-class Bessemer, all of it.

East of the main deposit and separated from it by 55 feet of rock, is another lense of ore of harder quality—leaner. They have drifted in it 80 feet, but have not cross-cutted. Possibly the "bar" of rock will prove to be a capping, and that at lower depth the ore will be found to be all of one body.

At 225 feet east of the main shaft is No. 2, and they have just started another one. It is close to the Wis, Central R. R. track, and will be No. 3—480 feet from No. 1.

No. 4 shaft is 185 feet west of the Tontine boundary and is now 94 feet deep. The Tontine found a small deposit of ore about 13 feet wide, and No. 4 shaft was sunk hoping to get this in greater magnitude in the Ironton side.

The company has 10,000 tons of ore in stock and hopes to mine this season 50,000.

The company shipped last season, 16,307 tons, which sold at an average price of 15.00 per ton.

The officers are Samuel P. Snyder, President, Minneapolis, Minn.; A. J. Tremble, Secretary and Treasurer, Hurley, Wis.; J. P. Christopher, General Manager.

## **THE TONTINE MINE**

joins the Ironton on the east. The main shaft is about 100 feet from the boundary, and is 130 feet deep. It is sinking to find the ore of which a small deposit was discovered in a shaft close to the line. The main shaft now sinking is vertical, and at bottom is 60 feet from the foot wall. They have just found the ore, but had not developed it as yet. They have a small engine house, with a limited plant of machinery, and several dwelling houses; also an ore dock convenient for stacking and shipping ore. The estate consists of 80 acres of land, being the E. ½ of the S. E. ¼ of section 17. The work is in charge of Capt. C. W. Hale.

## THE VALLEY IRON MINING COMPANY

joins the Tontine. It is between the Tontine and the Colby. The land lies in the low ground, in the valley between the high bluffs in which are the Colby on the one hand and the Puritan on the other. The estate consists of 240 acres of land, being the S.  $\frac{1}{2}$  N. W.  $\frac{1}{4}$ , N.  $\frac{1}{2}$  S. W.  $\frac{1}{4}$ , N.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$ , Sec. 16.

They are working, mainly, not far west from the east line. A shaft was sunk and some lean ore obtained, some of which was shipped, and some is now in stock at the shaft. The shaft has been abandoned, at least for the present, and they are sinking another at about 300 feet further west and also north. A test pit was first sunk 45 feet, and good ore was found in it. They have a width of ore of 20 feet, and have drifted in it 30 feet northeast.

To mine this ore they are now sinking a shaft in the foot wall to the south of it, and 30 feet east of the test pit. The shaft is 40 feet deep. The drift will be connected with the stops for air. They have some good ore in stock, taken from this test pit. Have built a new engine house, contains two drums, each four foot diameter, Marinette make, boiler 48"x16'.

Further west on the line of the vein are several shafts. One is in the quartzite, another in ore and jasper. Recently a fire in the woods burnt up the plant at the shaft, and so no work was doing at the time of my visit. The mine is near Bessemer, has railroad facilities for shipping ore, etc. The product in 1886 was 1,842 tons. It is one of the Barton series of mines.

John E. Burton, President; J. G. Sherman, General Manager; Thomas Hawking Mining Captain.

## THE COLBY MINE

is a phenomenon. It is a most extraordinary deposit of ore. It surpasses all the others in the Gogebic Range, in apparent magnitude, and then the situation is the most favorable for mining the ore cheaply. There is more ore in sight, more ore available, opened up, in readiness for stoping the present season, than can be seen in any other iron ore mine in the State.

The product will easily reach 300,000 tons the present season, and even exceed that amount if the company obtain sufficient facilities for shipping. No doubt the output will be greatly lessened through want of vessels. At the present writing, May 20, there are 90,000 tons in stock, and 50,000 tons have been sent away, and there are stopes enough in the mine to work all the shafts to their full capacity. One can stand on the surface at the west end, at the south deposit, and see in the open pit a stope of ore greater than he will often enjoy an opportunity of inspecting.

The mine is opened in two separate deposits of ore, situated north and south of each other, and running east and west. They are commonly spoken of as the north and the south veins. The south deposit is against the foot wall, the regular quartzite belt that underlies the ore

in this portion of the range. The deposit has been opened for a length of 1,000 feet, and has a width of clean ore of 40 to 130 feet. The ore was first attacked at the west end, where the lenses outcropped just beneath the dirt, in the upper face of the bluff, where it descends somewhat abruptly to the west. The formation dips north at an angle of 65°, and the ore inclines also to the east at an angle of about 30°. As the work advanced eastward, the inclination of the ore has carried it under the rock capping, which, for a considerable distance, has been removed, but now this work of "stripping" the ore will cease, and the mining will be wholly underground, as it already mainly is.

The skip roads for hoisting the ore are laid on the foot wall, and the ascent to the south, except one, which follows the pitch of the ore down to the east. There are four of these hoisting avenues in the south deposit, designated as Nos. 1, 2, 3 and 4, the first two being in the open pit at the west end; 3 and 4 are regular shafts, and are wholly underground from the surface.

No. 1 runs up from the bottom of the open pit to the west. No. 2 ascends on the foot wall at the east end of the open pit. Its length is 130 feet. The two hoist about 300 tons daily. No 3 is 300 feet east of No. 2, and No. 4 600 feet from same point, and the openings extend 80 feet further east. Each shaft is 200 feet deep, and the levels are opened, in the two bottom ones of which, most of the ore is still in the mine. In the second level the ore averages 120 feet in width. In the bottom it is narrower, perhaps about 80 feet wide, the abridgment in width being caused by a chloritic dike on the north side, against the hanging wall, which dips south and so cuts out the ore. This dike is of soft material, seemingly a decomposed feldspathic rock.

I understand that since I was under ground in the mine they have cut through this dike and found the ore again north of it. No. 4 shaft is not yet provided with a track, but it is ready for one. Just now the company can hoist more ore than can be taken care of from the other shafts. The stock ground is all filled, and but few cars are furnished for shipping away. The ore is run to the edge of the bluff on the west, where are the ore pockets and the stock ground, and at suitable distance below it the tracks of the M. L. S. & W. R. R. Co. The Wisconsin Central railroad company has ascended to the top of the hill with, its branch for the Colby, and built a track along on the foot wall, just south of the shafts, so that the ore will be dumped from the skips directly into the pocket. It will add greatly to the convenience and economy in handling ore. The ore is run from No. 3 to the pockets, etc., west, on a gravity incline, similar to that used at the Hematite shaft in the Lake Superior mine, which is fully described in the report of last year.

The method of mining contemplates taking out all the ore. The main drifts are east and west along the walls and at suitable distances through the deposit. Thence the ore is blocked out—rooms and pillars—each 40 feet. The rooms are timbered, using the usual sets, which are lagged up against the pillars. To remove the pillars the

rooms are filled up with rock; that is, the surface material is run down and made to occupy the opened space; after which the pillars are mined away by taking successive stopes on top of them, under the dirt. This final work of exhausting the levels will proceed from one to the other working down, and thus the same filling material will serve from one to the other; as each is worked out the refuse dirt will be let down into the next below, and so on in succession. This plan of extracting the ore is a great advance on the method of endeavoring to hold the mine up with timbers. It is economical, expeditious and safe. Of course it requires mining experience, skill and great care; but it is undoubtedly the cheapest way to mine this ore.

The ore is very dry; it is a dry mine, and thus the pillars stand well. The ore is easily mined, requires but little blasting. There is no more pleasant, comfortable mine to work in in the country than the Colby.

It costs to "run the drifts," which are 12' x 15' section, \$1.50 to \$2.50 per foot. They are made thus large for the timbers. The deposit is so large that when well opened there are an abundance of places to stope.

The north deposit, though not so large, has many interesting features. Measured on the surface it is 300 feet north of the south lense, but at the bottom they are now at less than 100 feet apart.

When I was at the mine in August of last year, the ore in the bottom of this open cut mine was exhausted; things looked a little blue. A dyke of "soap rock" had taken the place of the ore, and everywhere was rock. The dyke dipped to the south across the formation and thus cut off the ore. The indications favored the supposition that the ore would be found again in the foot wall, that the dyke had carried the ore south. The subsequent work has proved the correctness of this theory. The north mine is now all underground, away south of the open cut, and is constantly approaching the south deposit. Probably it will extend beneath it finally, or rather I incline to the supposition that the two will ultimately constitute one and the same deposit. At least that there will be no separation other than, may be, the chlorite, which is just now found on the north side of the ore in the south deposit. The ore in the north deposit varies somewhat from that in the south; it is harder, more banded, less homogeneous than the other. There are to be seen in the stopes in places; bunches or wide seams of ferruginous schist that look in section like the ore; it is not easy to tell this rock from the ore without close inspection.

The dike on the north side really makes the foot wall in this deposit. It lies pretty flat and they work from it, allowing the overlying burden to fall on it. Standing on the north side of the open pit and looking south we see this south wall constantly crushing down. As the ore is removed it is made to settle down on the dike. The underground opening made in the north deposit is 400 feet long and 80 feet wide. It is reached by two shafts, one on the north side inclining downward to the south,

following down on the face of the dike, and the other away over to the south, near the office, in what was thought, when it was sunk, to be the foot wall of the ore. But now the bottom of this shaft is near the dike, and the ore is away south of it. It is an easy mine to work; not much timbering is required; they worked south and let the roof crush in the dike.

All the surface appointments are simple. The machinery is such as is adequate to this work, but nothing superfluous. The mine is held on a limited lease, from the owners, by Pickands, Mather & Co., Cleveland, and the entire direction of the work is under Mr. Jos. Sellwood, of Ishpeming, who has a full corps of competent assistants, prominent among whom is Capt. Harry Roberts, who is full of enthusiasm for the Colby. The company's lease runs until Nov., 1888.

The estate consists of two quarter sections—320 acres—in sections 16 and 15, 47, 46. The mine is, mainly, in section 16, though the extreme east end is in 15.

At a quarter of a mile further east the company has sunk a shaft, recently, 100 feet deep on the quartzite foot wall and have a deposit of clean ore in the bottom 70 feet wide, and they have drifted east and west in it 180 feet.

An engine house has been built and is supplied with new machinery adequate to operate the mine. It does not seem likely that work here will be pushed greatly, since it will be difficult to ship the ore.

The situation at the Colby mine is a remarkably pleasant one. The location within the limits of the rapidly growing village of Bessemer, the seat of the new county of Gogebic, and is at an elevation of about 200 feet above the railroad. At the depot from the mine an extensive prospect is spread out to the north in the direction of Lake Superior, which is varied and beautiful. There were shipped from the mine in 1885, 84,312 tons of ore. In 1886, 257,433 tons; total, 341,745 tons.

The ore averages about 62% in iron and .040% in phosphorus; like all the Gogebic ores it is low in silica, some of it especially, along the walls, is black manganese ore.

## **THE PALMS IRON MINING COMPANY**

holds on a lease from the Palms estate the N. W.  $\frac{1}{4}$  of Sec. 14, east of the Colby. The Palms is a well arranged mine, so far as the surface plans determine the matter. The ground is elevated, one of the highest locations in the range, and the shafts are in line, sunk on the foot wall.

A new railroad track has just been laid along the foot wall side of the shafts, convenient for the pockets for receiving and transferring the ore directly from the skips. Away down the slope of the hill to the north is the track earlier located, where is an ore dock 300 feet long, and ore pockets, the latter 40 feet high. A tram track 700 feet long extends from the east part of the mine to this

ore dock; but now that the railroad company (M. L. S. & W.) has built along close to the shafts, it is not likely that the one down under the hill to the north will be greatly used.

The shafts are well distributed, but thus far they do not seem to have penetrated any large body of ore. They are mainly in a mixed ore formation. More or less rock is found in connection with the ore. This is true of all the shafts, but none of them is very deep yet, and judging from the experience recently acquired at the Anvil, which is the next mine on the east, better results are likely to be obtained at a greater depth.

No. 4 shaft is 700 feet east of the west line, and is 50 feet deep, all the way in ore. They struck ore in a test pit 22 feet west of the shaft, and drifted south in it to the quartzite. It is very good ore, and is thus a promising opening.

No. 3 is 300 feet east of it, and 78 feet deep. After passing through 17 feet of surface, the shaft came into ore in which it still continues, but it is not very wide. Possibly it will open out deeper down.

No. 1 is 300 feet east of No. 3, and is 130 feet deep; 18 feet of surface, thence on, ore until within 10 feet of bottom, when the rock appears in such quantity as to render the ore valueless.

A cross-cut was driven 78 feet north at the depth of 100 feet, which cut 12 feet mixed ore, 10 feet good ore, then nine feet mixed, six feet good, and so on alternating to the end of the drift. In this shaft they have also drifted east 80 feet, 60 feet of which is pretty good ore. The last 20 feet mainly rock. West of the shaft for 50 feet the drift is through ore, but ends in rock.

No. 2 shaft is 118 feet deep, and is 200 feet east of No. 1. The 100-foot level has been driven west 110 feet, one-fourth of which distance is in rock, thence 30 feet is in ore; the remainder of the distance is in mixed ore and rock. The 50-foot level has been driven east 25 feet, all the way in ore, but they have not tested its width.

There is a commodious engine house, holding two drums, each 4' diameter, for Nos. 1 and 2 shafts, Mariette make, two boilers, etc. The other shafts have smaller, separate hoists. There is room in the engine house for two more drums, which will soon be supplied, of a larger pattern than the others. The force of men employed consists of about 75. The company has a fine boarding house, and other essential buildings, including office, dwellings, etc.

The royalty on the ore which the company agrees to pay is 75 cents per ton.

Among the officers are F. Rockhauser, President, Milwaukee, Wisconsin; General Manager, John A. Hayward, Bessemer, Michigan; John Hoskins, Mining Captain, Bessemer, Michigan.

## THE ANVIL IRON MINING CO.

holds the quarter section next east of the Palms—the N. E.  $\frac{1}{4}$  of Sec. 14. From the shafts the ground descends steeply to the north to the railroad, and also on the east side begins its descent in the direction of the Black river, which lies 200 feet below the surface at the mine.

The Anvil is a new mine; as to that matter all the mines in the Gogebic may be called new, but the Anvil is a newer development than some others. It has come into prominence quite recently through the discovery that the main ore body is of very large proportions, a matter that has just been ascertained. So that now it is quite certain that the Anvil, for a time at least, is to be a large producer.

The parties who control the property now came into possession of it last November, and it is since then that most of the mining work has been done; certainly all that which has led to the late fortunate discovery of ore.

The mine is not yet equipped with machinery except to a very limited degree; a few cheap buildings, small engines, twenty-inch drums, with hemp ropes, constitute the outfit. But it is not to be supposed that this state of things will long continue. Steps have been taken to provide all that is requisite to pursue extensive operations.

The railroad company—M., L. S. & W.—is prolonging the Palms branch east to create a like convenience at the Anvil.

There seems to have been considerable desultory exploring work done on the property, which did not avail much, and I shall confine my description to those sinkings only which will be used as shafts.

No. 1 is 360 feet east of the west line, and 50 feet south from the east and west  $\frac{1}{4}$  line and 175 feet deep. It opens into the ore, which gives the mine its chief value. It is in this shaft that the main attraction lies, the basis of the great good fortune that has come to the hands of the owners.

The results in this shaft are a valuable experience; they suggest a similar good fortune to others, and stimulate to perseverance and continued effort where, seemingly, like conditions are found. There are those exploring diligently who, though they have nothing of much value, as yet, are still led by the hope of a final outcome of good luck, parallel with that reached at the Anvil.

To particularize in regard to No. 1 shaft, when the ore was first found, it was but four feet in width, and at 75 feet in depth it proved to be 13 feet wide, but when the shaft had reached a depth of 175 feet, a cross-cut to the north was again started and pursued for a length of 180 feet, 161 feet of which distance is in ore. I examined this drift, somewhat hastily, and did not discover anything but ore. Some of it is clean fine ore, especially in the part adjacent to the foot wall, but there are other portions, towards the north, in the north half of the drift, where the ore is mixed with sand. Still, the whole drift for the

length of 161 feet seems to be all ore; assuredly a wide body of it. The rock is at the north end of the drift, 19 feet of mixed rock and ore.

Samples of the ore for an average of the first 45 feet from the shaft, gave an analysis 64.80% metallic iron. The succeeding 35 feet of length gave 62.20%. The following portion of drift for 45 feet, 61.80%. Average for 130 feet of the drift was 61.80% in iron, .028 in phosphorus. The final 33 feet of the ore averaged 56% in iron, .031% phosphorus. These figures were given me by Mr. Scott.

At a point 60 feet from the foot wall a drift has been made in the ore west, 55 feet long. It is all in good ore. A winze is sinking at the end of this drift, with the view of securing circulation of air in the level below when it shall be opened.

A drift has been opened east along the foot wall 130 feet, all in ore. The end is under the air shaft, which is 120 feet deep. When sunk to the drift it will insure circulation to the east part of the mine. West, on the foot wall, have gone 80 feet, also, all in ore; are still drifting. The opening work has been limited to the power of the machinery. The new machinery for this shaft, and for No. 2, with compressor, two 5-foot Merritt drums, engine 125 horse power, and two steel boilers, 80-horse power each. There is one 45-horse power boiler on hand now, one 36" Rochester hoist, 3 Camerom pumps, No. 7.

No 2 shaft is 560 feet east of No. 1, and is on the hanging wall side of the ore. It is 110 feet deep, but is not worked in now.

No. 3 is 840 feet east of No. 2, and is 160 feet deep, all in ore, except the 10 feet of soil first penetrated. It is sunk, on the quartzite, having been commenced early in the winter.

At the bottom there is a drift east 163 feet, all the way in ore. At 30 feet from the shaft the ore proves to be 15 feet wide, and at 70 feet 17 feet in width.

The company employs about 50 men. A larger force cannot be used to advantage until the new machinery is ready, and the track is built along the foot wall.

There is a little ore in stock, taken from the openings, mainly in No. 1, which will be sent down the hill to the north on the ore tract, etc.

South of the mine is a level table land, on which the company designs to lay out a location for miners' houses, etc.

Some provision must be made for water. There is none on the surface, and the mine affords but little.

The officers are G. E. Tarbell, President, Milwaukee; F. H. Smith, Secretary, Milwaukee; W. B. Scott, General Manager; George Green, Mining Captain.

The same gentlemen have lately secured the control of 80 acres joining on the east, to wit: the W.  $\frac{1}{2}$  N. W.  $\frac{1}{4}$ , Section 13, and designate it as

## THE EAST ANVIL.

They are sinking a shaft on the foot wall near the west line, near the corner between the two forties. It is 55 feet deep in mixed ore and rock. Other parties have explored on this property for a year past. Several shafts have been sunk, but all of them north of the foot wall, and further down the hill. Nothing of value was discovered.

The present work is in charge of Capt. John Humble.

## THE GOGEBIC MINE

is the next 80 east, the steep side hill that extends to the Black river. On this property is also the village of Hubbardsville, where is an hotel, postoffice, etc., and down at the river a saw mill. There are a good many test pits on the property, but no ore has been found.

Some parties are exploring in the W.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$ , Sec. 11, which joins the Anvil on the north. It is called the

## NORTH ANVIL,

and lies in the Sunday Lake range west. Whatever it holds of value remains to be found.

Crossing the main branch of the Black river at the Gogebic, we reach, on the east side,

## THE WELLS AND MINER OPTION,

so called, being the N. E.  $\frac{1}{4}$  of Sec. 13. The exploring work in this property is mainly in the E.  $\frac{1}{2}$  near the center south of the railroad and by the east branch of the river. The two branches of the river form a junction near the N.  $\frac{1}{4}$  post of Sec. 13 and the east branch extends west and northwest to Sunday Lake, of which it is the outlet.

I noticed chiefly 3 shafts; one about 20 rods from the  $\frac{1}{8}$  line on the north side: it is 60 feet deep and is not worked in now.

No. 1 is the north shaft, 110 ft. deep. It has passed through a variety of rocks and is now in a quartzitic flag, above which the shaft cut through jasper. At a depth of 100 ft. from the surface a cross-cut was driven north 164 ft. through jasper, soap rock and poor ore.

No. 2 is 130 ft. deep, have a drift south, 80 ft. at 110 ft. down. From the drift 68 ft. from the shaft, drove west 38 ft. and at 25 ft. from shaft drove north 40 ft. All the rock is broken, partially decomposed, jasper, chlorite, lean ore, etc.

They are still working in the north drift in No. 2 shaft, following a small "leader of ore," hoping it will make into a body of ore. The river is about 40 feet below No. 1. I think I would sink deeper and drift north. The two shafts in which they are working are provided with machines for hoisting and pumping.

Frank D. Koob has charge of the work, and is assisted by about 30 men. They have been at work for 12

months, but have met with results scarcely equal to their efforts and hopes.

Joining this property on the east is

### **THE RHINELANDER,**

being the W.  $\frac{1}{2}$  N. W.  $\frac{1}{4}$  Sec. 18, T. 47, R. 45. The river crosses diagonally through the land, and the company has explored on both sides of the stream where it cuts through the ore formation. The main shaft, the only point at which work is now prosecuted, is in the west margin of the river, starting in the bank 20 feet above the water. This shaft is near the west line, and near the center of it. The shaft was sunk 30 feet, and then left, and the work pushed further north, on the west side of the stream; but as nothing favorable was found there, the work has been concentrated since February last, in the shaft first mentioned. It is now, May 27, 105 feet deep and still sinking. It is in ore, not first class ore, but good lean ore. I was told that it gave 57% in iron and .041% phosphorus, as an average analysis. At 85 feet down they started a cross-cut, which is now 17 feet in north, and is all the way in ore.

I believe the company is incorporated.

David H. Martin resides at the mine and superintends the work.

The next mine east of the latter is

### **THE MIKADO,**

being the E.  $\frac{1}{2}$  of the N. W. of Sec. 18.

At the time of my visit I thought that the Mikado looked quite encouraging. They were working in two shafts, which are located about 250 feet apart, north and south of each other. The railroad runs across the south part of the property, and the ground from the railroad north has been tested pretty freely at about the center of the land where they are now working.

The shafts are both 85 feet deep, and each is partially in ore. Some pretty good ore is taken from the bottom of each shaft, so that one is justified in thinking that possibly at greater depth there will be found a good body of clean ore. All the way down the shafts cut lean ore and jasper, and in the south shaft some chlorite.

At the Rhinelander, north of the ore, in the river bank, is an out crop of diorite, and I think it will also be found in the hanging wall at the Mikado and others of these mines.

There is a small hoisting plant and pump at the south shaft, and there is a boarding house, camp, for the men. The work is prosecuted under the direction of Capt. Harry Letcher.

Jay A. Hubbell, President, Houghton; Mat. Van Orden, Secretary and Treasurer.

Joining the Mikado on the east is the

### **ATWOOD OPTION,**

the N. W.  $\frac{1}{4}$  N. E.  $\frac{1}{4}$ , Sec. 18. In this forty, near the southwest corner, is a shaft about 30 feet deep, where I found in the material raised in sinking, a plentiful sprinkling of good ore. As they had no pump they were forced to stop sinking on account of the water. The ground is a little low and wet. They were sinking another shaft a few hundred feet northeast of the former, using windlass and bucket. It was, when I saw it, 40 feet down, and the south half of it in ore, good brown hematite.

Mr. James Atwood is superintending the work, and, I think, controls matters pertaining to it.

### **THE PILGRIM**

estate consists of 120 acres, being the E.  $\frac{1}{2}$  and the S. W.  $\frac{1}{4}$  of the N. E.  $\frac{1}{4}$  S. 18. It is controlled by the same gentlemen who hold the Mikado, and Capt. Letcher is superintending the work. He has tested north and south across the formation by means of shallow diamond drill borings and finally located a shaft, which is now rapidly sinking at the point where he judged the best results would be obtained. The shaft inclines to the north  $60^{\circ}$ . A small engine house has been built and holds a 36" drum, wire rope etc. for the work of sinking. The shaft is about 65 ft. deep, but no ore of any amount has been found yet.

### **THE SPEEDWELL**

is across the river east of the Pilgrim—the W.  $\frac{1}{2}$  of the N. W.  $\frac{1}{4}$  Sec 17. Capt. Letcher is in charge of the work and is boring with a diamond drill. The indications are favorable but the ore is yet to reward the sinking.

The adjoining 80, which is the complement of the preceding in this quarter section—to wit, the east half of the N. W.  $\frac{1}{4}$  of 17—is called

### **THE STAB,**

where they are also exploring with a diamond drill.

### **THE FLORENCE**

is the next property—the W.  $\frac{1}{2}$  of the N. E.  $\frac{1}{4}$  Sec. 17. The Florence and the Star have joined their forces and are boring with a diamond drill on the line "between the properties.

They sunk the sand pipe through 80 ft. of sand, etc. to reach the ledge in which the drill is now working. Capt. Letcher superintends the work.

I saw a drill also boring in the W.  $\frac{1}{2}$  of Sec. 16—not far from the depot in the village of Wakefield. They all find a little ore and good indications.

## THE SUNDAY LAKE RANGE

extends through the next line of sections north of the preceding. The chief mines are in sections 7, 8, 9 and 10, T. 47, R. 45.

The three most easterly ones—Brotherton, Sunday Lake and Iron Chief being ore producers. None of the others has ore in quantity and purity sufficient to make it a shipper in a commercial sense.

The most easterly mine in the Gogebic range which is producing ore is

## THE IRON CHIEF,

operated by Moore, Benjamin & Co. The description is the E.  $\frac{1}{2}$  S. W. Sec. 10, T. 47, R. 45, being  $\frac{1}{2}$  of a mile east of Sunday Lake. The company reported having mined and shipped in 1886 9,500 tons of ore which sold at an average price of \$5.50 per ton, which facts indicate favorably for a new development.

The mine workings are reached through two shafts that are but 40 ft. apart, and the east one of which is only to the 1st level 65 ft. below the surface. No. 2 shaft, the east one, is downright, while No. 1 inclines to the north. It is located 100 ft. east from the west line of the property and is 170 ft. deep on the lay. The bottom of the shaft is in ore, 10 ft. wide and they have drifted east 100 ft. in it. No cross-cutting has been done in the bottom but in the 1st level is a drift north 141 ft. and one south 90 ft., neither of them in ore. It is contemplated to procure heavier machinery for No. 1 shaft.

H. M. Benjamin, Prest, Milwaukee; Ric'd A. Parker, Gen'l Manager, Hurley, Wis.; D. McVichie, Supt., Wakefield, Mich.

## SUNDAY LAKE MINE

lies upon the side hill northeast from Sunday lake, being the W.  $\frac{1}{2}$  of the S. W.  $\frac{1}{4}$ , Sec. 10, and is one of the early and well known mines of the range. The mine has two working shafts, the west one of which is but 80 feet east of the west line of the land of the company. It is 150 feet deep and has been, since reaching the ledge, all the way in ore. At the bottom the ore east is about 10 feet wide, and so continues west of the shaft for a distance of 30 feet, thence west for 50 feet, to the line, it is 40 feet in width; but it is not clean ore, very much of it, especially on the north side of the deposit, is rock or ore in which there is so great a proportion of sand rock boulders as to render the ore of not much practical value. East, the shafts are connected 187 feet apart, and they were making at the bottom when I was last down in the mine a secure timber drift between the shafts.

No. 2 is 200 feet deep, and the ore extends east 100 feet. It is 18 feet in width, and is cleaner than the ore in No. 1 shaft. The shaft is downright, having started in the hanging wall, but has cut through the overlying rock and the ore, and is now in the foot.

The ore has been run from the shafts out on elevated tracks to the stock pile at the foot of the hill, where is the railroad track; but they are now building a track along on the foot wall side of the shafts, so that the matter of surface tramming of the ore will be saved in future. The company has a small stock pile of very nice ore.

The engine house situated south of the shafts is supplied with two drums each four feet diameter.

This is also one of the mines operated by Moore, Benjamin & Co., and has the same officers as those given in the preceding page for the Iron Chief.

## THE BROTHERTON MINING CO.

holds the north half of the S. E.  $\frac{1}{4}$ , Sec. 9, lying next west of the Sunday Lake mine. As the rectangle lies the long way east and west, the company possesses a full half mile in length of the ore formation. The lake takes a portion of the land in the southwest corner. Until recently the east end of the mine has not been much worked, but now they are concentrating the work in Nos. 2 and 3 shafts, the latter of which is the most easterly, being 180 feet west of the east line. It is 100 feet deep, and they have drifted east 170 feet in first level, and west 100 feet. They will open into the Sunday Lake mine and stope back the ore, which is 15 feet wide to the shaft. In the second level they have driven east 100 feet, but none west. Previous to February last this shaft was only a test pit. They find the indications so good that the hope is entertained that the shaft will prove a good producer of ore. They have not cross-cutted much as yet. The shaft is in high ground at least 50 feet above No. 2, which is in the swamp, or what was originally Cedar swamp. The daily product is now, May 25, about 60 tons.

No. 2 is, as above stated, in low ground 500 feet west of No. 6, and is 100 feet in depth. It is sunk in rock, in what is supposed to be a separation between the two branches into which the ore body at No. 1 divides in going east. Work in this shaft, as well as in No. 1, was seriously impeded in the spring when the snow melted, by reason of the pits being flooded with water.

At the time of my recent visit to the mine they were erecting the frame for a shaft house at No. 2, and an elevated tram road 100 feet long from the shaft south to the railroad where will also be an ore pocket.

In this shaft are two cross-cuts, one 25 feet north and the other south 12 feet. The ore "makes" north in the south deposit and south in the north one, so that they may come together, in which case Capt. Bowden, a former copper miner, entertains the opinion that at the union will be found a large deposit of ore.

The ore obtained at the Brotherton has been mined, chiefly, in No. 1 shaft, 500 feet west of No. 2, with which it is connected by drift in the first level. The workings also reach west, 300 feet from the shaft, making the total length underground in the first level 800 feet. The ore was of variable width, reaching a maximum of 40 feet.

The shaft is sunk to the second level. I did not go underground in No. 1 shaft, but inferred from what was told me that the mine did not have a hopeful look in the bottom of this shaft. There were about 14,000 tons of excellent ore in stock, and it was stated that the product for the season would reach 50,000 tons.

No. 1 and 2 shafts are operated by the machinery in the main engine house, consisting of boiler, two Merritt drums, each five feet diameter. No. 3 has a separate plant near the shaft.

There were shipped from the mine in 1886, 8,880 tons of ore.

Jos. Sellwood, General Manager, Bessemer, Mich.;  
Richard Bowden, Supt.

### **THE CROWN POINT MINING CO.**

holds the S. W.  $\frac{1}{4}$  of Sec. 9, all of which, except a narrow strip along the north side, is covered by Sunday Lake.

The company has been exploring here about 14 months and has now 18 men and at the time of my visit was getting in a new boiler to secure an increased amount of steam for pumps, etc. The main shaft is 30 rods east of the west line, near the margin of the lake, and is 140 ft. deep. At 64 ft. down is a crosscut 34 ft. and at 110 ft. from surface is another drift north 28 ft. They found seams of ore and jasper; not enough ore to mine. Intend to sink deeper and cross-cut more.

The work is in charge of Thomas Cavender, who resides on the land.

### **THE CHICAGO MINING CO.**

is exploring on the E.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$ , Sec. 8; joining the Crown Point on the west. Considerable work has been done. The company has a shaft 300 ft. from the line 87 ft. deep, vertical, and has a small deposit of good ore. There are about 20 tons in stock, merchantable ore. There are other shafts and pits, but none showing ore. Joseph Lee, Supt. Work 12 men, have suitable plant of machinery.

### **THE HOUGHTON,**

formerly the Jumbo, is the W.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$ , Sec. 8; has sunk several shafts, but found no ore; the one in which they were working when I inspected the location is 96 ft. deep. They were cutting through jasper with seams of good ore. Near the shaft is a hoisting plant, boiler, etc. The other shafts were in rock—one in quartzite. Capt. John Cruse superintends the work.

### **THE ALPHA MINING CO.**

holds the S. W.  $\frac{1}{4}$  of the N. E.  $\frac{1}{4}$  and the N. W.  $\frac{1}{4}$ , Sec. 9.

The work is under the direction of John Sparling. He is sinking No. 1 shaft 224 ft. north of the south line and 100 ft. east of west line and is down 135 ft. And 400 ft. further east is No. 2 shaft, 60 ft. deep. They found some ore with the jasper cut in the shafts, which they pick and save.

No. 2 contains the most ore as it was found right under the sand, not quite clean but pretty good. When greater depth is attained they will cross-cut.

Frank V. Holston, Prest., Ashland.

### **THE IRONSIDES,**

is the E.  $\frac{1}{2}$  S. W.  $\frac{1}{4}$ , Sec. 8. Joins the Houghton on the west. The main shaft is 200 ft. south of the north line and is 105 ft. deep in mixed ore and rock.

At 100 ft. down is a drift south 48 ft., also in jasper and mixed ore. They have no body of clean ore. There is another shaft 70 ft. deep.

N. M. Stowell, Prest., Milwaukee; Ralph Wilcox, Supt., Wakefield, Mich.

### **THE NORWAY MINING CO.**

holds the W.  $\frac{1}{2}$  of the S. W.  $\frac{1}{4}$  of Sec. 8—next west from the Ironsides. The Co. is sinking in a shaft that is 80 ft. deep in mixed ore and rock. Good indications; looks as if ore would be found.

West of the Norway, in the E.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$  Sec. 7, is

### **THE IRON PRINCE,**

which is one of the most prominent locations in this portion of the Sunday Lake range. But with this, as with the others, the ore in quantity sufficient to mine is yet to be discovered. Work began here on the 2d of January last and has been continuously prosecuted since. Omitting any mention of the earlier pits, I found one shaft 72 ft. deep and in it a cross-cut north 28 ft., through mixed ore and rock. Also at 60 ft. down they have drifted east 26 ft. on top of a lense of ore. Same mixed stuff as found in cross-cut. They will sink 50 ft. more and again cross-cut, etc.

J. M. Stowell, Prest., Ralph Wilcox, Supt.

But it is useless to multiply descriptions. These new explorations nearly all show pretty good indications, but none of them shows any considerable body of ore. No doubt it is a little discouraging, as most of them anticipated better results ere this.

East from Sunday Lake for a distance of 16 miles, all the way to lake Gogebic, is almost a continuous line of exploring camps. On nearly every section, every 80 in towns 47, R. 43, and 47, 42, in the line of the ore formation is a mining location.

Among those which I visited are

## **THE HOLYOKE,**

in the S.  $\frac{1}{2}$  S. W.  $\frac{1}{4}$  Sec. 18, 47, 42.

Messrs. Wright and Wakefield, in the N. E.  $\frac{1}{4}$  Sec. 20 and the N. W. Sec. 21, near Gogebic Lake. They have a number of men working and have several pits down in the ledge. The same parties have also the

## **THE IRON AGE MINING CO,**

and are working hi the N.  $\frac{1}{2}$  N. E.  $\frac{1}{4}$ , Sec. 24, 47, 43.

## **THE DICKIE,**

E.  $\frac{1}{2}$  N. E.  $\frac{1}{4}$ , Sec. 47, 42,

## **THE CHICAGO,**

W.  $\frac{1}{2}$  E.  $\frac{1}{2}$ , Sec. 23, 47, 43.

## **AT CHANNINGS,**

in the N. E.  $\frac{1}{4}$ , Sec. 23, 47, 43, is a large camp, that has several good buildings, etc., and the men are busy digging in search of ore.

But is unnecessary to mention them all. They have a good deal of faith as yet, but to keep it up some one must find ore after a while, or they will become discouraged. The formation is not unfavorable for the occurrence of ore.

By far the best explorations are north of Marinesco, in the vicinity of the east branch of the Presque Isle river. These are the JOLIET, LA RUE, PRESQUE ISLE, ARTHUR, LOGAN, HOLLAND and LINCOLN. The locality is known as the

## **TOBIN RANGE,**

through the fact that Capt. James Tobin, a well known explorer, has conducted several of the above mentioned explorations. He has also, recently, in expectation of the final success of the exploratory work, platted a "town site" to be known as TOBIN.

### *THE JOLIET*

is in the N.  $\frac{1}{2}$  N. E.  $\frac{1}{4}$ , Sec. 22, and the

### *LA RUE*

is in the W.  $\frac{1}{2}$  N. W.  $\frac{1}{4}$  of the same section.

### *THE PRESQUE ISLE*

is in the S.  $\frac{1}{2}$  N. E.  $\frac{1}{4}$ , Sec. 21, T. 47, R. 43, and is rated as one of the most valuable properties in the Tobin Range. Just now it is eclipsed by the explorations on the opposite side of the river, to wit: at

## *THE HOLLAND,*

and others. The Holland is in the N.  $\frac{1}{2}$  S. E.  $\frac{1}{4}$ , Sec. 20, T. 47, R. 43, where is a shaft 91 feet deep, which has cut through banded red slate very much contorted. They found in the shaft, at 80 feet down, some clean ore, very nice ore, which analyzed 63% in iron, and .029% phosphorus. This ore "cut out," and the shaft is now in mixed rock and ore. The ore is black, soft hematite.

## *THE ARTHUR*

is in the same section, west of the Holland, where good ore is also to be seen. It differs from the other, however, being a slate ore, not hard, but firm in texture. It is found at only 11 feet from the surface. Just how much of it may exist is not determined.

## *THE LOGAN*

joins the Arthur on the west, also in Sec. 20. I found them sinking in a shaft which was 40 feet deep. It is 14 feet to the ledge, after reaching which the shaft cut through rock with indications of ore. I saw some large pieces of first-class hard ore, found in the bottom of the shaft. The shaft is now in mixed ore and rock, gray siliceous flag and jasper.

## **THE APPLETON**

is the name given to an exploration southeast of Marinesco, in what is called the Magnetic Range, in township 46 N., R. 42 W. There are strong magnetic attractions, and specimens of good magnetic ore found in this locality.

Considerable exploring has been done by different parties during the past two years. Mr. J. Lowenthal and others of Appleton, Wis., are operating now on the N. W.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$ , Sec. 13, and S. W.  $\frac{1}{4}$  of the S. W.  $\frac{1}{4}$  of Sec. 12. Mr. F. A. Wright is boring with a diamond drill for these gentlemen and seems to be approaching good results. At the time of my visit, about the first of June, he had a core of seven feet of ore, first-class magnetic ore. Heretofore the deposits have all appeared to be too small to be of value.

## **THE REPUBLIC REDUCTION COMPANY**

is the title to an enterprise at Republic, controlled by Peter Gottstein and S. D. North, of Hancock, Michigan. The plan is to extract by crushing and washing, the ore contained in the waste rock of the Republic mine.

They have a suitable building and steam power. They are experimenting now with a Sturtevant mill, No. 12, 1,200 revolutions per minute. They are using No. 12 wire mash, and finishing on No. 30. They run through 38 tons of rock in 7 hours, and get 55% of ore from the rock; that is, they waste 45%. There is practically an inexhaustible supply of the rock. No doubt the concern

will ultimately be successful. The ore is Bessemer, and is, when reduced, in proper condition for a "fix."

## PIG IRON.

### DESCRIPTION OF BLAST FURNACES.

#### SPRING LAKE IRON CO.

owns and operates a furnace at Spring Lake, in Muskegon Co., Mich. The furnace is in many respects extremely favorably situated for economical work, and the record of the furnace since it first went into blast has been exceptionally good.

The furnace is placed near the dock, so that the ore is unloaded directly from the vessels into the stock house. Other material is loaded and unloaded into and from vessels with the greatest facility. Railroad advantages are all that can be desired. The furnace stack is 46 feet in height; diameter of bosh 10' 8".

The wood used for charcoal is 75% hard and 25% soft wood. The bushel is 2,748 cubic inches, and weighs, when suitably dry, 20 pounds. Use Kelly Island limestone. The ores used in past year were Lake Angeline mine, 10,000 tons; Ludington non-Bessemer, 10,000 tons, also Great Western and the Cleveland mine, No. 1, hard ore; used of the hard ore 25%.

The ores used in 1885 were 25% and 50%, respectively, of Lake Superior mine No. 1 specular and hematite, and 25% of Milwaukee mine ore. The following table shows the comparative record of the two years' work:

Record of Fruitport Furnace.	1885.	1886.
Bushels of charcoal used.....	1,444,675	1,610,850
Gross tons of ore used.....	28,684	29,551
Gross tons of limestone used.....	386	431
Number of tons of pig-iron made.....	17,217	17,776
PARTICULARS.		
Number of charges run.....	57,787	64,434
Number of bushels per ton of iron made.....	84	90%
Per cent of yield of ore in the furnace.....	60%	60
Number of pounds of limestone used per ton of iron.....	50	54%
Number of days run.....	321	324
Average daily product.....	53.63	54.85

The temperature of the blast was made less in the past year than heretofore, being reduced to about 800° Fahrenheit.

The company contemplates building a second stack. It has also lately leased the Bangor furnace and will run it in 1887.

J. C. Ford, Supt.; Robert Lomeraux, founder.

#### THE ELK RAPIDS IRON COMPANY.

It would be difficult to locate a furnace more favorably with respect to obtaining wood for charcoal, and for shipping by water. The height of the stack is 47 feet, and diameter of bosh 11½ feet. In 1885 the furnace

made, on the average for the year, 304 days, 53 tons of iron per day, using 93 bushels of charcoal per ton. The following table shows the results for the year 1886, just closed:

Total No. of tons of pig iron made.....	17,434,220
Total No of tons of ore used.....	29,801,240
Per cent of yield of ore in the furnace, i. e., No. of lbs. of iron to each 100 lbs of ore used.....	58.70
Total No. of tons of limestone used.....	925,210
Total No. of bushels of charcoal used.....	1,715,905
Average No. of bushels of charcoal to ton of iron made.....	98.42
Total No. of days that the furnace was in blast.....	309
Average number of tons of pig iron made per day run.....	56,245
Market value of pig iron made.....	\$388,728.67

The ores used were Cleveland and Barnum mines hard specular, Cleveland hematite, Jackson south side, Detroit, Great Western.

Edwin S. Noble, Secretary, Elk Rapids, Michigan.

#### MARTEL FURNACE COMPANY.

The Martel furnace is situated at St. Ignace, in the Upper Peninsula, on the Straits of Mackinac. It was built in 1881, on the completion of the railroad from St. Ignace to Marquette, but after being in blast for a brief time, it was closed down, and has since been idle, until the past year, when it was put into blast, and has been run 139 days. Height of stack, 53 feet; diameter of bosh, 10½ feet.

No. of bushels of charcoal per ton of iron.....	84
No. of days run.....	139
Total No. of tons of pig iron made.....	7,666
Yield of ore in furnace.....	60%

Ores used, Lake Superior Iron Company's "A" shaft, Champion mine Suffolk ore, Wetmore mine ore, and Milwaukee mine ore.

W. B. Vance, Secretary.

#### THE PIONEER FURNACE

at Negaunee, No. 2 stack, has been run as usual, but they were necessitated to stop for some time, so that a less amount of iron was made as a whole than usual. Product for 1886, 11,079 tons. The Pioneer has been run for 30 years.

Alex. Maitland, General Manager, Negaunee, Michigan.

#### THE GAYLORD IRON CO.

operates a furnace at the foot of Iron street in Detroit. The height of stack, from bottom stories to cover of bell and hopper is 44 ft.

Diameter of bosh is 9½ ft.

The furnace made in 1885 4,803 tons of iron, using 99¾ bushels of charcoal to the ton of iron. Charcoal weighs 20 lbs to the bushel. In 1886 the furnace made 8,903 tons of pig iron.

No of days furnace was in blast in 1886, 356 days.

No. of bushels charcoal used, 753,000,

No. tons of iron ore smelted, 13,225.  
No. of bushels charcoal used per ton of iron made, 84½.  
All Lake Superior ores, yield of ore in the furnace, i. e.,  
No. lbs. of iron made from each 100 lbs. of ore, 61%.  
N. Woods, clerk, etc., Gaylord Iron Co., Detroit.

#### *THE JACKSON IRON CO.*

has operated one stack at Fayette, Delta Co., L. S.,  
Mich., in which were made during the year 1886  
10,581¼ tons of pig iron.

No. bushels of charcoal used, 1,122,840.  
No. bushels of charcoal used per ton of iron made,  
115½.

Total No. of tons of limestone used was, 871.

Per cent, of yield of ore in furnace, 61.6%.

Average market value of the iron in Cleveland, \$17.59  
per ton.

Height of stack 59 ft, diameter of bosh 9½ ft. Ore used  
was Jackson mines ore, hard and soft. The wood for  
charcoal was 50% soft wood.

H. S. Merry, Supt., Fayette, Mich.

#### *EUREKA IRON AND STEEL WORKS*

manufacture at Wyandotte, Mich.

The furnace is 56 ft. high with 11 ft. diameter of bosh.

The Co. made during 1886, of pig iron, 11,668½ gross  
tons.

No. of days the furnace was in blast, 241.

No. of bushels charcoal consumed, 1,124,000.

No. of bushels charcoal consumed to the ton of iron  
made, 96½.

Average yield of ore in furnace, 60%.

Iron sold from \$19 to \$24 per ton.

A great variety of ore was used, consisting of  
Michigamme, Barnum and Cleveland mine hard ores,  
Salisbury, Chapin, Norway, Detroit, Gt, Western  
hematites.

J. G. Van Alstyne, Agt.

#### *DETROIT IRON FURNACE CO.*

has a furnace in operation at Hamtramck Detroit, which  
is 50½ ft. high, with 10½ ft. diameter of bosh.

No. of days run in 1886, 181.

No. of tons of pig iron made, 7,641.

No. bushels charcoal used per ton of iron made, 95.

Yield of ore in furnace, L. S. ores, 59 6-7%,

Seven tuyeres each 3 in diameter.

Top at charging line 7 ft diameter.

Closed top. Lee Burt's patent charging apparatus.

Hearth water jacketed.

Capacity of furnace 50 to 55 tons per day, according to  
richness of ore used. The No. of bushels charcoal used  
per ton of iron also varies from 85 to 95, according to the  
quality of the iron made, i. e., it requires more charcoal  
to make No. 1 and 2 iron than it does to make Nos. 3, 4,  
5, etc. The Co. was organized in 1879. James  
McMillan, Prest.; Hugh McMillan, Treas. and V. P.; E. C.  
Wetmore, Sec., and Lee Bart Manager.

#### *THE ANTRIM IRON CO.*

has a furnace located at Mancelona, Mich., being near  
the northern, end of the lower peninsula, in a fine  
hardwood region. The furnace was operated during the  
past year—1886—1898 days.

No. of tons of pig iron made, 9,414.

No. of tons of pig iron made par day, 47½.

No. of bushels of charcoal used per ton of iron made,  
86½.

Average percentage of furnace yield of the ore used, 59  
1-7%.

Kind of ore used, Cleveland, Lake Superior mine,  
Jackson mine, Detroit mine, Winthrop and Iron Cliff Co.'s  
ore.

Pig iron sold at an average price of \$17.50 per ton.

E. Fitzgerald, manager.

Since writing the foregoing I have been furnished by the  
agent with the following which I regard as valuable:

#### RECORD OF THE ANTRIM IRON FURNACE.

The furnace at Mancelona has been from the time it  
passed under the present management, extremely  
successful. Its record during the past year will compare  
favorably with any charcoal furnace in the country.

The stack is 48 feet high, and the diameter of the bosh is  
8 feet 6 inches— not by any means a large furnace. As  
stated below, the limestone for fluxing was from  
Petoskey.

The following is a statement of the working of the Antrim  
furnace for the year ending June 1st, 1887:

Days run.....	340
Bushels of charcoal used.....	1,312,680
Tons of ore used.....	27,364
Tons of limestone used.....	1,122
Furnace charges run.....	43,171
Blank charges run.....	585
Tons of pig iron made.....	16,152
Bushels of charcoal per ton of iron.....	81½
Pounds of limestone per ton of iron.....	156
Pounds of ore smelted per ton of iron.....	3,754
Pounds of ore smelted per bushel of coal.....	46½
Average number of gross tons of pig iron made per day.....	47½
Per cent of yield of ore.....	60
Per cent of hematite ore used.....	80
Per cent of specular ore used.....	20
Average blast pressure.....	3½ lb
Average blast temperature.....	850°
Average steam pressure.....	75 lb
Average revolutions per minute of blowing engine.....	47

The oven is on the Player plan, having 27 U pipes, each 12 feet high, furnishing 950 degrees temperature of blast. The engine used is a Weimer; 16x30 steam cylinder, and 30x48 wind cylinder.

The ore used were Lake Superior Iron Co.'s Specular, Lake Superior Old Mine Hematite, Cleveland Iron Co.'s Fine Scotch, Winthrop Hematite Co.'s Mitchell. Petoskey limestone was used, and the wood used for coaling was of excellent quality—principally maple, beech and elm.

The largest day's run by this furnace was fifty-six tons.

The furnace is advantageously situated on a small inland lake and on the line of the Grand Rapids & Indiana railroad. The ores are received direct from the mines by rail, and are dumped into the stock house from an elevated track. The freight of the ore from the mines laid down in the stock house is \$1.60 per ton. Freight to Chicago on the iron \$2.25 per ton. The wood costs from \$1.25 to \$1.35 per cord. Wages paid, \$1.25 to \$2.00 per day.

These figures and statistics were taken direct from the books of the company. Since the company took possession of the property, March 15th, 1886, the machinery has all been thoroughly overhauled, the stack relined, the oven repaired and an additional one built. Besides all this, a 75-barrel lime kiln has been built and 33 charcoal kilns erected—making altogether 43 kilns (of 50 cords capacity) for the manufacture of coal. They have increased their stock room for ore to double its former size, relaid and repaired all tracks, trestles and tramways, built an addition to their store 28x60 feet in size, and a large and substantial «barn for stabling their own horses. They are building a new brick engine and boiler room, 40x80 feet in size, and are now making preparations for the erection of a duplicate stack and a new iron elevator shaft. In fact, it is extremely difficult to say just when or where the company will leave off remodeling, rebuilding and making additions and improvements.

The indications are that the present stack will not be blown out for six or eight months to come.

The credit is due to Messrs. Fitzgerald, the agent, and to James Mackey, the founder; the latter is a practical furnaceman having acquired his knowledge by working in every department of labor connected with a furnace.

Every one familiar with furnace work knows how much of the success depends on the founder.

### BANGOR FURNACE COMPANY.

The Bangor furnace is situated in the pleasant village of Bangor, in Van Buren county, in a comparatively old and settled portion of the State, still, there is yet a fair supply of hard wood timber for fuel. The ore is brought from Escanaba to St. Joseph by boat, and thence 27 miles by rail, via. the C. and West Michigan R. R., to the furnace. The originators of the enterprise deem it a mistake that the furnace was not placed on the lake, so as to save all railroad cost of the ore. The furnace has been leased to the Spring Lake Iron Company, which company will operate the furnace the coming year.

No. of days the furnace was in blast in 1886.....	305
Total number of tons of iron made.....	12,941
Furnace yield of ore, <i>i. e.</i> , No. lbs. of iron to 100 lbs. of ore.....	60%

They used a mixture, ½ specular and ½ hematite. Ores, L. S. mine specular and L. S. hematite, Winthrop, Chapin, Great Western ores. The charcoal cost on the average six cents per bushel. Height of furnace stack, 51 feet, use bell and hopper, diameter of bosh, 10½ feet.

W. H. Nelson, Superintendent, Bangor, Michigan.

### PINE LAKE IRON COMPANY

operates a furnace at Ironton, in Charlevoix county, which has been in blast but a portion of the past year. It is now idle, and has been for two months preceding the close of the year. Total number of tons of iron made, 5,070.

R. M. Cherrie, President, Ironton, Michigan.

### THE PENINSULAR IRON COMPANY

operates a furnace in Detroit. Height of stack, 42 feet; diameter of bosh, 9½ feet.

No. of days that the furnace has been in blast in 1886.....	220
No of tons of pig iron made.....	5,263
No. of bushels of charcoal used per ton of iron made.....	106
Average total in lbs. of bushels of charcoal.....	17
The charcoal was made of beech and maple 50%, and 50% elm, ash and oak.....	
Average yield of ore in the furnace.....	58.68%

Ores used were from the Milwaukee, Rolling Mill and Norrie mines, soft ores, and of hard ores from Champion, Barnum, Lake Superior and Michigamme mines.

Solon Burt, Secretary.

### THE DEER LAKE IRON COMPANY'S

furnace is located about two miles northwest of Ishpeming, in the Upper Peninsula. It produced the last year 10,898½ tons of pig iron.

One remarkable work done at this furnace during the past year was re-lining the stack without extinguishing the fires, an operation that was successfully performed. The furnace was "banked up," the burden thoroughly covered, provision made for the escape of the gas, and the men entered the inside of the stack and took down the old lining and replaced it with new in as thorough a manner as could be desired.

Wm. H. Rood, President, Ishpeming, Michigan.

### VULCAN FURNACE CO.

was organized in 1882. James McMillan, Prest ; Wm. C. McMillan, Sec.; Hugh McMillan, Treas.; Lee Burt, Manager. General business office Newbury & McMillan's building, Detroit, Mich.; manager's office at the Detroit Iron Furnace Company's Works, Detroit, Michigan, manufacturers of charcoal pig iron for car-wheel and malleable iron.

The Vulcan furnace is at Newbury, in Luce county, in the upper peninsula, and is one of the most substantial and best appointed furnaces in the State.

The local superintendent is Royal A. Jenney, Newbury, Mich.

Height of furnace stack is 53 ft.

Diameter of bosh, 10', 6".

Seven tuyeres each 3" in diameter.

Diameter of top at charging line, 7', 3".

Hearth is water jacketed.

Charged with Lee Burt's patent charging apparatus.

Capacity of furnace is 50 to 55 tons of iron per day.

Average yield of ore in the furnace 58%.

Ores used comprise a suitable mixture of hard and soft ores from the Marquette range mines. The furnace went into blast Sept. 1, 1885, and will be blown out for repairs about April 1, 1887, at which time it will have made a total output during the blast of upwards of 28,000 gross tons. The delay will be as brief as possible, when the furnace will again be at work. It is confidently predicted that the furnace will outdo its former record. Product for 1886 was 16,360 gross tons of pig iron.

Table showing product of Michigan Blast Furnace for the years given:

Name of Company.	1884.	1885.	1886.
Eureka Iron and Steel Works, Wyandotte.....	6,000	10,904	11,668½
Gaylord Iron Company, Detroit .....	7,200	4,803	8,093
Detroit Iron Furnance Company, Detroit.....	6,205	13,619½	6,741
Union Iron Company, Detroit.....	8,000	3,303	6,000
Peninsular Iron Company, Detroit.....	7,200	7,439	5,263
Bangor Furnace Company, Bangor.....		6,891½	12,941
Elk Rapids Iron Company, Elk Rapids.....		16,077½	17,434½
Spring Lake Iron Company, Fruitport.....		17,217	17,768
Jackson Iron Company, Fayette.....		8,456	10,581
Vulcan Iron Company, Newberry .....		11,426	17,360
Deer Lake Iron Company, Ishpeming.....		9,245½	10,898½
Iron Cliff Company, Negaunee.....		15,718	11,079
Antrim Iron Company, Mancelona.....			9,414
Pine Lake Iron Company, Ironton.....			5,070
Mortel Furnace Company.....			7,666
Total.....		125,190	148,952

## COAL MINES.

There is nothing new to record in the coal mining business in this State. It is an industry that in Michigan is never likely to be of much magnitude. Nowhere has the coal seam been found to be thick enough to make it easily mined, and frequently, when it does exist in quantity that it would do to mine, the overlying rock is too soft and friable to form a roof. Although the only deposits that have been worked to any profit have been found in Jackson and Shiawassee counties, still, coal exists to some extent in many of the counties of the Lower Peninsula. I have seen very fine quality of coal dug in the southwest part of the State, in Cass, Berrien and Van Buren counties. But so far as I know, it does not exist in those localities in any appreciable quantity.

Coal has been mined in a small way, and is yet, at Williamston, and at Grand Ledge, and the coal at the former place is of a superior quality for Michigan coal, but I am informed that the deposit is wanting in a roof, and besides that the seam is thin.

No matter if the coal is ever so desirable, if the overlying rock cannot be made to support the burden, the coal cannot be mined, and this is the trouble with much of the Michigan coal. It won't pay to strip it; it is too deep down for that, and it cannot be roomed out, as the rock and dirt would come. This seems to be the trouble with the coal deposits in Saginaw Valley. There is no overlying deposit of rock of sufficient strength to support the dirt as the coal is removed. The vicinity of the city of Jackson has ever been, and still continues to be, the best coal mining section in the State. Second to this is Corunna.

The Corunna coal is harder than that at Jackson. It requires to be blasted, while at Jackson no powder is used. In addition to the cost of powder, the Corunna company pay seven cents more per ton for mining than they pay at Jackson. At Jackson the cost per ton for mining is 30 cents; at Corunna it is 37 cents. The companies in both places make the entries and turn the rooms. The miners break the coal, load it and tram it to the shaft.

There has been more profit in the business in the past year than there was in 1885. Those engaged in mining state that they can sell all they can get out now. Mr. Kincaid, the agent at Corunna, says he wants men, the trouble he has mainly is to get good miners and to keep them. The men cannot make good wages until they get used to working here, and learn to exercise skill in placing their blasts so that they shall be effective. At first men are almost certain to make a failure and they get discouraged and quit. The experienced miners, it is claimed, make good wages. The Corunna company is working 75 men now. The mine is looking well and is in good shape. The vein is 2 to 4 ft. thick, averaging about 3 ft. They are mining about 1,500 tons a month. Could sell three times the amount if they could get it out. The safety of the work is illustrated by the fact that only two serious casualties have occurred in ten (10) years; one man was killed and another had a leg broken. The fatal accident was due to blasting.

At Jackson the largest producers of coal are R. W. Emerson Co., the JACKSON Coal Company. Their old mines, however, are exhausted and they are now exploring with the drill for more coal.

Besides the Jackson Coal Co. the only other producers are the STAR Coal Co. and the STANDARD. These are both new companies and are operating shafts that were opened in 1885.

The old mines, Woodville, Slope, Porter, Eureka, etc., are worked out and abandoned and really at the present writing, February, 1887, there are but the two shafts in operation, the Star and the Standard.

The Star company's mine is looking first-rate. The shaft is 50 ft. deep, but the coal lies much deeper in places, owing to the surface rise of the ground. The coal is 2' 9", 3' 7", 4' thick with a good roof. The company claims to be doing well financially just now, working 65 men, and pays out \$1,700 per month for wages. The mine is not very largely opened just yet. The company holds the lease of the mining right to 460 acres in one body. The lease is for 30 years at 15c. per ton royalty. The company sells 15 cons per day to the State Prison, and it is the work of only two teams to haul it from the shaft.

It is reported that an effort is to be made to mine coal extensively at FLUSHING. Some mining has been done here for many years but the coal seam has a poor roof, as one of the important drawbacks, and only a small quantity has ever been obtained in any year.

The following table shows the product of the Michigan coal mines for the years indicated:

	Years previous to 1877.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Williamston.....							10,454	884			1,000
Jackson mine.....		67,147	61,785	65,000							
Corunna Coal Co.....			22,537	16,215	12,252	7,060	8,624	9,000	8,000	10,000	15,975
Other mines.....		1,500	1,000	800							1,000
R. H. Emerson & Co.....					66,780	61,668	60,103	40,412	13,712	15,553	21,363
Eureka Coal Co.....					30,000	37,477	25,000				
Michigan Coal Co.....					30,021	23,987	25,000				
Porter Coal Co.....							6,158	21,000	15,000	13,000	
Star Coal Co.....										5,123	5,821
Stanford Coal Co.....										15,000	4,743
Total.....	350,000									45,174	49,902

## SALT.

It is well known that Michigan leads every other State and Territory in the Union in the production of salt. It is an industry that has grown up very rapidly in this State and has become of immense proportions. Formerly the production was confined to the Saginaw valley, but now there are wells affording equally rich brine on the shores of Lake Michigan. In all there were pumped in this State, during 1886, 297 wells, which range in depth from 750 feet to 2,000. The average depth is about 1,000 feet.

The following is from the report of the State Salt Inspector, Geo. W. Hill, and covers the whole subject of the salt production in this State for the year 1886. It shows an actual production of over 4,000,000 barrels of salt in the past year, which sold at an average net price of 65 cents per barrel of 280 pounds. It is expected that prices will rule lower in 1887.

There is a Michigan State Salt Association with general office at East Saginaw. W. R. Burt, President.

The law requires that the report shall contain:

1. The number of districts into which the salt-producing territory of the State may then be divided, with the name and locality of each, and the number and capacity of the works of each district.
2. The quantity and quality of salt inspected in each district during the preceding year.
3. The amount of money received and expenses incurred under this act.

### THE SALT DISTRICTS.

The salt-producing territory of the State is divided into nine districts, having a manufacturing capacity as follows:

#### *District No. 1, Saginaw County—*

Has 52 salt companies, with 45 steam, 12 pan blocks, and 4,000 solar salt covers, having a manufacturing capacity of 1,400,000 barrels of salt.

One steam and one pan block belonging to T. Jerome & Co., of the above, destroyed by fire this season.

#### *District No. 2, Bay County—*

Has 31 salt companies, with 34 steam blocks and 500 solar salt covers, with a manufacturing capacity of 1,300,000 barrels of salt.

*District No. 3, Huron County—*

Has 16 salt companies, with four steam, eight pan blocks, and with a manufacturing capacity of 350,000 barrels.

*District No. 4, St. Clair County—*

Has 12 salt companies, with 10 steam and two pan blocks, with a manufacturing capacity of 600,000 barrels.

*District No. 5, Iosco County—*

Has eight salt companies, with eight steam blocks, having a manufacturing capacity of 300,000 barrels of salt.

*District No. 6, Midland County—*

Has four salt companies, with three steam and one pan block, having a manufacturing capacity of 100,000 barrels of salt.

*District No. 7, Manistee County—*

Has 10 salt companies, with nine steam and one pan block, having a manufacturing capacity of 900,000 barrels of salt.

*District No. 8, Mason County—*

Has two salt companies, with two steam blocks, having a manufacturing capacity of 200,000 barrels of salt.

*District No. 9, Gratiot County—*

Has one salt company, with one steam block, having a manufacturing capacity of 15,000 barrels of salt.

RECAPITULATION.

From the above we find there are 136 firms engaged in the manufacture of salt, during the year 1886, operating 116 steam and 24 pan blocks. Total number of blocks 140, and 4,500 salt covers, with an estimated manufacturing capacity of 5,165,000 barrels of salt:

DISTRICT No. 1—SAGINAW COUNTY.	
For whom Inspected.	Barrels.
Nason, Allan & Co.....	19,120
Green, Ring & Co.....	56,062
Cameron & Merrill.....	38,313
Saginaw Manufacturing Co.....	13,974
N. & A. Barnard.....	45,686
D. Hardin.....	12,211
D. Hardin & Co.....	7,400
Williams Bros.....	24,634
Brand & Hardin.....	12,536
Wright Lumber Co.....	47,878
Wylie Bros.....	20,621
J. H. Pearson & Son.....	17,238
C. K. Eddy & Son.....	34,372
Redmond & Nolan.....	3,351
J. H. Freaney.....	9,393
E. R. Phinney.....	7,968
W. A. O'Donnell.....	12,245
Frank Bischkee.....	1,924
Wiggins, Cooper & Co.....	30,359
Eaton, Potter & Co.....	11,334
Rust Brothers & Co.....	25,738
Gebhardt & Estabrook.....	18,727
Burnham & Still.....	1,902

For whom Inspected.	Barrels.
D. S. Chapin.....	2,899
W. B. Stillman & Co.....	4,976
Sample & Camp.....	18,261
Nelson Holland.....	33,077
Warner & Eastman.....	21,536
C. & E. TenEyck.....	15,224
J. G. Owen.....	27,094
J. J. Winsor.....	8,650
W. L. Webber (trustee).....	34,731
Tyler & Son.....	20,046
Saginaw Lumber & Salt Co.....	33,684
C. Merrill & Co.....	44,149
G. E. Anthony.....	15,897
Whittier & Co.....	11,097
Backus & Binder.....	5,070
W. B. Mershon.....	20,057
E. F. Gould.....	23,487
T. Jerome & Co.....	24,821
A. T. Bliss (upper mill).....	47,132
Stevens & La Due.....	38,228
Sanborn & Hill.....	29,958
C. L. Grant & Co.....	12,120
A. T. Bliss & Bro (lower mill).....	43,175
E. C. Chapman.....	13,693
Rust, Eaton & Co.....	29,948
Hamilton, McClure & Co.....	60,947
Whitney & Batchelor.....	71,831
Melchers & Nerretter.....	10,282
LaDue, Stevens & Co.....	11,971

TOTALS.	
Fine, bulk.....	262,444
Fine, bbls.....	910,263
Coarse.....	49
Packers'.....	2,361
Solar.....	27,677
Second quality.....	10,970
Total bbls.....	1,213,811

DISTRICT No. 2—BAY COUNTY.	
Dolsen, Chapin & Co.....	35,722
Pitts & Cranage.....	53,511
Birdsall & Barker.....	12,068
N. B. Bradley & Sons.....	43,812
McLean, Son & Co.....	43,820
Wm. Peter.....	29,549
Eddy, Avery & Eddy.....	33,952
F. E. Bradley & Co.....	34,392
L. L. Hotchkiss & Co.....	57,860
Laderach Bros.....	15,749
Malone & Co.....	42,654
H. W. Sage & Co.....	73,160
Keystone S. & L. Co.....	461
C. B. Curtis (agent).....	34,357
C. E. Lewis.....	9,251
mith Bros & Co.....	23,012

For whom Inspected.	Barrels.
J. R. Hall.....	47,258
E. Hall.....	27,208
Butman & Rust.....	20,489
McEwan Bros & Co.....	37,761
Miller & Lewis.....	32,998
Rust Bros & Co.....	36,870
G. C. Meyers.....	10,197
W. B. Rouse.....	22,900
Michigan Pipe Co.....	14,102
E. Y. Williams & Co.....	25,327
Eddy Bros & Co.....	27,772
Murphy & Dorr.....	10,125
Folsom & Arnold.....	24,608
T. H. McGraw.....	22,939
Atlantic Salt Co.....	3,500

TOTALS.	
Fine bulk.....	186,431
Fine.....	709,077
Coarse.....	568
Packers'.....	1,815
Solar.....	3,500
Second quality.....	5,993
Total bbls.....	907,384

DISTRICT No. 3—HURON COUNTY.

Huron Dairy Salt Co.....	22,856
Port Hope Salt Co.....	50,022
R. C. Ogilve.....	17,333
New River Salt Co.....	.....
Caseville Salt Co.....	11,072
C. F. Soule.....	2,665
Port Crescent Salt Co.....	8,395
T. Winsor & Co.....	1,278
Port Austin Manufacturing Co.....	11,890
Ayres & Co.....	29,914
Frank Crawford.....	693
Bennett Haskell.....	2,023
Cleveland Stone Co.....	4,268
D. L. Davis.....	24,773
Worthington & Sons.....	18,481
R. Winsor & Sons.....	33,906

TOTALS.

Fine bulk.....	25,171
Fine.....	212,084
Packers'.....	1,770
Second quality.....	2,644
Total bbls.....	240,569

DISTRICT No. 4—ST. CLAIR COUNTY.

R. B. Baird.....	19,676
Thompson Bros.....	71,500
Marine City Stave Co.....	100,363
J. A. Wanzy & Sons.....	8,373
Lester & Roberts.....	2,812
For whom Inspected,.....	Barrels.
Germania Salt Co.....	6,226
Johnson & Henry.....	50
Excelsior Salt Works.....	2,007
Marine City Salt Works.....	15,536
Marine City Salt and Brick Works.....	6,525
Algonac Salt Co.....	8,113
Toledo Salt Co.....	9,431

TOTALS.

Fine bulk.....	3,450
Fine.....	229,079
Coarse.....	816
Packers'.....	3,228
Second quality.....	13,929
Total bbls.....	250,602

DISTRICT No. 5—IOSCO COUNTY.

East Tawas Lumber & Salt Co.....	29,333
Pack, Woods & Co.....	52,673
Gratwick, Smith & Fryer.....	46,584
J. E. Potts & Co.....	23,004
Oscoda Salt & Lumber Co.....	12,229
Emery Bros.....	28,984
Iosco B. S. Co.....	19,096
Winona Salt & Lumber Co.....	23,240

TOTALS.

Fine.....	234,367
Coarse.....	30
Packers'.....	525
Second quality.....	221
Total bbls.....	235,143

DISTRICT No. 6—MIDLAND COUNTY.

Wm. Patrick.....	19,361
Chas. Brown.....	7,313
Larkin & Patrick.....	21,960
Sam. Foster.....	18,487

TOTALS.

Fine.....	61,226
Second quality.....	5,895
Total bbls.....	67,121

DISTRICT No. 7—MANISTEE COUNTY.

Davis, Blacker & Co.....	37,401
Louis Sands.....	34,460
Manistee Salt and Lumber Company.....	96,464
R. G. Peters.....	197,481
Wheeler, Magill & Co.....	54,926
Engelman & Kitzinger.....	34,305
Reitz Brothers.....	63,013
Stronach Lumber Company.....	53,480
Canfield & Wheeler.....	69,672
John Canfield.....	61,871

TOTALS.

Fine bulk.....	19,727
Fine.....	620,744
Coarse.....	2,154
Packers'.....	12,422
Second quality.....	2,856
Total bbls.....	683,103

DISTRICT No. 8—MASON COUNTY.

For whom Inspected,.....	Barrels.
Pere Marquette Lumber Company.....	70,309
Thos. R. Lyon (agent).....	8,912

TOTALS.

Fine.....	75,318
Coarse.....	276
Second quality.....	3,627
Total bbls.....	79,221

DISTRICT No. 9—GRATIOT COUNTY.

St. Louis Salt Company.....	350
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TOTALS.

Fine.....	350
Total bbls.....	350

RECAPITULATION.

District No. 1—Saginaw County.....	1,213,764
District No. 2—Bay County.....	907,384
District No. 3—Huron County.....	240,569
District No. 4—St. Clair County.....	250,602
District No. 5—Iosco County.....	235,143
District No. 6—Midland County.....	67,121
District No. 7—Manistee County.....	683,103
District No. 8—Mason County.....	79,221
District No. 9—Gratiot County.....	350

TOTALS.

Fine bulk.....	497,223
Fine.....	3,051,508
Coarse.....	38,932
Packers'.....	2,221
Solar.....	31,177
Second quality.....	71,235
Total.....	3,677,257

The above table shows an increased inspection over 1885 of 379,854 barrels of salt, but does not show the amount actually manufactured during the fiscal year of 1886:

Add to the amount inspected.....	3,677,257
Salt now in bins.....	933,970
Total.....	4,611,227
Deduct salt inspected in December, January and February, 1886.....	513,284
Amount actually manufactured fiscal year 1886.....	4,097,943

Showing an actual production over any preceding year of 798,169 barrels.

Table showing increased and decreased inspection per district:

County.	1885. Barrels.	1886. Barrels.	Increase.	Decrease.
Saginaw.....	1,178,910	1,213,764	34,854	.....
Bay.....	951,810	907,384	.....	44,426
Huron.....	306,664	240,569	.....	66,095
St. Clair.....	125,014	250,502	125,588	.....
Iosco.....	236,543	235,143	.....	1,400
Midland.....	62,710	67,121	4,411	.....
Manistee.....	432,637	683,103	246,466	.....
Mason.....	.....	79,221	79,221	.....
Gratiot.....	3,115	350	.....	2,765
Total income.....	3,297,403	3,677,257	512,540	114,686

COMPARATIVE TABLE.

The following table shows the amounts of the various grades of salt inspected in Michigan since 1869, the first year of the establishment of the State inspection law:

Year.	Number of Tons of Land Plaster produced by Michigan Companies.					Number Barrels of Stucco produced by Michigan Companies.										
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
1869.....	513,908	123,908	15,264	19,177	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1870.....	568,326	17,869	15,507	19,650	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1871.....	655,923	14,677	37,645	19,930	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1872.....	672,034	11,110	31,461	19,876	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1873.....	746,702	23,671	32,267	20,706	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1874.....	960,757	20,000	29,391	16,741	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1875.....	1,027,866	10,233	24,336	19,410	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1876.....	1,402,410	14,233	24,233	21,668	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1877.....	1,590,841	20,839	22,818	26,818	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1878.....	1,770,391	19,267	33,544	32,615	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1879.....	1,997,350	15,641	18,020	29,027	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1880.....	2,559,037	16,691	22,237	45,823	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1881.....	2,673,910	13,885	9,683	53,821	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1882.....	2,928,542	17,208	31,335	60,222	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1883.....	2,828,987	15,424	16,735	33,526	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1884.....	3,087,064	19,308	16,957	38,508	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1885.....	3,230,626	15,480	19,840	31,428	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1886.....	3,548,731	22,221	31,177	71,235	3,896	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Salt manufactured prior to 1869.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total amount of salt produced in Michigan to date, barrels.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

GYPSUM.

The gypsum deposits, quarries and mills, etc., in this State have been fully described in previous reports—particularly in the report of 1878, and in that of 1881, and I do not deem it necessary to go into any further details of the subject at the present time beyond giving the tables showing annual production.

TABLE Showing the Amount of Land and of Calcined Plaster produced in Michigan, for each year since 1868, and for previous years.

Years.	Land Plaster, Tons.	Stucco—Barrels, 300 lbs. each
For years previous to 1868.....	*100,000	80,000
1868.....	14,604	.....
1867.....	17,439	.....
1866.....	28,837	34,996
1865.....	29,996	41,187
1870.....	31,437	46,179
1871.....	41,128	48,685
1872.....	43,536	59,767
1873.....	44,972	82,457
1874.....	39,126	88,449
1875.....	27,019	61,120
1876.....	39,131	64,386
1877.....	40,000	55,000
1878.....	40,000	48,346
1879.....	43,658	50,800
1880.....	49,570	106,004
1881.....	33,173	112,813
1882.....	37,821	135,655
1883.....	33,225	201,133
1884.....	27,888	156,677
1885.....	28,181	141,575
1886.....	29,398	153,274
Total product.....	820,142	1,686,469

\* Partly estimated.

TABLE Showing the product of Land Plaster and Stucco produced by the different Companies in Michigan, in the Years indicated.

Name of Company.	Number of Tons of Land Plaster produced by Michigan Companies.								Number Barrels of Stucco produced by Michigan Companies.							
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Godfrey & Bro.....	9,117	9,000	6,422	6,980	5,682	4,393	4,467	4,560	.....	23,000	27,500	30,374	27,000	30,433	30,942	28,273
Grand Rapids Plaster Co.....	8,970	12,000	6,375	7,512	5,013	3,044	4,143	3,822	.....	23,000	20,400	23,254	40,000	24,380	26,488	28,627
Wyoming Mills.....	7,000	10,000	6,009	6,801	4,400	3,032	4,059	3,714	.....	.....	.....	.....	12,000	13,108	11,193	11,827
Union Mills.....	4,200	7,500	6,716	8,298	5,500	3,185	3,663	3,687	.....	33,000	34,913	23,074	30,000	21,176	15,654	18,627
D. Noble & Co.....	10,685	9,570	6,572	6,037	4,000	3,302	3,900	1,947	.....	24,500	30,000	27,665	38,000	30,288	26,344	28,700
Smith, Bullard & Co.....	1,386	1,300	1,000	2,063	4,000	4,122	4,346	6,000	.....	.....	.....	.....	11,817	30,061	25,061	27,113
Alabastine Co.....	1,900	.....	.....	.....	4,032	6,000	3,006	5,008	.....	.....	.....	.....	16,172	11,261	10,147	11,147
Geo. H. White & Co.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	63,656	69,670	33,178	37,221	33,225	27,888	28,181	29,398	.....	106,104	112,813	135,655	201,133	156,677	141,575	153,274

THE COPPER MINES.

About the close of the year 1886 the copper mining business had a favorable outlook. The price of Lake copper had advanced to 11 or 12c. per lb. and it seemed likely that those figures would be maintained; thus a reasonably prosperous year was anticipated. But, unfortunately for the mining companies, as the season advanced the price of copper again dropped to 10c., and has not advanced above it thus far during the fourth part of the year 1887.

The action of the Calumet and Hecla company in selling a large amount of copper recently for 10c. per lb. is, generally, severely condemned by other Lake Superior companies.

It is claimed that the price is thus unnecessarily depressed and brought below the point at which many of the other Lake Superior companies can afford to produce it.

On the other hand, in justification of the action taken by the Calumet & Hecla, it is stated that such large sales at low price drive out competition, by forcing the closing up of many mines in other copper mining regions, thus lessening the aggregate production and bringing it more nearly to an equality with the demand.

The production of copper has increased more rapidly, of late, than the consumption, so that the price has steadily decreased until it has reached so low a figure that it would seem to be impossible, judging from our past experience of the cost of production, that it can be mined and sold without loss, at the prices which now prevail.

Our Lake Superior copper companies, however, have fully appreciated the signs of the times and have constantly sought to reduce the mining and manipulating cost of the metal to such a degree as should enable them successfully to meet the exigences of the case, that is to make the cost so low, that there should still be a profit to them in the business.

I have endeavored to go over this ground so fully in previous reports and to explain the methods by which this reduction of cost has been effected and to show how skillfully and economically all the work in our copper mines is performed, that I deem it unnecessary to dwell upon the subject further at this time. One thing is apparent: the days of operating small copper mines have passed. It is only by the vast increase in the magnitude of the work that the relative cost has been so greatly cheapened. Energy, economy, the greatest

mining skill, the use of every mechanical appliance, all have their place, all are brought into requisition, and the result is the marvellous success attained at the Franklin, Atlantic, Osceola, Quincy and other of our great copper mines.

In writing of the copper mines I shall be as brief as possible. I have described them so fully heretofore that in going through the mines again the past winter I find very little to state that I have not previously written, except, of course, the statistics for the year.

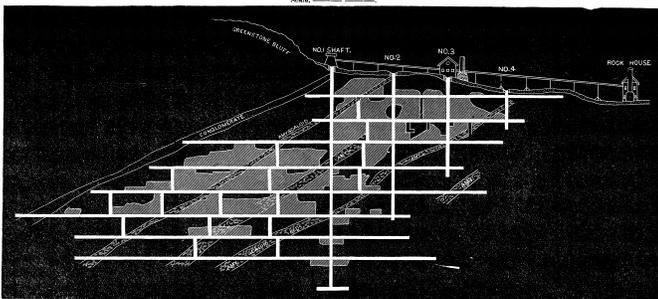
The mines at the extremes of the range are those which fare the most depressed. In both Keweenaw and in Ontonagon counties the mines are nearly all idle or working in a small way on tribute. Commencing with

## THE CONGLOMERATE,

is the most northerly of the mines that have produced any copper in the past year. I find little to add to what was given in my previous report. A few tributers extracted 22 tons and 505 lbs. of refined copper, all barrel work and small masses obtained in the old Northwest vein and in the upper levels of the Conglomerate.

Those who are acquainted with the history of our copper mines will remember that this mine, under the various names which it has had in the past, is one of the oldest locations in the Peninsula. Formerly they worked here only in fissure veins; in veins holding chiefly mass copper, which cross the range at practically right angles to the trend of the formation and which dip vertically, or nearly so. Several of these veins have been opened and worked on this property and all the money derived from the sales of the copper obtained, together with that advanced by the stockholders, to the amount of the capital stock, of the several organizations, has been expended on the location. Not a penny of profit has passed into the pockets of the unfortunate shareholders.

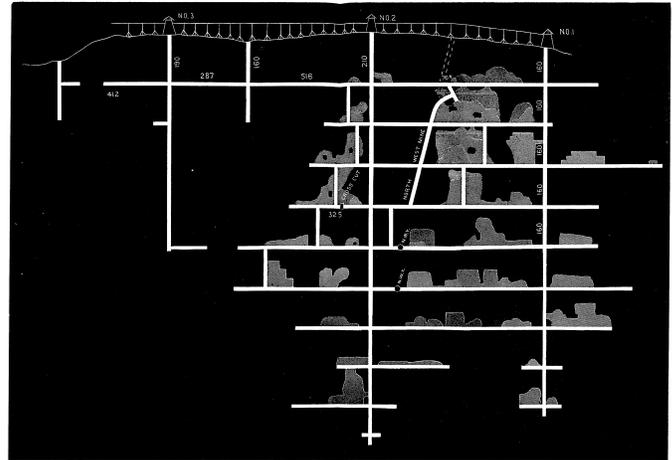
LONGITUDINAL SECTION OF THE DELAWARE MINE, CONGLOMERATE MINING CO., 1887.



These companies were known as the Northwest Copper Mining Association, which was formed in 1847, and owning 4,320 acres of land in T. 58 N., R. 30 W.—the mine which had been prospected. In 1849 the capital stock was increased and the company re-organized under the title of The Northwest Mining Co. In the succeeding ten years the company expended \$939,000 and thus exhausted its capital stock. In 1861 re-organization was effected, taking the name of the Pennsylvania Mining Company. The estate comprise!

2,880 acres of land, to which were soon added by purchase 6,000 acres of timbered land.

LONGITUDINAL SECTION OF THE CONGLOMERATE MINE, 1885.



In 1863 the estate was divided and another company organized called the Delaware Mining Company, to which was set off 720 acres of land on the range south of the old mine.

Both these companies worked extensively and expended together, in mining and surface improvements, the aggregate sum of \$2,000,000. It seems incredible at this time that so much money should have been paid out with so inadequate a result.

But we must bear in mind that it was during the time of the war and just after it, when prices for all commodities and for labor were higher than they have ever been at any other time in this country. They erected at the Pennsylvania the largest stamp mill that, up to the time, had ever been seen on the lake, and at that period such machinery was enormously costly. Of course the value of copper was at least three times its present cost.

In 1866 the companies having failed to meet their pecuniary obligations, the property came into the possession of the bondholders who operated the mines for two years, when the bonds were purchased by Mr. E. M. Davis, of Philadelphia, who assumed charge of the affairs and in 1876 perfected the fourth organization—The Delaware Copper Mining Company. Work was prosecuted by this company until January 1, 1881, when the estate passed to the ownership of the present company. The Conglomerate Company operated extensively for three years—in opening a mine in what is known as the Allouez Conglomerate—a copper bearing belt that underlies the greenstone, and in making extensive surface improvements. In this way it has expended \$1,300,000. Everything is substantial, the houses are well built, are numerous and commodious. The machinery is new, powerful and of approved pattern. At Lac La Belle the company completed one of the best stamp mills in the State and built and equipped a railroad to connect it with the mine. There is everything complete and in order for operating a large mine, but all is practically idle, though well cared for by

the agent, Mr. Chas. H. Palmer, who resides on the premises.

The extent of the mine openings in the Conglomerate belt and in the old Northwest vein, are shown in the accompanying maps. The Conglomerate has a width of 25 feet, which Mr. Palmer, in 1884, found to yield 9 43-100 lbs. of copper to the ton of rock, treated in the mill.

And it was also found to cost \$1.58 per ton to mine and treat the rock. At present price of copper it is not possible to operate the mine, except at great loss.

I did not learn that the company has any mature plans for the future.

General office of company 308 Walnut street, Philadelphia.

Geo. H. Lewars, Secretary; Chag. H. Palmer, Agt., Delaware, Mich.

The following table shows the copper production at this mine:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
Years previous and 1855.....	654	80	1874.....	40	1,271
1856.....	1	1,348	1875.....	12	1,260
1857.....	29	543	1876.....	88	1,701
1858.....	83	100	1877.....	16	1,417
1859.....	74	144	1878.....	140	345
1860.....	121	97	1879.....	70	12
1861.....	54	1,920	1880.....	116	1,814
.....	.....	.....	1881.....	193	91
1864.....	111	660	1882.....	335	1,681
1865.....	241	861	1883.....	111	117
1866.....	64	90	1884.....	599	691
1867.....	163	660	1885.....	20	1,155
1872.....	81	1,161	1886.....	22	505
1873.....	170	743			
Total.....				3,618	467

## THE CENTRAL MINING COMPANY

has the honor of being the only company in Keweenaw county that is fully operating. The others are either all idle or are only working partly, but the Central pursues the even tenor of its way, keeps up its usual annual product, and declares regularly its accustomed dividend.

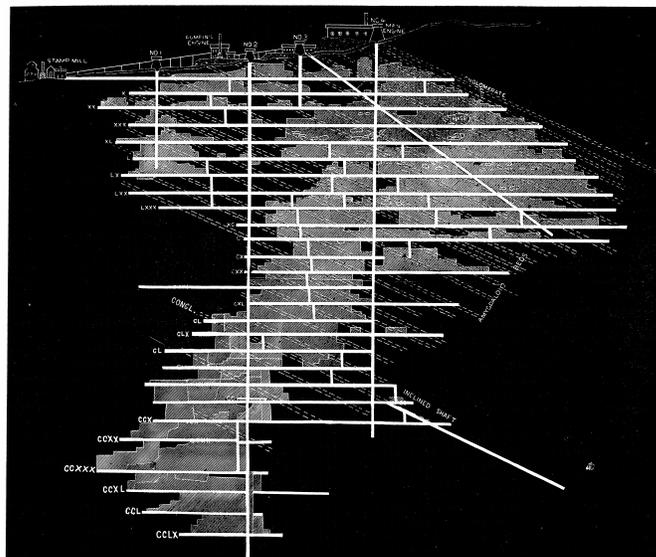
It is a very interesting mine, and the affairs of the company are exceedingly well managed.

The mine is in a fissure vein, which dips vertically, and crosses the formation. The copper is nearly all found in the vein. The amygdaloid belts cut by the vein never did produce much copper, and the conglomerate, which yielded considerable copper a few years ago, has ceased to be of value, and is now no longer worked in.

The mine is found to be rich or poor at times as the case may be. At the time of my visit the mine was looking well. There was a world of fine masses of copper in the bottom, and at the rock house, also, at Eagle Harbor, ready for shipment in the spring. In the rock house were 10 masses, each weighing four tons and upwards. Subsequently—two months afterwards—I was told by Capt. Dunstan, that the mine was looking poor. And so it

varies. I have been down in the mine when there was a world of copper in sight, and again, the next time I visited it, it would be almost barren.

LONGITUDINAL SECTION OF THE CENTRAL MINE, JAN., 1887.  
Scale, 30 ft. to one inch.



The mine has become so deep that more powerful hoisting machinery is required, and, acting on this necessity, the company has just completed the erection of a new plant that will probably prove adequate to the work. The drum is 21 feet diameter at large end, and 14 feet at small end, and 12 feet face.

The conical drum for the counter weight is 6 feet and 13½ feet diameter, respectively, at the ends, and 14 feet long. The two engines to operate them are each 30"x60", built by Frazier & Chalmers, Chicago.

The steam raises the brake, so that if the steam is shut off the drum stops. The new stone building for the machinery is 60 feet by 60 feet by 18 feet in height. The counter balance runs on the incline, running down as the skip comes up. It is provided with automatic brake on the counter weight car, so that in case of breakage of the skip rope, or other equivalent contingency, the car will stop instantly. There is also on the skip machinery an automatic cut-off, to prevent hoisting too far. The skip comes to the top when, automatically, the cutoff acts to reverse the engine. The matter of this machinery has been in contemplation for several years, and it has been the endeavor to incorporate every device that should render the work effective and safe. It is all plain and substantial, as with everything else at the Central; there is nothing for show. The advantage of this new machinery will be great. It takes, with the old machinery, seven minutes to hoist the skip, holding but one-half ton of rock. With the new the estimated time is but one and one-half minutes, and the skip carrying one and one-half tons.

The copper ground is now all south of No. 2 shaft, as may be seen by consulting the accompanying map. The depth of No. 2 is, vertically, 2,220 feet. The company works about 100 men.

I notice a considerable improvement in the appearance of the location: all the houses have been painted and rendered more neat and comfortable in appearance. The workmen at the Central are all old employees; that is they are nearly all men with families and have, many of them, lived on the location for years. The company provides them with good houses, they earn satisfactory wages and there is never any discontent.

The statistics of the year's work are shown in the following statement by officers of the company:

The directors present the following statement of the operations during the year 1886:

The production of mineral was 1,600 755-2000 tons, and the quantity smelted was 1,590 815-2000 tons, which yielded about 79 per cent., or 2,512,886 pounds of refined copper.

The following is a summary of the year's business:

PRODUCTION.		
Copper sold.....	2,033,922 lb., av. 10 67-100c.	\$217,047 79
Copper on hand.....	478,964 lb. at 10½c.	50,291 22
	2,512,886	\$267,339 01
Silver.....		432 70
		\$267,771 71
Mineral at mine December 31st, 1885, 164 1925-2000 tons, at \$145 per ton.....	\$23,919 56	
Mineral at mine December 31st, 1886, 174 1865-2000 tons, at \$125 per ton.....	21,866 56	
		2,053 00
Net value of product of 1886.....		\$265,718 71
Add interest received.....		3,907 84
		\$269,626 05
COSTS.		
Working expenses at mine.....	\$153,471 76	
Construction account at mine.....	21,540 05	
Smelting, freight, and all other expenses.....	42,774 90	
		217,786 71
And showing a net gain in 1886 of.....	\$51,839 34	
There has also been paid for lands purchased.....	24,017 01	
Making the net increase in assets.....	\$27,822 33	
The surplus from 1885, after payment of dividend, was.....	228,281 98	
Making the net surplus, December 31st, 1886.....	\$256,104 31	
as shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of two dollars per share (\$40,000) was paid February 1st, 1887.		

The item, construction, embraces the payments made in constructing and erecting the new hoisting plant named in last year's report, with the necessary connections, and alterations in roadways and shafts. The new machinery will shortly be in operation, and its completion will require a further expenditure of about \$15,000 during the current year.

The lands purchased comprise two tracts, one of 1,600 acres adjoining our mine and known as the "Northwestern mine;" the other of 1,920 acres, about a mile distant, and known as the "Madison mine." These lands are worth to us fully the sum paid for them, for their timber value alone, aside from any "mineral value" they may possess. The winding up of the companies owning these lands gave us a chance to purchase them at a reasonable price, and it would have been unwise to have neglected the opportunity and allowed the lands to pass into other hands. As we have occasion to use the timber a fair allowance for "stumpage" will be credited to the proper account, so that eventually the entire cost of the lands will be reimbursed by the timber.

The report of our agent at the mine shows the present prospects of the underground workings, and to this we refer for information regarding the mine. The usual financial statement showing assets and liabilities December 31st, 1886, is also appended.

GEORGE A. HOYT,  
ROBERT PORTERFIELD,  
JOHN J. CRANE,  
ALBERT J. HATCH,

WM. C. STURGES,  
JOHN STANTON.  
Directors.

ASSETS AND LIABILITIES, CENTRAL MINING COMPANY, DECEMBER 31ST, 1886.		EXCLU- SIVE OF REAL ESTATE AND MINE PLANT.
<i>Assets.</i>		
Cash.....		\$22,663 37
Loans.....		92,040 00
Silver on hand.....		432 70
Copper on hand, sold.....		39,308 62
Copper on hand, unsold, 478,964 pounds.....		50,291 22
Accounts receivable.....		6,032 40
		\$210,768 31
<i>At Mine.</i>		
174 1865-2000 tons mineral, at \$125.....	\$21,866 56	
Cash.....	3,115 97	
Merchandise in store.....	23,860 00	
Supplies.....	32,970 24	
		81,312 77
		\$292,081 08
<i>Liabilities.</i>		
Agent's drafts.....	\$9,739 07	
Indebtedness at mine.....	18,005 30	
Accounts payable.....	8,232 40	
		35,976 77
Balance of assets.....		\$256,104 31
(Less dividend, February 1st, 1887, of \$40,000.)		

SUMMARY OF RECEIPTS AND EXPENDITURES OF CENTRAL MINING COMPANY FROM ITS ORGANIZATION TO DECEMBER 31, 1886.

Receipts.		
Capital stock paid in.....		\$100,000 00
Copper sold (including silver).....	\$8,114,780 19	
Copper on hand.....	50,291 22	
		8,165,071 41
Profit on timber sold.....		70,011 75
Total receipts.....		\$8,344,083 16
Expenditures.		
Net expenditure for mining operations, buildings and machinery, smelting and marketing copper, and incidental expenses.....	\$6,233,961 84	
Net cost of "Madison" and "Northwestern" lands.....	24,017 01	
Total expenditures.....		6,307,978 75
Balance of receipts.....		\$2,036,104 31
Deduct dividends paid.....		1,780,000 00
Net surplus, December 31st, 1886.....		\$256,104 31
as shown in statement of assets and liabilities.		

AGENT'S REPORT.

CENTRAL MINE, KEWEENAW CO., MICH.,  
January 1st, 1887.

John Stanton, Esq., Secretary and Treasurer, New York.

DEAR SIR:-The following report of operations at our mine during the year 1886 is respectfully submitted:

GROUND BROKEN.		
Sinking in shafts and winzes 188 feet, average cost.....		\$20 26
Drifting on vein, 979 2-12 feet, average cost.....		9 02
Stoping on vein, 1,781 3-36 superficial fathom, cost.....		13 74
Stoping on vein, 22 cubic fathom, cost.....		18 00
The total amount of ground broken in openings and stopes is 3,000 cubic fathoms.		
PRODUCTION.		
1,172 bbls. stamp copper, weighing.....	1,679,135 lbs	
214 hds barrel copper, weighing.....	689,125 "	
324 masses copper, weighing.....	832,495 "	
Total.....	3,200,755 "	
Or 1,600 755-2000 tons.		
Average yield of mineral per fathom of ground broken.....	1,066 lbs.	
Average yield of ingot per fathom of ground broken.....	842 "	
EXPENDITURE AT MINE.		
The total expenditure for the year is as follows :		
Mining and surface expenses.....	\$140,448 07	
Stamp mill expenses.....	14,032 06	
Taxes.....	3,658 70	
Construction account.....	21,540 05	
	\$178,678 88	
Less rents received.....	4,667 07	
Total expenses.....	\$175,011 81	

SINKING.

No. 2 shaft has been sunk 80 feet to the 27th level. A winze has been sunk just opposite the shaft, from the 26th to the 27th level. We cannot determine the richness of the vein in this winze, as we only broke into it in one or two places while sinking, but where it was broken it showed good copper rock.

DRIFTING.

The 23d level south has been driven 22 feet.

The 24th level south has been driven 28 feet, and opened up some good ground. At present it is poor.

The 25th level has been extended south of No. 2 shaft 162 2-12 feet. The vein has been very changeable, but has opened up some good stopping ground.

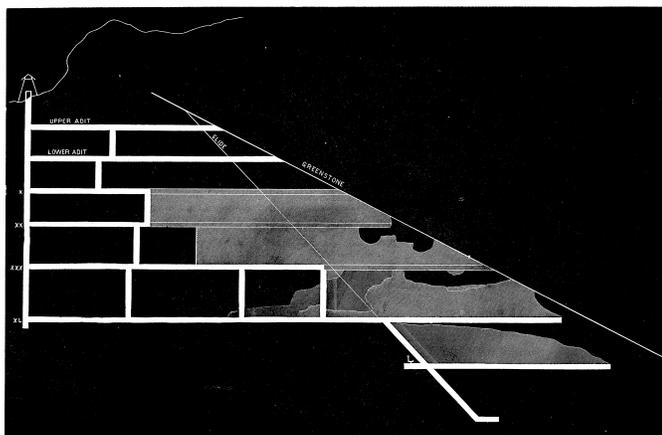
The 26th level has been extended 318 2-12 feet south, and 140 9-12 feet north of No. 2s shaft, and has opened up considerable good copper ground. In the north drift the vein, has proved much better than we expected, the copper chute being about 150 feet in length.

At the 27th level we have drifted 70 feet north and 31 feet south of No 2 shaft. The north drift has exposed a good vein about 2½ feet in thickness, but the south drift is poor.

### STOPING.

Most of the stopes throughout the mine have yielded well the past year. We have considerable ground opened that shows copper, but not deemed rich enough to pay to work at the present low price of copper. The stopes back of the 24th level south have yielded some large and pure masses. We have considerable good stoping ground remaining, and if the bottom level (27th) opens up as expected we shall be in good condition for the ensuing year. On the whole, I should consider the prospects for this year good, if we could realize a reasonable price for copper, say 11 or 12 cents.

LONGITUDINAL SECTION OF THE ST. CLAIR MINE, 1881.  
Scale, 100 ft. to one inch.



### CONSTRUCTION.

We have done considerable construction work the past year. We have built a new stone engine house, 60x60 feet, with a very heavy and strong foundation for our new hoisting machinery, and we are now putting the same in place. I expect to have the new engines in operation about the first of May. We have built a rock cistern back of No. 4 shaft, 8 feet deep, 18 feet wide and 48 feet long, which will not only give us a reserve of water for feed water and fire purposes in dry times, but gives us a head of water 180 feet high. In the mine we have put in a six-inch plunger pump at the 27th level, and have renewed the skip road in No. 2 shaft by putting in 30 pound steel rails. We have also done a large amount of repairing in the inclined shaft. Considerable has also been done in the way of repairing and painting our dwelling houses, which was much needed.

Table showing product of Central Mine—refined copper:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
1856	32	403	1872	623	56
1857			1873	751	1,117
1858	71	1,011	1874	870	900
1859	84	312	1875	733	952
1860	125	1,370	1876	1,080	1,400
1861	70	139	1877		997
1862	133	1,972	1878		945
1863	278	1,548	1879		899
1864	381	1,855	1880	1,013	78
1865	346	1,200	1881		709
1866	574	1,842	1882		676
1867	687	745	1883		634
1868	1,353	1,827	1884		723
1869	903	1,801	1885		1,078
1870	663	1,156	1886		1,256
1871	716	662			886
Total.....				19,447	1,173

John Dunstan, Agent; Samuel Bennett, Mining Captain; J. F. Robert, Clerk.

### THE ST. CLAIR COPPER COMPANY

is not operating. The mine is idle, and the financial affairs of the company are in bad shape. Most of the stock was held by men in the copper region who had faith in the mine and furnished the money. The loss falls somewhat severely on some of them. The mine and the finances were no doubt badly managed. By referring to former reports, a full description of the mine will be found. The map, however, is included here.

### THE COPPER FALLS MINE

is one in which a good deal of interest has been taken for many years. It is situated in the north slope of the range, north of the Central, and was early a fissure vein mine, which produced richly of mass copper. The map herewith given shows the section of old Owl creek fissure vein mine, but it is now chiefly used as an entrance to the ash bed, the belt in which all this mining work is done.

The vein crosses the formation nearly north and south, and the so-called ash bed extends east and west, dipping north at an angle of about 28°, and having a width of about seven feet. It is a soft amygdaloid rock yielding, the portion which is mined and treated, about 7-10 of one per cent of copper. The drawbacks to the Copper Falls mine are want of richness of the rock, narrowness of the belt, and the low angle at which it dips. These are so great that, while the copper is produced with great cheapness, it is still, under the circumstances, with the low price of copper now prevailing, nearly impossible to operate the mine at a profit.

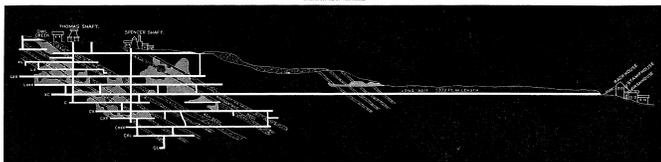
For some years past the company has mined exclusively west of the vein, and the workings extend an extreme distance in this direction of about 1,400 feet, and is opened in depth to the fourteenth level, five levels below the adit, the avenue through which all the copper finds its way out of the mine.

The method by which the mine is worked is fully explained in my last report, and there has been no change, except that now much of the rock is brought down from the stopes in cars, which run on suspended wire ropes. They are so arranged that two of these tracks, each running to a different shute, extend from the same stope, or are connected so as to operate together. On the one the loaded car going down, draws up an empty car on the other. This arrangement facilitates getting the dirt down the foot wall very materially. I watched the working of it, and saw no hitch or delay in the movements.

I have been through the mine almost annually for the past seven or eight years, and I never saw it look better than it does now. It is more extensively opened than I have ever found it before, and it seems that there is more rich ground; but perhaps this is only an impression that one receives on account of seeing more of it. Between the underground shafts Nos. 1 and 2, all the way is good ground. The bottom, the thirteenth and fourteenth levels, look well. I never saw better ground in the ash bed.

Capt. Moyle's plan is to get the mine largely opened, so there shall be stoping ground sufficient to enable them to operate four heads of stamps. The mill has been enlarged, and provided with two new stamp heads, the improved Bell, that are second to none in the country. These two large heads are the only ones now operated. They will stamp 450 tons per day. The rock is yielding 17 lbs of copper to the ton. In 1885 the average yield was but 13 lbs. Capt. Moyle thinks he can furnish equally good rock in quantity sufficient for the four heads.

LONGITUDINAL SECTION OF THE COPPER FALLS MINE THROUGH THE OWL CREEK VEIN, JAN., 1875.  
FROM THE MINE OFFICE.



The former agent, Mr. B. F. Emerson, long and favorably known in the copper region, met with a fatal injury at the mine in August last, and he has been succeeded by Capt. J. H. Moyle, who has been in charge since October, 1886. Capt. Moyle was mining captain at the Copper Falls ten years ago, so that he is only returning to familiar ground.

The total expenditures to date have been ..... \$3,047,823  
 The total mining expenses for the year 1886 were ..... 113,534 73  
 The total number of tons of rock stamped were 122,410; the  
 total stamp mill expenses were ..... 38,979 23  
 Making the stamp mill cost per ton of rock ..... 3 18

This is certainly very low, considering that the water has all to be pumped, the cost of which work is five cents per ton.

Since I visited the mine it has been decided to shut down the mill, and the company is only doing opening work in the mine.

The officers of the company are the same as heretofore, with the exception of the local agent, who is now J. H. Moyle.

President, David Nevins, 19 Exchange Place, Boston.

The mind has yielded as follows:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
Previous to 1855.....	158				
1855.....	100		1871.....	239	883
1856.....	104	10	1872.....	260	802
1857.....	153	1,305	1873.....	643	540
1858.....	151	1,852	1874.....	535	359
1859.....	173	174	1875.....	203	1,587
1860.....	255	818	1876.....	8	1,488
1861.....	280	11	1877.....	5	1,950
1862.....	299	299	1878.....	5	1,790
1863.....	159	1,348	1879.....		
1864.....	179	808	1880.....	3	645
1865.....	235		1881.....	334	1,121
1866.....	568	1,169	1882.....	293	1,500
1867.....	1,128	1,485	1883.....	402	
1868.....	239	1,384	1884.....	445	1,168
1869.....	345	1,400	1885.....	375	538
1870.....	386	990	1886.....	689	679
Total.....				9,495	133

## THE PHOENIX COPPER COMPANY

has ceased to operate. The mine has passed to the ownership of the bondholders. Mr. J. H. Chandler, of Houghton, Michigan, is the agent of the present owners. There is no reason to rate the property any lower now than heretofore. It has undoubtedly been unfortunately managed.

The mine has not been worked for a year on company account. Some copper is obtained by tributaries. In previous reports I have fully described the mine and all matters pertaining to its previous record. No doubt the mine will at some time be again in a prosperous condition.

The following table shows the product:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
Previous to 1855.....	19		1871.....	609	1,800
1855.....	3		1872.....	364	47
1856.....	8		1873.....	260	1,600
1857.....	17		1874.....	619	
1858.....			1875.....	702	
1859.....	28	590	1876.....	698	900
1860.....	20	62	1877.....	511	
1861.....	34	790	1878.....	150	
1862.....	31	1,560	1879.....	272	
1863.....	72	118	1880.....	218	
1864.....	142	187	1881.....	204	1,357
1865.....	202	1,000	1882.....	268	1,177
1866.....	206		1883.....	256	291
1867.....	155	115	1884.....	310	1,004
1868.....	130		1885.....	183	1,108
1869.....	398	930	1886.....	50	1,804
1870.....	499	1,040			
Total.....				7,724	542

## THE CLIFF COPPER MINING CO.

The mine is not worked, but a couple of gentlemen who are familiar with the situation have secured a quantity of wood with the intention of running the stamp mill and washers on the waste sands at the mine. They have found by testing the matter that these tailings hold a sufficient amount of copper to pay for re-washing.

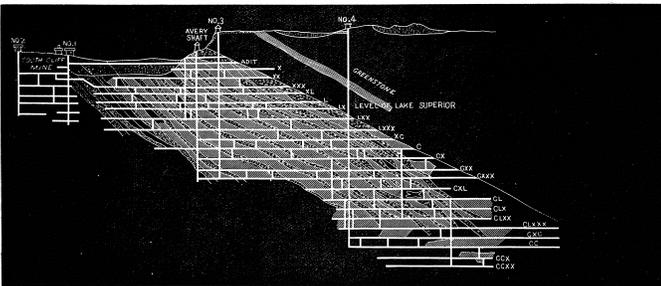
But owing to the continued low price of copper this plan has not been pursued and the mine is idle.

The Cliff has produced as follows:

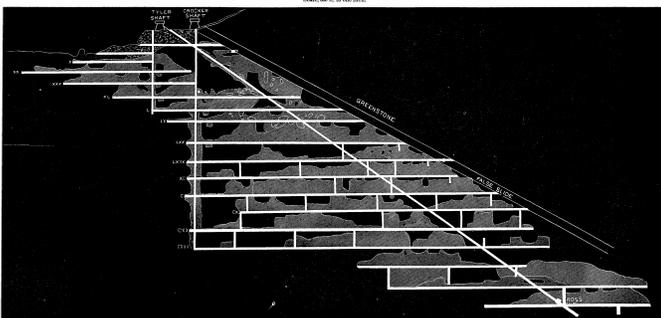
Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
Prior to 1855 .....	3,400				
1855 .....	937	197	1871 .....	71	238
1856 .....	1,110	934	1872 .....	59	386
1857 .....	1,118	850	1873 .....	357	1,203
1858 .....	1,130	433	1874 .....	527	901
1859 .....	707	1,007	1875 .....	581	873
1860 .....	921	1,303	1876 .....	450	146
1861 .....	964	11	1877 .....	80	1,319
1862 .....	1,002	900	1878 .....	207	415
1863 .....	1,050	354	1879 .....	67	336
1864 .....	675	1,334	1880 .....	30	962
1865 .....	747	626	1881 .....	39	1,382
1866 .....	821	428	1882 .....	33	53
1867 .....	560	1,725	1883 .....	5	374
1868 .....	613	746	1884 .....	14	255
1869 .....	362	1,247	1885 .....	4	332
1870 .....	222	381	1886 .....	11	342
<b>Total.....</b>				<b>19,064</b>	<b>1,643</b>

D. D. Brockway, Agt., Phœnix, Mich.

LONGITUDINAL SECTION OF THE CLIFF MINE, 1887.  
Scale, 600 ft. to one inch.



LONGITUDINAL SECTION OF THE PHOENIX MINE, 1887.  
Scale, 600 ft. to one inch.



## THE ALLOUEZ MINE

is still worked on tribute by Messrs. Watson & Wall, though they do not find the profit sufficiently great to induce them to push things very much. On the contrary the tendency is to circumscribe the operations. They have recently ceased to hoist in No. 1 and in No. 3

shafts, and in the ensuing year they will only stope in the vicinity of No. 2. shaft.

Last summer the stock took a slight boom, owing to the finding of some rich ground in the 16th level, 250 feet from No. 2 shaft. It was rumored that they had found the Calumet and Hecla lode. The ground did not hold rich going up, but the indications seem to afford assurance that this rich "shoot of copper" will continue on down.

Mr. Fred Smith, the company's gentlemanly and efficient agent, continues to reside at the mine and superintend the affairs of the corporation.

The force employed consists of 36 miners, 36 trammers, 8 block holers, 3 timbermen and 3 helpers; 9 power drills are operated. The mine has been fully described in previous reports.

### ALLOUEZ MINE REPORT.

The directors present the following summary of the operations at the mine, and of the business of the company during the year 1886.

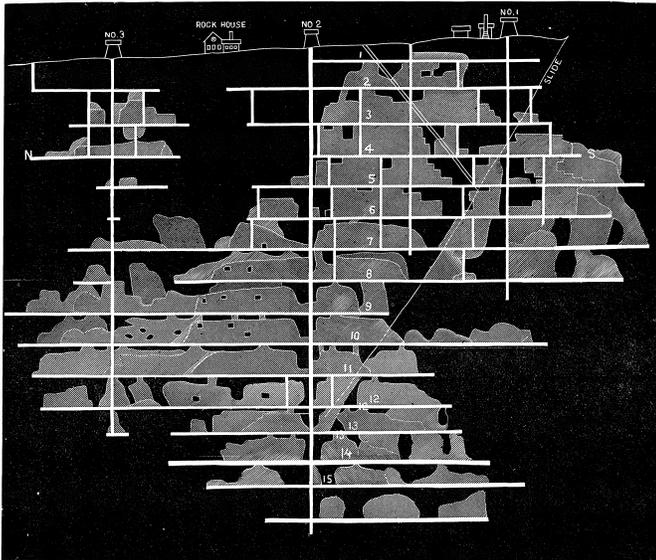
The lessees of the mines stamped 116,612 tons of rock, which yielded 1,725,463 pounds refined copper, or an average yield of 14 3-10 pounds per ton of rock stamped. The royalty received by the company was one-tenth of the copper produced, or 172,545 pounds ingot copper, and the following statement shows the receipts and expenditures for the year:

RECEIPTS.	
Copper sold.....	125,973 lbs. average 10.93 cents..... \$13,776 74
Copper in New York and at smelting works.....	46,572 lbs. valued at 10c. net..... 4,667 20
	172,545 lbs. \$18,433 94
Interest account.....	464 65
	<b>\$18,898 59</b>

EXPENDITURE.	
<i>At Mine.</i>	
Taxes on personal property.....	\$273 83
Insurance on buildings and machinery.....	1,447 50
Surveying mine.....	31 00
Canal tolls on copper.....	12 48
Copper barrels.....	268 80
Legal expenses.....	150 00
Agent's salary and other expenses.....	1,706 10
	<b>\$3,889 71</b>
<i>In New York.</i>	
Freight and other charges on copper.....	\$704 18
New York State tax.....	12 00
Office and other expenses.....	1,150 68
	<b>1,866 86</b>
Total running expenses.....	<b>\$5,756 57</b>

<i>Add other payments, viz.:</i>	
State of Michigan, tax on copper of 1885, due July, 1886.....	336 95
St. Mary's Mineral Land Co., in final settlement of claim for trespass pending for several years.....	849 84
Machinery account, paid for Knowles' pump.....	375 00
Rent of water privileges for 1885.....	265 00
	<b>\$7,640 36</b>
Net gain in 1886.....	<b>\$11,238 23</b>
Add balance of assets, December 31, 1885.....	<b>48,612 66</b>
Net surplus, December 31, 1886.....	<b>\$59,870 8</b>

LONGITUDINAL SECTION OF THE ALLOUEZ MINE, JAN., 1887.  
Scale, 80 ft. to one inch.



STATEMENT OF ASSETS AND LIABILITIES, DECEMBER 31, 1886.

<i>Assets.</i>	
Cash in bank.....	\$6,337 64
Deposits in trust companies.....	30,000 00
Copper on hand, 46,572 lbs., at 10 cents net.....	4,657 20
Accounts receivable.....	916 23
	\$41,911 07
<i>At Mine.</i>	
Cash in bank.....	\$1,090 75
Supplies.....	9,192 81
Standing wood and timber, not on company's lands.....	7,602 68
Accounts receivable.....	166 07
	18,054 41
	\$59,965 48
<i>Liabilities.</i>	
Accounts payable.....	92 59
Net surplus.....	\$59,870 89

By order of the directors,  
JOHN STANTON, Treasurer.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1869.....	1	1,575	1880.....	658	471
1873.....	10	1,163	1881.....	736	1,007
1874.....	504	130	1882.....	841	1,557
1875.....	692	1,574	1883.....	875	1,337
1876.....	780	1,785	1884.....	964	174
1877.....	650	479	1885.....	1,085	476
1878.....	565	1,146	1886.....	862	1,468
1879.....	715	1,452			
Total.....				9,946	1,723

## KEARSARGE MINING COMPANY.

The company has existed for some years, but until the past year has never done much work. A few years ago some parties had the mine on option, but finally gave it up after working a while. The mine is just north of the Wolverine, in the S. ½ Sec. 6, T. 56 N., Range 32. In point of fact, the company owns here a rectangular area, consisting of 520 acres, 1¼ miles east and west, and one half mile north and south.

The Kearsarge amygdaloid, in which the exploring is done, is an irregular, pockety, epidote lode. There are two shafts, 400 feet apart, which have been sunk to the third level, and are connected in the second. No. 1 shaft

is now, March 1, 350 feet deep, and No. 2 shaft is 300 feet.

The levels are 100 feet apart, after the first one, which is, at No. 1 shaft, 150 feet below the surface, and at No. 2 shaft 100 feet, there being fifty feet difference in surface level at the shafts.

The stock is divided into 50,000 shares, par value \$25.

The work done in past year is shown by following financial statement:

Sunk No. 1 shaft 230 feet, at cost of \$11.65.....	\$2,563 85
Sunk No. 2 shaft 191 at cost of \$12.64.....	2,356 15
Total.....	\$4,920 00
Total amount drifting 216 feet, cost.....	1,621 20
Total amount forks cut, cost.....	179 00
Total.....	\$6,720 25
No. of days worked, 2,137; average No. of men, 12.....	
Sinking 41' shaft, cost.....	\$11.71 per foot.
Drifting 231 1-10 feet, cost.....	7.00 per foot.
Total days, 5,417; average men per month, 26.....	
Overseer.....	\$248 00
Surveyor.....	208 45
Smith, machinist, carpenters.....	824 86
Engineers.....	987 15
Timbermen.....	1,091 27
Landers, laborers, teamsters, etc.....	1,957 78
	\$5,319 51
No. days worked, 3,280.....	
Supplies.....	4 452 03
Total.....	\$16,267 69
Less sundry credits.....	29 50
Making net total.....	16,462 79
Surface expenses, net total.....	2,721 29
Total No. of days 1,037; average No. men per month, 5.....	
Incidental expenses, total.....	745 12
Total number of days' work, 208; average number of men, 1.....	
Construction account, total cost.....	13,902 21
Total days, 2,010; average No. men per month, 10.....	
Total running expenses—mining and construction. Mining expense, days, 5,417.....	\$16,462 79
Surface expense, days, 1,037.....	27,212 29
Incidental expense, days, 208.....	745 12
Construction, days, 2,010.....	13,902 21
Total.....	\$33,851 41
No. of days, 8,672; average No. men per month, 39.....	
Supply account: Purchased.....	16,290 04
Labor.....	83 42
Credits.....	13,836 61
Balance.....	2,336 85
Fuel.....	1,969 49
Treasurer's account: By drafts.....	29,866 27
Received from treasurer.....	29,866 27
Received from other sources.....	1,718 58
	\$31,564 85

Mr. Frank Klepteko, the company's engineer, tells me that the distance from No. 3 pit, measured at right angles to the Kearsarge lode, to the Calumet and Hecla Conglomerate, is 2,850 feet west.

J. W. Clark, President; John Daniel, Agent; Capt. Haskins, Supt.

## THE WOLVERINE MINING CO.

The Wolverine mine was worked on tribute for two years after the failure of the company by Messrs. Funkey & Wilcox. At present, however, the mine is wholly idle. The question of the title to the land is in dispute and the legal ownership is yet to be determined.

John Wall, Allouez, Mich., now exercises control of the property.

The mine was opened in 1883 and has yielded a total of 989 tons, 1,378 lbs,

## THE CENTENNIAL MINING CO.

The Centennial mine, although idle, is a property regarded with considerable interest because of its situation. It joins the Calumet & Hecla on the north and the ground in the bottom of the Calumet shaft nearest to the boundary is proving rich in copper, suggesting the possibility that the same "shoot," or others north of it, may be found under the surface at the Centennial. The company owns in fee the S.  $\frac{1}{2}$  of Sec. 12, 56, 33, and has an option for the purchase of the N.  $\frac{1}{2}$ , thus making a mile square. The property is crossed by all the prominent lodes in the country and there is pretty good evidence to assume that they here possess richness enough to at least pay well for working. Provided with the facilities that other larger mines now have and worked on the same extensive plan, the Centennial would show favorable results.

The original company was organized in 1863 and opened in the Calumet & Hecla conglomerate. Several shafts were sunk, No. 2 to 2d level, No. 3 shaft to the 4th level, No. 5 to 4th level and No. 1 only to the ledge.

The ground between Nos. 3 and 4 shafts was nearly all stoped out, and in the second level, 400 feet N. of No. 4 shaft, good copper ground was found, it is said. These shafts are 650 feet apart, No. 4 being north of the others.

Judging from the map there appears to be a shoot of copper starting at No. 3 shaft, near the top, and at the bottom is 200 feet north of the shaft. The shoot has a lateral dimension in the direction of the strike of the lode of 300 feet, No. 3 shaft is 430 feet deep and No. 4 500. The rock at the burrows shows the character of the conglomerate of which more is known now than when the Schoolcraft was worked 20 years ago. A test pit was sunk 350 feet north of No. 4 shaft, into the ground. It is said a good showing of copper was found, but they were driven out by the excess of water. Also the drift in the second level from No. 4 shaft goes under this and the ground was found to be good.

Capt. Hall's plan is to sink No. 3 shaft to an indefinite depth and explore the ground. The hope would be to cut some shoots or pockets of conglomerate that are rich in copper.

More recently some work was done in the Osceola amygdaloid, two shafts were sunk 650 ft. apart and No. 1, the north shaft, 200 feet to the second level. No. 2 was sunk 500 feet to the fifth level. The shafts were connected in the second level.

In the third level they drifted north 300 feet and south 200 feet. In the fourth level in No. 2 the drift north is 150 feet and south 100 feet. The best ground was found in the vicinity of No. 1.

I saw this ground when they were working in it in 1881 and thought it as good as the Osceola.

The Osceola amygdaloid is 802 feet east of the conglomerate, surface measurement. At the Osceola mine the distance between the belts is 760 feet.

Distance between the Allouez and the Calumet and Hecla Conglomerates is 2,125 to 2,140 feet varying at different points.

At the mine is good machinery, hoisting engines, etc., also a Rand's duplex compressor of same size as in use at Osceola. The company has all the machinery requisite for a thorough exploration of the property.

President, S. L. Smith, Lansing, Mich; Josiah Hall, Supt., Calumet, Mich.

## THE CALUMET & HECLA CO.

is constantly increasing its facilities for enlarging its output of copper. At present more is doing in this direction than at any period heretofore. The company is prepared to hoist far more rock than formerly and the capacity of the stamp mills has been increased in the requisite degree to dispose of the additional rock. The stamps are all now Leavitt heads, seven in the Hecla mill and five in the Calumet; three more are to be added in 1887, which will make 15 in all. The gravity incline at the stamp mills has been done away with and the railroad tracks run now to the rock bins. The bins have been sufficiently elevated to secure automatic feed to the stamps. The grade from the mill up is 185 feet to the mile. The line describes a letter S. Two additional locomotives have been supplied to work on this grade, they weigh respectively 55 and 60 tons on the driving wheels, 90 tons including tender. The boilers—new steel boilers—to supply the steam for all the machinery at the stamp mills are all in the new stone boiler house.

The smelting works, situated about a mile from the stamp mills, are nearly completed. The buildings are of stone, brick and iron as well as wood, and are of the most substantial character. The arrangements are admirable for doing the smelting work economically and expeditiously. There is nothing of the kind in the country better for such work than the facilities they have for storing and unloading coal. The coal is elevated from the holds of the vessels up to the cars on the tracks that extend into the building. The cars work automatically; in fact it is known as Hunt's automatic railway—Hunt's automatic system for unloading coal vessels. These smelting works are designed to be equal to the present product of the mine and more furnaces will be added as occasion requires.

At the mine the company has been trimming and enlarging the shafts with the view of using larger skips. At the time of my visit to the mine these new skips had already arrived; they hold six tons of rock each, when trimmed. They will not dump at the shaft but will be ran to the rock house before discharging the contents. A new rock house will be built the coming year. At the Hecla mine two of the shafts will soon be provided, each with a separate hoisting plant that will bring the skips from the bottom at greater speed than is now done.

The Hecla hoisting engine will be used in driving air compressors. It is contemplated that possibly the plan of

erecting a separate hoisting plant at each shaft may be adopted for all the shafts of the mine; in which case the "Superior"—the great hoisting engine on the Calumet side, will be used to drive air compressors. It will not be removed from its present location.

They are hoisting now from 11 shafts, the two deepest of which are to the 38th level; the others are at from the 33d to the 37th, except the two South Hecla shafts, which are down one to the 11th and the other to the 12th level. No. 12 shaft—a new one—is at the 9th level.

They now leave pillars on each side of the shafts in each level 50 feet long. Capt. Hoatson is of the opinion that the shaft pillars heretofore left, of 25 feet long, are insufficient; as the ground settles, the shafts grow smaller and have to be trimmed.

The lode is from six feet to 18 feet wide and has a bad hanging wall, much of it, and has to be kept in place with timbers. They are now using short sets instead of long round stall timbers. The former are more easily handled.

The company employs underground an average of 1,100 men and a total force of 2,600.

The No. of tons of rock stamped in 1886 was 598,522 tons.

No. of tons of barrel work, i. e., of copper not run through the stamps, 602¼ tons.

In this connection the following table is of interest:

Year.	Tons of Rock Stamped.	Yield Per Cent. of Ingot Copper.	Year.	Tons of Rock Stamped.	Yields Per Cent of Ingot Copper.
1875.....	249,704	4.3	1881.....	340,080	4.61
1876.....	236,935	4.37	1882.....	344,132	4.59
1877.....	247,935	4.55	1883.....	372,570	4.45
1878.....	271,000	4.66	1884.....	435,352	4.63
1879.....	284,715	4.61	1885.....	535,820	4.32
1880.....	334,343	4.75	1886.....	598,522	4.22

The company returned to the shareholders in 1886 \$15 per share, making a total to date of \$30,050,000.

Table of product of Calumet & Hecla mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1867.....	657	1,173	1877.....	11,284	468
1868.....	2,549	375	1878.....	12,625	1,128
1869.....	6,157	1,771	1879.....	13,135	943
1870.....	7,630	1,584	1880.....	15,837	1,239
1871.....	8,111	590	1881.....	15,680	781
1872.....	8,981	183	1882.....	16,026	1,528
1873.....	9,424	265	1883.....	16,562	1,045
1874.....	10,062	1,235	1884.....	20,236	1,585
1875.....	10,736	1,954	1885.....	23,623	1,900
1876.....	10,845	732	1886.....	25,259	220
Total.....				243,948	1,437

Mr. J. N. Wright, General Superintendent, Calumet, Mich.; Alex. Agassiz, President, Boston, Mass.

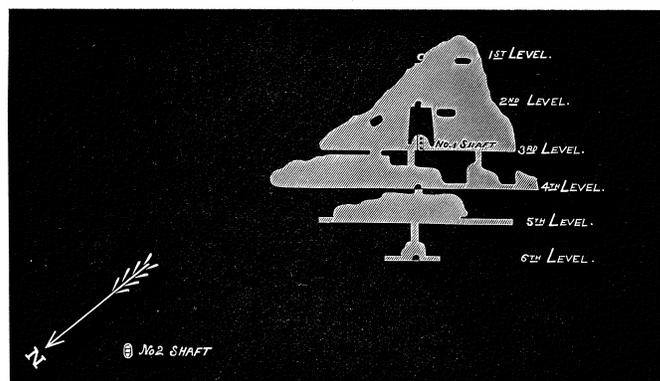
## THE TAMARACK MINING COMPANY

gives continued evidence of progressive mining spirit. The No. 2 shaft has been located and is already several

hundred feet in depth on its way down into the earth. The third section of No. 1 shaft has been completed, provided with a cage that goes to the bottom, and with a separate hoisting plant to operate it, which is placed in a brick building, standing at some distance from the other engine house. It is called the emigrant cage, and is used exclusively for men and for timber.

The railroad is fully completed and operated, and the new stamp mill is also finished and ready to operate. It is not far from the Osceola mill, and is, as would be naturally inferred, one of the best in the region.

LONGITUDINAL SECTION OF THE TAMARACK MINE, JAN., 1887.  
Scale 300 ft. to one inch.



There are two heads of stamps now, with place for the third. They are similar to the new heads at Copper Falls mine, and cost each in Milwaukee, \$5,600. The two have a capacity of 450 tons of rock per day; 18" cylinders. Outside, the foundations are laid for two more heads, five in all, when the mine is sufficiently opened to furnish the rock, 1,000 tons per day.

In the Tamarack mill, as also in the Osceola, the railroad track passes through, and is connected with the main line both ways. There is sand room in the lake, it is estimated, sufficient for 14 years, 1,000 tons per day.

More recently the company, or the same gentlemen who control the Tamarack and Osceola companies, have begun the task of erecting smelting works, also on Torch Lake, not far from the stamp mills.

The mine underground is shown on the accompanying plan. In going through it I find it dry and airy. There is a no more comfortable mine in the country to work in than the Tamarack. There are no evidences of "shoots." There is good ground and poor all through the mine; but very little if any, however, that would be designated as valueless. Some portions of rock are rejected in the rock house, and some sandstone, also, occurring in the deposit, is broken down with the good rock, but is sorted out and left in the mine.

The dip is about 38°. No. 1 shaft is now, April 1, 2,495 feet deep, and No. 2 is 490 feet. The levels are not the same distance apart, but average 82 feet on the lay of the deposit. The collar of No. 1 is 640 feet above Lake Superior. From the bottom of the shaft to the seventh level is 333 feet, and the vertical distance is 205 feet, giving for the angle a dip of 37½°. No. 2 will intersect

the lode at about the eighth level, when they will have a working length of lode of 1,340 feet. The first level is 215 feet long; second, 210 feet; third, 575 feet; fourth, 725 feet; fifth, 865 feet; sixth, 1,020 feet; seventh, 1,170 feet.

They operate 17 to 19 drills now. The compressor has a capacity of 30. The machinery for No. B cage is a Corliss engine, conical drum, 10 feet diameter at small end, and 18' diameter at large end; holds 350 feet of rope.

The following is from the Director's report:

We have proved that our lode is identical with the Calumet and Hecla, in all respects, and on the whole, as rich.

We have demonstrated the fact that depth is no hindrance to cheap mining. On the contrary, we have shown from the result of steady work day in and day out for months, that more than five times the amount of rock can be hoisted through a vertical shaft than through one of like dimensions sunk on the plane of a lode, as is the custom of copper mining elsewhere on Lake Superior. This result would not have been accomplished had not our machinery and appliances been of the very best.

Our openings on the lode are still very limited, and can be extended to meet our wants only by almost unlimited patience and energy, for it will be readily seen that our opportunities for the speedy opening up and development of the lode are necessarily restricted, for the reason of having but one shaft from which to run our levels and cross-cuts.

It will be remembered that the *surface* of our productive property is over 2,200 feet in the bowels of the earth, with only a single opening to the light of day.

Proving the productiveness of the Calumet and Hecla lode to this great depth, gives it a value almost beyond computation, contingent only, it would seem, on the future value of copper. On this point we shall have no misgivings while the present extended use and consequent increased consumption all over the world continue. It will not be forgotten or overlooked by our stockholders that this vast inheritance falls ultimately into the possession of Tamarack, for surely and legitimately every one of the eleven northern shafts of the Calumet and Hecla mine falls by its natural inclination or "dip" into our property, and it is a well known geological fact that every lode or bed, whether conglomerate amygdaloid, or anything else, follows this universal law of "dip." We have met a good deal of hostility, and have overcome obstacles which have cost considerable money and delay, but perhaps not more than was to be expected in an enterprise which, if successfully accomplished, could not fail to have an important influence and bearing on the future of our neighbors.

On reviewing our work from the start, it would be difficult to point out serious error in judgment. We believe our work has been accomplished as expeditiously as due regard to economy would warrant. The treasurer's account will show our financial condition.

It would probably have been wiser to have called an assessment last autumn, thus adding, say \$200,000, to our active capital. That this sum, and more, would be needed to cover the cost of the new mill with the heavy machinery and mining equipment to put it in operation, was as well known then as it is to-day. To re-imburse for these heavy outlays from current production of copper at present reduced prices, was a trial of strength never before put upon any similar

enterprise on the lake, or elsewhere, as far as we have been informed.

A considerable advance in ingot copper was anticipated, but instead of this we have had to meet the most serious decline that has been known for many years, reducing the price both here and in Europe to less than ten cents a pound, the lowest quotations ever recorded in the history of copper mining. Still, we are firmly of the opinion that the results of this radical change will not prove wholly disastrous in the future. The price of copper, like coffee or other merchandise, will be governed by quotations from the leading markets of the world, and as soon as we, in the United States, become the largest consumers, as we are already the greatest producers, then by fair reasoning we may expect that New York, and not London, will lead in giving quotations for the various markets of the world. Under our heavy tariff of four cents a pound, we have made our domestic consumer pay two or three cents more than his foreign competitor. The effect and influence of our tariff will not be so largely felt in the future while we continue to be large exporters and not importers. Lake Superior, it is well known, is the best copper produced. It is worth, to-day, in Liverpool or in France, fully four pounds sterling a ton more than Chile bars, which are the recognized standard for quotations.

ASSETS AND LIABILITIES.	
Cash in bank at Boston.....	\$3,977 02
Suspense account—stamp mill site.....	833 80
Hancock & Calumet R. R. Co. 6 per cent bonds.....	57,000 00
Assessment No. 1.....	108 00
Supplies on hand at mine.....	23,883 87
Cash on hand at mine.....	169 23
Accounts receivable at mine.....	594 17
Wood and timber land.....	14,832 00
Balance due on 350 shares H. & C. R. R. stock.....	28,000 00
Copper on hand, 1,900,571 pounds, at 10 cents.....	190,217 10
Total cash assets.....	\$324,584 19
<i>Liabilities.</i>	
Drafts outstanding.....	\$28,427 70
Accounts payable at mine.....	52,356 95
Bills payable.....	108,200 00
Loan account.....	35,000 00
Total liabilities.....	223,984 65
Balance of cash assets July 1, 1886.....	\$100,599 54

STATEMENT OF RECEIPTS AND EXPENSES OF ALL KINDS, 1882 TO JULY 1, 1886.	
<i>Receipts.</i>	
From capital stock, 50,000 shares, \$13 a share paid in.....	\$650,000 00
“ 363 lbs. copper produced 1882, at 18.....	865 34
“ 7,435 “ “ “ 1883, at 14.71.....	1,093 37
“ 1,979,400 “ “ “ 1885-6, at 10.05.....	1,98,944 56
From 1,987,198 lbs. copper produced at mine.....	200,103 27
From interest receipts, 1882.....	\$832 83
“ “ “ 1883.....	592 44
“ “ “ 1884.....	1,656 19
“ “ “ 1885 (6 months).....	506 92
“ “ “ 1885-6.....	2,581 12
From 350 shares Calumet R. R. Co.'s stock.....	6,169 50
	35,000 00
Total receipts.....	\$851,272 77
<i>Expenses.</i>	
Running expenses prior to July 1, 1885.....	\$147,574 62
Running expenses during 1885-6.....	160,464 94
	\$308,039 56
Construction expenses prior to July 1, 1885.....	56,761 03
Construction expenses during 1885-6.....	95,872 64
	152,633 67
Real estate.....	330,000 00
Total expenses.....	790,673 23
Balance of receipts July 1, 1886.....	\$100,599 54

DETAILS OF MINING EXPENSE.

*Underground Expense*

Shaft sinking, 85.10 feet at \$45.67.....	\$3,587 09	
Winze sinking, 404.20 feet at \$12.90.....	5,217 70	
Drifts, 976.14 feet at \$10.33.....	10,090 06	
Cross-cuts, 237.20 feet at \$8.23.....	1,953 12	
Stoping, 1,822.46 feet at \$13.32.....	24,372 95	
Tramming.....	7,022 86	
Timbering, labor, materials and supplies.....	14,074 13	
Extra work.....	2,259 51	
Supplies, labor, fuel, etc., for air drills.....	10,499 62	
Supplies, fuel, and labor for engines.....	12,972 64	
Mining superintendence and company account labor.....	8,077 27	
Blacksmith, machinist, and carpenter labor.....	2,831 64	
	\$103,258 59	
Less profit on supplies.....	7,257 90	\$96,000 69

*Other Expenses.*

Rock-house.....	\$3,300 08	
Surface labor, supplies, etc.....	1,602 32	
Office labor, supplies, etc.....	7,107 76	
Transportation.....	7,387 32	
Stamping.....	28,903 20	\$48,300 68
Total running expense.....		\$144,301 37

*Construction Costs.*

Number 1 auxiliary engine.....	\$1,933 89	
Number 2 shaft and equipment.....	7,964 23	
Electric light plant.....	3,291 93	
Rock-house.....	13,113 77	
Change or dry-house.....	2,003 91	
Dwellings.....	13,884 28	
Compressor.....	10,375 75	
Machine shop.....	5,017 80	
Carpenter shop.....	371 46	
Blacksmith shop.....	329 10	
Office.....	1,086 51	
Number 1 engine and shaft equipment.....	28,896 22	
Third compartment, Number 1 shaft.....	3,318 04	
Stamp mill, dwellings, etc.....	4,265 75	
Total construction costs.....	95,872 46	
Total expended at mine.....		\$240,174 01

*Summary.*

Rock stamped.....	36,129 tons.	
Product of mineral.....	2,638,020 lbs.	
Product of refined copper.....	1,979,400 lbs.	
Yield of refined copper per cubic fathom of ground broken.....	923 lbs.	
Yield of mineral per cubic fathom of ground broken.....	1,230 lbs.	
Percentage of mineral in stamp rock.....	3.650	
Percentage of refined copper in stamp rock.....	2.738	
Refined copper, cost per pound at mine.....	5.895 cts.	
Cost of smelting, freight, commission, and Boston expense.....	1.599 cts.	
Total cost per pound of refined copper laid down in New York and sold.....	7.494 cts.	

I have given in previous reports full details of the sinking of the Tamarack shaft and of other matters pertaining to the mine. So far the per cent, of copper in the rock is less than obtained in the same lode by the Calumet & Hecla, but probably it will in time afford an equal yield.

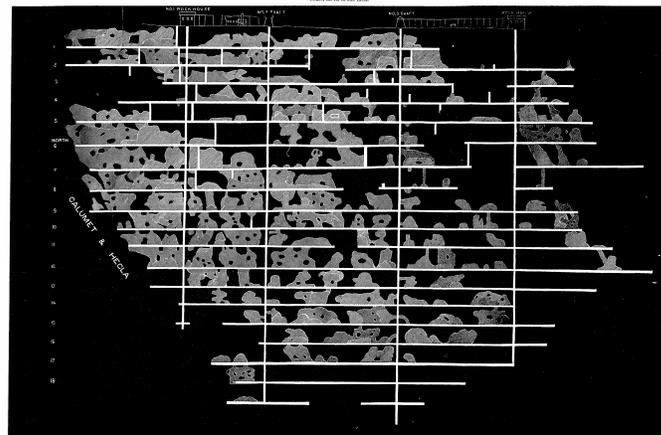
J. W. Clark, Prest., Boston; A. S. Bigelow, Sec. and Treas., Boston; John Danville, Agt.; J. B. Quick, Mining Captain.

**THE OSCEOLA MINING CO.**

The Osceola is on her feet again and is pursuing the even tenor of her way as of olds with equally good results.

It now has the stamp mill again all to itself, two of the stamps having been used by the Tamarack until now. Since that mine began to produce copper. It will be seen by examining the map printed herewith that the mine is extensively opened.

LONGITUDINAL SECTION OF THE OSCEOLA MINE IN THE AMYGDALOID BELT, JAN., 1887.  
Scale 50 ft. to an inch.



They push the work at the Osceola and keep the mine well in advance of all demands that can be made upon it.

There is no better place to study good mining work than at the Osceola. It is noted for clear headed, progressive, energetic management.

The stock of the Osceola took an astonishing rise in the summer of 1886, going up from about \$14 per share to \$32, and remaining at about \$28 to \$30, which price it still holds now with copper at 10c. per lb

This rise is due to a possible result in the conglomerate. It was found that in the South Hecla—Black Hills—mine the drifts south in the direction of the Osceola were proving rich in copper. This is below the depth at which the conglomerate was worked in the Osceola mine.

To determine whether the Osceola holds any further mineral wealth in the Calumet and Hecla conglomerate a drift has been started to intersect it from the amygdaloid mine.

The location of this drift is from the 16th level, south of No. 2 shaft, 1,450 feet below the surface on the lay of the formation, or 526 feet below the deepest point in the old workings. Its length will be 775 feet.

The distance from the point where this cross-cut will cut the conglomerate to No. 3 conglomerate shaft is 550 feet.

In the old conglomerate mine, the first mine worked in the Osceola, are three shafts, intact.

No. 12 shaft of the Calumet & Hecla is down to the 11th level and they have gone south to within a few hundred feet of the Osceola boundary. The copper holds good so that it is deemed to be strongly probable that this copper ground continues into the Osceola. The cross-cut will be completed in August of the present year.

I have described the mine so fully in previous reports that it could not be otherwise than repetition to enter into a more lengthy statement here. Capt. Daniell kindly gavs me leave of copying from the company's report all the items I wished, and I have availed myself so far of the privilege as to extract all that is not embraced in the company's printed report.

OSCEOLA MINE REPORT.

The directors present the following report of the operations for the past year, and statement of the financial condition of the company:

The product of mineral was 4,133,345 pounds, which at 86.14 per cent, gave 3,560,786 pounds of refined copper, for which has been realized the gross sum of.....	\$374,144 13
From interest receipts.....	206 01
From sale of building lots at Hancock.....	240 00
From sales of silver.....	1,308 93
	<u>\$975,899 07</u>

The costs have been:—

Running expenses at mine.....	\$262,068 44
Smelting, transportation, and all other expenses.....	46,598 19
	<u>\$308,666 63</u>
Showing a mining profit of.....	\$67,332 44
There has also been realized from 300 shares of Hancock & Calumet R. R. stock.....	36,000 00
The balance of assets January 1, 1886 was.....	\$102,281 60
Add 250 shares Hancock & Calumet R. R. stock.....	25,000 00
	<u>\$127,281 60</u>
There has been expended in mine plant during the year.....	4,772 05
	<u>122,509 55</u>
Making the balance of assets January 1, 1887.....	<u>\$225,741 09</u>

A dividend of \$1 per share, or \$50,000, payable February 15, has been declared from, the earnings of the past year.

The superintendent's report, herewith submitted, is regarded by the directors as highly promising. Although the developments during the year show nothing of striking character, a gradual but decided improvement is observed as the shafts and levels are extended and opened up in depth and in the south. While we do not anticipate such results as have been realized in the neighboring conglomerate lodes, we feel assured that there are well grounded reasons for hoping and expecting a better outcome than we have seen in the past few years. Our territory is extensive on the south, and as the best results are realized in that direction, we see no good reason why we may not look for reasonable returns in dividends from the amygdaloid lode, just as it is, with its regular and legitimate extension south and in depth. The mine is more extensively opened and is stronger and richer in its resources than at any former period of its history. The amount of money actually invested in underground openings, while the mill was in process of rebuilding, aggregates nearly \$50,000, and all of it was taken from our surplus fund.

There is little doubt that this is a better investment than if we had the money to our credit in bank to-day.

There was quite a boom on the street in our stock a few months back, growing out of the developments in the neighboring mine, and great results were predicted in the early future. It is to be hoped that these expectations may be realized, but it is obvious that they were largely based on speculation. Reference by Capt. Daniell to this matter in his report will be noticed. The cross-cut from the amygdaloid at 16th level, which is between 700 and 800 feet west of the conglomerate, will reach that lode in about six months, and will expose a section of it some 600 feet greater in depth than has ever been seen on our property, which joins the Calumet and Hecla location, without a break in the conglomerate lode. When it is remembered that we have this lode outcropping for a length of over a mile, without surface indications to show that there may be in the depths below vast deposits and stores of copper waiting to be brought to light by the hand of industry, and when it is considered further that the character of this conglomerate lode is so unique, and has in reality been so comparatively little examined and studied, in the light of more modern science, the possibility of the future can hardly be over estimated.

The directors have never for a moment lost sight of the purpose and object of this exploration by cross-cut. As soon

as the mine should attain sufficient depth to promise the best results in time and money, whatever the outcome may be, they would not be justified in longer delaying the work.

We have a most extensive mine, thoroughly and economically opened on the best scientific mining principles, and, although it must be classed as a lean or low grade mine, it ought to give, and in the long run it is not doubted that it will give, satisfactory returns in dividends, on a valuation of its stock at higher figures than we have seen in the past half dozen years. All this is predicted upon a fair price for ingot copper.

The management may justly take pride in comparing their work with any of their neighboring mines on Lake Superior or elsewhere in this country or abroad.

Our smelting arrangements are not satisfactory. The directors have under consideration a plan by which we ought to be placed in better shape for handling and marketing our product. This subject is regarded by the directors as of the highest importance to the future well-being of the mine.

<i>Assets and Liabilities.</i>	
Cash in bank at Boston.....	\$26,133 89
Cash on hand at mine.....	1,253 02
Supplies on hand at mine.....	26,605 15
Fuel on hand at mine and stamp mill.....	33,094 53
Accounts receivable at mine.....	14,599 79
Bills receivable at Boston.....	20,616 10
1,700 acres of land at Dollar Bay, Michigan.....	15,536 87
Hancock & Calumet R. R. Co. 6 per cent bonds.....	38,000 00
Balance due on 300 shares Hancock and Calumet R. R. stock.....	14,400 00
250 shares Hancock and Calumet R. R. stock.....	25,000 00
Copper on hand, 1,187,719 lbs., at 10½ cents.....	124,710 50
Total assets.....	<u>\$339,949 65</u>
<i>Liabilities.</i>	
Drafts outstanding.....	\$34,949 85
Accounts payable at mine.....	30,213 43
Bills payable at Boston.....	45,059 97
Due Laurium Mining Company.....	3,874 16
Dividends uncalled for.....	110 25
Total liabilities.....	<u>\$114,207 66</u>
Balance of assets January 1, 1887.....	<u>\$225,741 99</u>

STATEMENT OF RECEIPTS AND EXPENSES OF ALL KINDS FROM SEPTEMBER 25, 1873, TO JANUARY 1, 1887.

<i>Receipts.</i>	
From capital stock, 50,000 shares, \$25 a share full paid.....	\$1,250,000 00
From 996,002 pounds copper, 1874, at 23.37c.....	\$218,736 92
From 1,339,313 pounds copper, 1875, at 22.77c.....	302,862 96
From 1,693,737 pounds copper, 1876, at 20.57c.....	345,333 25
From 2,774,777 pounds copper, 1877, at 18.19c.....	504,636 93
From 2,705,998 pounds copper, 1878, at 15.53c.....	420,340 14
From 3,197,357 pounds copper, 1879, at 17.79c.....	568,659 89
From 3,331,061 pounds copper, 1880, at 19.15c.....	647,487 19
From 4,179,976 pounds copper, 1881, at 17.77c.....	742,585 84
From 4,179,782 pounds copper, 1882, at 17.70c.....	739,458 28
From 4,256,409 pounds copper, 1883, at 14.90c.....	636,946 63
From 4,247,630 pounds copper, 1884, at 12.82c.....	544,651 02
From 1,939,169 pounds copper, 1885, at 10.75c.....	208,558 65
From 3,560,786 pounds copper, 1886, at 10.51c.....	374,144 13
Total, 38,380,027 lbs., at 16.30c.....	<u>\$6,257,332 01</u>
From sales of silver to date.....	32,439 04
From interest receipts to date.....	36,220 87
From 300 shares Hancock & Calumet R. R. stock.....	36,000 00
Total receipts.....	<u>\$7,611,991 92</u>
<i>Expenses.</i>	
Running expenses prior to 1886.....	\$4,823,259 10
Running expenses during 1886.....	308,666 63
	<u>\$5,130,925 73</u>
Construction expense prior to 1886.....	\$705,062 17
Construction expense during 1886.....	4,772 05
	<u>\$709,834 22</u>
Real estate.....	589,036 20
Dividends prior to 1886.....	972,500 00
Exploratory work.....	8,953 78
Total expenses.....	<u>\$7,411,249 93</u>
Balance of receipts January 1, 1887.....	200,741 99
Add 250 shares Hancock & Calumet R. R. stock.....	25,000 00
Balance of assets January 1, 1887.....	<u>\$225,741 99</u>

*Details of Mining Expense.*

Shaft sinking, 418.10 feet, at 12.49.....	\$5,220 84	
Winze sinking, 284.70 feet at 10.37.....	2,951 90	
Drifts, 4,471.55 feet, at 6.55.....	29,269 44	
Cross-cuts, 21.30 feet at \$7.50.....	159 75	
Stoping, 8,996.05 fathoms at \$9.42.....	84,794 10	
Tramming.....	22,065 38	
Timbering, labor, materials and supplies.....	7,021 10	
Extra work.....	832 72	
Supplies, labor, fuel, etc., for air drills.....	23,814 02	
Supplies, fuel and labor for engines.....	29,668 71	
Mining superintendence and company account labor.....	17,083 57	
Blacksmith, machinist and carpenter labor.....	2,557 71	
	<u>\$225,409 24</u>	
Less profit on supplies.....	29,924 08	195,485 16

*Other Expenses.*

Rock-house.....	\$18,391 49	
Surface, labor, supplies, etc.....	1,481 32	
Incidental expenses, including taxes.....	5,214 94	
Office labor, supplies, etc.....	5,561 63	
Transportation.....	21,410 50	
Stamping.....	14,523 40	
	<u>\$66,583 28</u>	
Total running expenses.....		<u>\$262,068 44</u>

*Construction Costs.*

No. 3 engine plant.....	\$1,356 73	
Fire boxes at mine.....	1,690 55	
Dwelling houses at stamp mill.....	307 77	
Compressor, boiler house, etc.....	857 05	
Houses from John Bagley.....	1,522 15	
School-house at mine.....	4,705 38	
Rock-bin at stamp mill.....	347 99	
Dock at stamp mill.....	392 41	
Transfer of engine from No. 3 to No. 4 shaft.....	75 03	
Stamp mill construction.....	3,756 99	
	<u>\$15,012 05</u>	

*Credit.*

By rock cars sold.....	10,240 00	4,772 05
Total expended at mine.....		<u>\$266,840 49</u>

*Summary.*

Rock stamped.....	137,725 tons	
Product of mineral.....	4,133,545 lbs.	
Product of refined copper.....	3,560,786 lbs.	
Yield of refined copper per ton of stamped rock.....	25.85 lbs.	
Yield of refined copper per cubic fathom ground broken.....	386 lbs.	
Yield of mineral per cubic fathom of ground broken.....	459 lbs.	
Percentage of mineral in stamp rock.....	1.50 per cent.	
Per centage of refined copper in stamp rock.....	1.29 per cent.	
Cost per ton of rock hoisted.....	\$1 62	
Cost per ton of rock stamped.....	1 90	
Refined copper, cost per pound at mine.....		7.39 cts.
Cost of smelting, freight, and all other expenses.....		1.31 cts.
Total cost per pound of refined copper laid down in New York.....		8.97

**SUPERINTENDENT'S REPORT.**

OPECHEE, February 1, 1887.

To the President and Directors Osceola Consolidated Mining Company:

GENTLEMEN:—The following report of our operations for the year past, and present conditions of the mine is respectfully submitted.

Work has gone on with much regularity. Stamping for Tamarack mine has restricted our output to some extent, but this cannot be regarded as a disadvantage in any way. The cost of stamping has been reduced on account of keeping the mill fully employed. A profit has been made on the stamping for Tamarack, and we have been enabled to more closely select ground for working.

Rock hoisted from the mine was 161,929 tons, the equivalent of 8,996.05 fathoms of ground; this afforded in all 4,133,545 lbs. of mineral, which, at 86.14 per cent, gave 3,560,786 lbs. of ingot copper.

The mill product was.....	3,808,400 lbs.
Barrel work was.....	326,065 lbs.
	<u>4,133,545 lbs.</u>

Yield of ingot per fathom of ground treated, equals 395.83 lbs., which is 29 lbs. in excess of the previous year. Each ton of rock hoisted afforded 22 lbs. of ingot copper.

The underground operations foot up as follows:

Shafts.....	418.1 feet
Winzes and rises.....	210.2 "
Levels and cross-cuts.....	1,461.8 "
	<u>5,090.1 feet</u>
West amygdaloid winzes.....	74.5
Levels.....	31.0
Total.....	<u>5,195.6 feet</u>

The sinking in each shaft and present depths, can be gathered from the following:

Shaft.	Sunk.	Depth from Surface.
No. 1.		1,387.1 feet 18 feet under 15th level
" 2.	88.2 feet	1,714.5 " 8 " " 19th "
" 3.	154.1 "	1,798.2 " " " 20th "
" 4.	175.8 "	1,535.4 " 7 " " 17th "

As intimated in the preceding annual report, we have given more attention to the development of the south part of the mine, the ground between Nos. 3 and 4 shafts and south of No. 4 absorbing much of the year's openings. It is satisfactory to note that better ground has been found in this part of the mine than before, the average being equal, both in length and quality, to what has prevailed in the northern ground. If it has not been proved that the copper ground has a decidedly southern trend, there can be no question as to its improving and lengthening in that direction, as the mine deepens.

The extension of the several levels, for the year, foots up as follows:

4th level, 112.9 feet	16th level, 667.7 feet
11th " 155.1 "	17th " 712.1 "
12th " 501.9 "	18th " 924.5 "
13th " 383.0 "	19th " 701.4 "
15th " 264.9 "	20th " 17.1 "
16th " Cross-cut west.	21.3 "

The sinking of No. 2 shaft has been in the foot wall part of the lode. No copper of consequence was noted until near the 19th level; at and under that level good ground was encountered, and the prospects for deeper sinking are extremely good. In cutting 19th level plat the width of lode exposed was fully 16 feet, and this good copper ground. As no stoping has been done, for the present this width is regarded as exceptional.

The 19th level north of No. 2 shaft, 163.6 feet has opened good stoping ground for the whole length. The 18th level north of No. 2 shaft also proved good for all the distance driven, 150.4 feet. The 17th level has been drifted north of No. 2 shaft 238 feet, the last 175 feet in stoping ground, but so far has proved rather under average.

The 19th level south of No. 2 shaft, drifted 218.9 feet, shows good copper ground for 150 feet from shaft, much longer than was expected, because 18th level, over, was poor for fully 200 feet south of the same shaft, except that in places we found some isolated patches of barrel work.

No. 3 shaft, sunk to the 20th level, has continued in the hanging wall trap. In sinking, the lode has occasionally been pricked into, and has invariably shown good copper ground. The 20th level, opened 17 feet in all, shows a good lode in the north opening, but going south has not yet been seen to any extent.

The 19th level north of No. 3 shaft has been driven 186.6 feet. The first 80 feet shows ground of average quality; later we find harder ground, generally lean, but showing an occasional piece of barrel work. Looks like the ground nearer No. 2 shaft at 18th level, before referred to.

The 18th level, for fully 300 feet north of No. 3 shaft, afforded good stoping ground.

The 19th level south of No. 3 shaft is advanced 132.8 feet; the lode has been somewhat irregular in productiveness, but of very good character. Expect it to afford average quality ground for copper.

The 18th level south of No. 3 shaft extended 278.8 feet; the whole drivage here shows stoping ground, some of it quite rich, and altogether of better than average for copper. The 17th level has been holed between Nos. 3 and 4 shafts. No ground opened in the mine has proved more continuously productive than what is exposed here; some of it is quite good, and much of it above average. The 16th and 15th levels between Nos. 3 and 4 shafts have been communicated also.

Extensive stoping has been done near No. 4 shaft in the back of 15th level, and for 200 feet in length the lode has been about 12 feet wide and of full average quality. The 16th level between the shafts, it is expected, will prove better than the 15th, but comparatively little stoping has been done as yet.

In sinking No. 4 shaft from 15th to 16th level, a very good lode was exposed. From 16th to 17th level the shaft passed into the hanging wall trap, and of course shows nothing of value.

The 16th level south of No. 4 shaft has been drifted 123.6 feet wholly in stoping ground. The 15th level south of same shaft has been opened for 215 feet. No stoping has been attempted, but the lode for the whole length indicates better than average quality ground. The 13th level south of No. 4 shaft, drifted 383 feet, gave nothing of special value for 150 feet; the lode then improved and 100 feet in length of good ground was drifted through. Latterly the lode has been bunched, but stoping ground will probably be found when it is thoroughly tested.

The 12th level south of No. 4 shaft has been drifted 501.9 feet. About 350 feet from shaft good ground was found, and this continued for nearly 150 feet. In stoping the lode has afforded considerable barrel work. Nearer the end of the drivage the lode has been bunched, but of good character. This opening will be pushed ahead, expecting more ground of value in advance of us.

The 11th level south of No. 4 shaft has been drifted 155.1 feet, and opened copper ground of low quality nearly all the length. The 4th level south of No. 4 shaft has been drifted 112.9 feet. Lode here is of good character, but not good enough to remove at present.

The openings for the year have afforded as much length of copper ground, proportionately, and of as good quality, as in any like period. There is good reason to conclude that the lode in the deeper levels going south will prove as productive as elsewhere in the mine. The intention is to develop in that direction to determine the limits of the copper ground, and the advisability of sinking one of the Opechee shafts.

The sinking of No. 2 shaft under the poor bar, and into a good copper lode, is important. Fully 300 feet of continuous stoping ground has been opened at 19th level in the vicinity of this shaft. The pitch of this ground is south, gaining quite rapidly in that direction.

It would be more satisfactory if your attention could be directed to the expectation of a higher grade of rock in future. Though this is not impossible, yet in such a bunched mine it would not be wise to do so. This, however, can safely be said,—the mine has never in its history looked more promising for a continuance than at this time, and if our expectations are met, going south of No. 4 shaft, more extensive operations must, follow in due course.

Our work on the West Amygdaloid has not encouraged us to develop it on a more extensive scale. We got from it 1,150 tons of stamp rock, rich in copper, and 62½ tons of barrel work. As we leave seven-eighths of the rock we break underground, in the conglomerate workings, the copper obtained left us a margin of profit. Under the circumstances we shall continue the work, hoping to find a rich bunch that is extensive enough to be important.

As you are aware, it had been settled for some time that a cross-cut should be driven from one of our deep levels to the conglomerate. Developments in the neighboring mine on that lode indicate the possibility of copper ground being prolonged south into our property. To prove this, the cross-cut was started at 16th level. As we expect to drive not less than 80 feet monthly, the conglomerate will probably be reached next September. The lode will be seen 600 feet deeper than it has been proved on our property. The result may be regarded as purely speculative, but I think the expenditure a most judicious one. The importance to us of finding only a moderate good conglomerate can scarcely be estimated.

Rock house expenditures are much the same as in previous years. Of the rock hoisted, 161,929 tons, there were discarded 24,204 tons, and 137,725 tons were sent to mill.

Transportation and filling of rock cars cost us 15 55-100 cts per ton, railroad company keeping tracks clear of snow, and affording every facility for dispatch of work.

Stamping was done, after the whole mill was complete in January, with great regularity. Osceola rock amounted to 137,725 tons, Tamarack 71,889 tons, or a total of 209,615 tons stamped, cost of stamping being 34 52-100 cents per ton. Considering that 39 per cent, was conglomerate rock, there is every reason for being satisfied with the duty of the mill.

The heavy items of construction account were for completion of the stamp mill and surroundings, and for new school-house at the mine. Unless we make preparations for the rapid development of our south ground, which will be determined later, there will be no call for any important extra expenditures for the year.

Plans of the mine have been prepared by Mr. Klepetko, our engineer. Also a detailed summary of the year's accounts, by Mr. J. H. Vivian, clerk, to be submitted to you.

The staff of officers continue the same, and to them my thanks are due for continued regularity with which work progresses. Very respectfully,

JOHN DANIELL, *Superintendent.*

PERCENTAGE OF COST IN EACH DEPARTMENT IN 1886.

West vein.....	.0449
Amygdaloid.....	.7015
Rock-house.....	.0701
Transportation.....	.0819
Stamping.....	.9542
Incidental.....	.0190
Surface.....	.0065
Office.....	.0212
Whole number of men.....	364
Total expenditures.....	\$22,063 44
Fathoms of ground broken.....	9,228
Tons of rock hoisted.....	161,929
Tons of rock discarded.....	24,204
Tons of rock stamped.....	137,725
Pounds of mineral produced.....	3,808,490
"    " masses.....	325,065
"    " mineral.....	4,133,545
"    " ingot.....	3,560,918
Cost per ton of rock hoisted.....	\$1.6184
Cost per ton of rock stamped.....	1.9028
Cost per ingot copper per lb.....	.0736
Percentage of stamp rock in rock hoisted.....	.85-100
"    " mineral in rock hoisted.....	.01176 lbs to the ton, 23.52
"    "    "    " stamped.....	.01363 " " " 27.66
"    " masses "    " hoisted.....	.001 " " " 2
"    "    "    " stamped.....	.00118 " " " 2.36
"    "    "    " total product.....	.0786 " " " 157.20
"    " mineral product in rock hoisted.....	.01276 " " " 25.52
"    "    "    " stamped.....	.015007 " " " 30.01
"    " ingot copper "    " hoisted.....	.01099 " " " 21.96
"    "    "    " stamped.....	.01263 " " " 25.86
"    "    "    " mineral product.....	.8615
Pounds of ingot copper in each ton of mineral.....	1,723
Total cost of working air drills.....	\$23,814 02
Number of drills worked.....	21
Average number of men working drills.....	78.54
Transportation cost per ton of rock, including the loading of cars.....	15.55 cents.

STAMP MILL ITEMS.

Total number of days run.....	288.13
Tons of Osceola rock stamped.....	137,725
Tons of Tamarack rock stamped.....	71,889
Total rock stamped.....	209,614
Tons of rock stamped per ton of coal or unit of fuel.....	22.47
Average per cent of mineral in rock.....	.01333
Cost of stamping per ton, including Tamarack.....	.3462

STAMPING EXPENSE 1886.

1886.	Amount.	1886.	Amount.
Superintendent.....	\$16 80	Cost of fuel.....	\$31,535 00
Engineers.....	1,351 50	Illuminating oil.....	130 60
Firemen.....	2,948 70	Lubricating oil.....	1,035 37
Coopers and carpenters.....	1,513 56	Stamp shoes.....	2,615 27
Watchmen.....	539 70	Hardware.....	528 97
Machinists.....	1,704 58	Iron and steel.....	2,696 49
Smiths.....	868 39	Tools and machinery.....	.....
Head runners.....	1,154 35	Waste.....	125 73
Head feeders.....	3,717 25	Packing and belting.....	235 08
Oilers.....	1,029 35	All other supplies.....	2,851 38
Sundry labor.....	4,701 03	Total supplies.....	41,753 29
Tramming.....	465 65	Amount of labor brought down.....	30,568 73
Overseers of work-house.....	860 00	Incidental.....	36 90
Copper washers.....	1,194 55	Stamping Tamarack rock.....	57,836 12
Laborers and machinists.....	6,433 70	Total expense, not including Tamarack stamping, i. e., cost of stamping Osceola rock.....	14,523 40
Silver pickers.....	225 40		
Assaying.....	61 02		
Total.....	30,568 73		
Wood supplies, per cent.....			57.76
Labor lost, per cent.....			52.24

Table of product of Osceola mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1874.....	468	.....	1881.....	2,089	1,576
1875.....	665	303	1882.....	2,088	782
1876.....	846	1,737	1883.....	782	2,128
1877.....	1,382	777	1884.....	2,123	1,630
1878.....	1,352	1,908	1885.....	969	1,169
1879.....	1,589	1,387	1886.....	1,780	786
1880.....	1,691	1,387			
Total.....				19,186	491

THE PENINSULAR MINING CO.

did a small amount of work of an exploratory kind in the last year but finally closed down again.

There is no likelihood of the resumption of mining work in the near future. There is nothing to describe beyond what is given in previous reports.

S. D. North, Prest., Hancock, Mich.

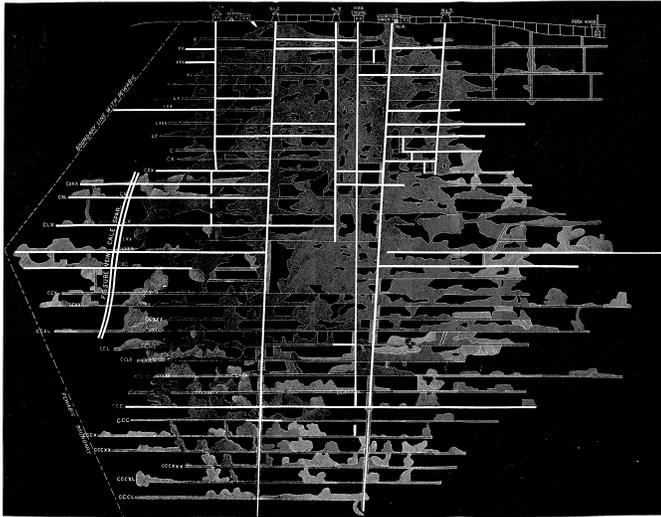
THE QUINCY MINING CO.

The Quincy is the richest amygdaloid mine in the State. In the per cent, of yield of mineral of the rock, in the aggregate of production, in the annual profits of its work, it ranks only second to the Calumet and Hecla.

This position it has held for years and there is no diminution in the richness of the mine. It was never better than it is now, though of course it is each year getting deeper. The Quincy has a large territory, so that it can never be circumscribed for the want of ground to extend its opening into, but it is possible that the deposit may become leaner. They may not always have the rich ground that has held for so many years in the mine.

In this respect the Calumet and Hecla enjoys an advantage. That mine is proved far ahead of present working. The Quincy is not; a few years of stoping in poor ground would lessen the product and cripple its resources. There is no reason to apprehend any such occurrence, only the experience in all amygdaloid belts—and in conglomerate, too, as to that matter—shows that good ground is likely to be succeeded by poor.

The Pewabic was once as rich as the Quincy and continued to be so for years, or until the deposit in the old mine was all exhausted; but when the advance was made into the new ground—the Edwards and Uren purchase—the mine became poor and did not pay to work. It is possible that a similar experience may await the Quincy, and to avoid possible, serious future embarrassment, it would seem to be the part of wisdom to prove the ground far in advance of the present stoping. It must be remarked that the map scarcely indicates the full extent of the stoping ground opened, without an accompanying ground plan. The mine is in two deposits, so designated, east and west deposits, which open into each other by cross-drifts, either through rock or in amygdaloid connections, so that it is a wide mine and a very irregular one. It must be borne in mind also that much of the ground standing in the mine—and it will be seen from the map that there is very much of it—is good paying amygdaloid that will be mined and crushed as occasion requires. This is the mine's reserve, and there is enough of it to tide over a long period of occurrence of poor ground in the bottom. The Quincy is a conservative, well managed corporation and well sustains its share of the credit of our mining interests and makes its pecuniary returns to its stockholders of such magnitude and with such regularity, that its shares are ever esteemed as among the safest and most profitable investment.



For the second time in recent years the Quincy has met with the loss of its rock house by fire. Early in June, 1887, the rock house was struck by lightning, occasioning its total loss. Steps were immediately taken for its rebuilding, and the delay will be of short duration.

The following statements by the company cover all the further information that is essential:

**QUINCY MINE REPORT.**

The directors submit the following report of the business of the mine for the past year, and statement of the financial condition of the company.

The shipment of the season was 6,974,300 pounds of mineral, which has been smelted and yielded about 82 48-100 per cent, or 5,752,816 pounds of refined copper.

The product of the mine, as prepared for shipment, was 7,158,500 pounds, or 8,576 1800-2000 tons of mineral, of the following description, namely:

Stamp copper.....	6,748,785 lbs
Mass ".....	404,715 "
	<u>7,153,500</u>

For which, estimating copper on hand, unsold, at 11 cents per pound, has been realized

The gross sum of.....	\$640,292 17
Realized from sale of silver.....	3,349 39
	<u>\$643,641 56</u>

The expenses of the year are as follows:

Running expenses at mine .....	\$311,369 90
Building and construction account.....	27,614 75
Smelting, transportation and all other expenses.....	99,425 43
	<u>\$438,409 48</u>
Which, deducted from gross earnings.....	643,641 56
Leaves as mining profit.....	\$205,232 08
There has also been realized during the year, from interest on loans.....	9,488 97
From real estate, "Hancock,".....	1,060 00
	<u>\$215,781 05</u>

The statement of assets and liabilities in our last report showed a balance on hand, as of date,

January 1, 1886.....	\$573,000 41
Add earnings of 1886.....	215,781 05
	<u>\$788,781 46</u>
Deduct dividend of February 15, 1886.....	\$160,000
" " " August 16, 1886.....	80,000
	<u>\$240,000 00</u>
Leaving balance of assets, January 1, 1887.....	\$548,781 46

A dividend of \$4.00 per share, or \$160,000, payable February 15, has been declared which, with dividend of \$2.00 per share, paid August 16 last, makes a total for the year \$240,000.

The usual financial statements are submitted, and also the report of the agent, which states clearly the present condition of our property.

THOMAS F. MASON, *President.*

New York, February 12, 1887.

**GENERAL SUMMARY OF RECEIPTS AND EXPENDITURES OF THE QUINCY MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1886.**

<i>Expenditures.</i>	
For expenditure on location previous to 1886.....	\$42,097 98
" " " Quincy vein, 1885, not now worked.....	55,000 00
For openings and explorations on 3,800 feet "east" or Pewabic vein, extending to Portage Lake, preparatory to future work.....	11,500 00
For real estate and permanent improvements on same, including dwelling houses, stamp mill, machinery, steam engines, tram road, dock, warehouses and other buildings and roads.....	942,560 94
For mining and surface labor, expenses of smelting and marketing copper, and all incidental expenses.....	11,966,007 60
Balance carried down.....	4,958,781 46
	<u>\$17,975,947 98</u>
<i>Receipts.</i>	
From capital stock paid in.....	\$200,000 00
From proceeds, copper and silver (88,243,927 lbs. copper).....	17,522,181 25
From interest.....	116,229 04
From profit on sale P. L. & R. Improvement Company stock, and other investments.....	79,637 16
From sales of real estate, Hancock, Michigan.....	57,950 43
	<u>\$17,975,947 98</u>
By balance brought down, being receipts over expenditures.....	\$4,958,781 46
Deducting dividends declared, Nos. 1 to 36 inclusive.....	4,410,000 00
Leaving balance as per statement in detail on next page.....	<u>\$548,781 46</u>

**STATEMENT OF ASSETS AND LIABILITIES, EXCLUSIVE OF REAL ESTATE, MINE PLANT AND SUPPLIES IN USE, JANUARY 1, 1887.**

<i>Assets.</i>	
Loans on call.....	\$300,000 00
Cash in bank.....	20,641 24
Cash on hand at mine.....	8,489 86
Copper on hand.....	202,196 57
Accounts receivable—since paid.....	15,066 00
	<u>\$546,393 67</u>
<i>Liabilities.</i>	
Drafts unpaid.....	\$1,311 30
Dividends unpaid.....	788 00
Accounts payable in New York.....	16,700 00
" " " at mine.....	33,787 51
	<u>52,566 81</u>
Add at mine, viz:	
Supplies per inventory on file.....	\$47,055 69
Farm accounts (horses, wagons, etc.).....	7,756 81
Accounts receivable.....	142 10
	<u>54,954 60</u>
Less dividend payable February 15, 1887, \$4 per share, \$160,000.....	\$160,000 00
	<u>\$548,781 46</u>

<i>Summary for Year.</i>	
Average force employed.....	415 men
" number of miners.....	140 "
" wages of miners on contract, per month.....	\$45 80
Yield of mineral per fathom of ground broken.....	777 lbs
" refined copper per fathom of ground broken.....	638 "
Total rock mined.....	165,618 tons
" hoisted.....	115,608 "
" stamp rock treated.....	109,702 "
Yield of rock stamped 8.08 per cent.....	6,748,785 lbs
Product mineral.....	7,153,500 "
" refined copper.....	5,923,519 "

**AGENT'S REPORT.**

Quincy Mine, Lake Superior, Mich., January 31st, 1887.

The results of our operations at the mine for the past year have fully realized our anticipations, and I herewith submit the following report.

In the northern part of the mine the openings made by drifting on the vein, by cross cutting and by winzes, were at the twenty-second, twenty-fourth, thirty-first, thirty-second, thirty-third and thirty-fourth and thirty-fifth levels north and south of No. 2 shaft.

The openings made in the southern part of the mine by drifting, etc., were at the twenty-second, thirty-second and thirty-third levels, south, and the thirty-fourth and thirty-fifth levels north and south of No. 4 shaft. All those levels are now connected with both shafts.

No. 4 shaft was sunk from the thirty-fourth level to a point fifty feet below the thirty-fifth level; but No. 2 shaft was not sunk below the thirty-fifth level during the year.

The stoping done was at various places between the twenty-second and the thirty-fifth levels north and south of No. 2 shaft, and between the twenty-second and the thirty-fourth levels north and south of No. 4 shaft.

The most productive ground worked was at the thirty-second, thirty-third and thirty-fourth levels north and south of No. 4 shaft and at the thirty-second, thirty-third, thirty-fourth and thirty-fifth levels north and south of No. 2 shaft.

The diamond drill work was limited during the year. The total number of holes bored was only some eighteen or twenty, and the aggregate depth of drilling about 2,000 feet.

Those explorations were at different points in the twenty-second, twenty-fourth, thirtieth and thirty-fifth levels, and for the most part developed nothing of an unusual character.

The man-engine shaft in course of extension below the twenty-seventh level, at the end of last year, was completed to the twenty-ninth level, and a further extension will probably be made during the present year.

Of the principal improvements by way of construction account, under consideration at the last annual report, the following have been carried out, viz: At No. 2 shaft some additional changes and improvements were made to the hoisting plant.

At No. 4 shaft the new drum was put in operation in July. Previous to this the shaft had been straightened and retimbered for two levels below the surface, and the dump in the shaft house lowered and changed.

The mine pump bob pits and bobs at the surface were entirely rebuilt and enclosed with small, substantial frame buildings.

Several of the tenement houses received necessary repairs, and two other dwelling houses were purchased from parties who had built them at their own expense on the company's land.

At the man-engine shaft a set of iron "angle" or balance bobs was placed at the fourteenth level, and a set of iron "V" bobs was placed at the thirteenth level. This improvement was rather an expensive undertaking, but nothing better could be devised, and the bobs admirably answer the purposes for which they were designed.

During the summer the Mineral Range railroad company constructed a branch line to connect with our mine boiler-house, which makes it more convenient for the transportation of coal, wood, or other freight from the dock to the mine.

A coal yard was made at the mine boiler-house, and the coal bin at the dock was removed to a more favorable position for receiving and discharging coal.

The mine office building, and the mine supply building, which had become extremely dilapidated, were thoroughly overhauled and repaired, making them practically as good as new.

A new fire plant for the mine, consisting of a size "E" Worthington pump, with some twenty-three hundred feet of four-inch pipe, and suitable hydrants, was purchased, and partially laid; but owing to some unaccountable delay in shipping them, the pipes were not received in time to complete the work before winter set in.

At the stamp mill a small addition was made to what is called the "Little Mill Building," for the purpose of furnishing storage for iron, and for such pieces of machinery under repairs as heretofore have been crowded into the mill machine shop.

The dock extension, spoken of in the last annual report, was also made. The expense of this, together with the improvements already mentioned, make the construction account for the present year a total of \$27,614<sup>75</sup>/<sub>100</sub>.

During the present year it will be necessary to rebuild the "tram road," or "incline," as it is called, from the "drum house," to the stamp mill, and to procure a new dump scow of larger size than the old one now in use, for the removal of waste stamp sand. The mine maps enclosed, which are filled up as usual to the end of the year, will show the diamond drill borings, and, as near as may be, the extent of openings made, and the ground in reserve available for stoping. The general appearance of the mine is altogether encouraging.

There is a decided improvement of the vein in the lower levels, particularly so in the vicinity and south of No. 4 shaft, while at No. 2 shaft, and north of it, the vein holds its own remarkably well.

For the successful accomplishment of the year's work I am under renewed obligations to the several officers of the mine, all of whom have been in hearty cooperation, and have labored faithfully and well.

S. B. HARRIS, *Agent*.

Table showing yearly product of Quincy mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1856.....	6	1,462	1872.....	1,134	1,134
1857.....	61	762	1873.....	1,400	-----
1858.....	153	772	1874.....	1,525	654
1859.....	178	1,114	1875.....	1,334	281
1860.....	970	414	1876.....	1,536	1,171
1861.....	1,218	852	1877.....	1,427	336
1862.....	1,153	218	1878.....	1,480	449
1863.....	1,115	1,737	1879.....	1,323	1,458
1864.....	1,251	586	1880.....	1,848	263
1865.....	923	1,500	1881.....	2,753	884
1866.....	1,172	1,000	1882.....	2,882	1,796
1867.....	1,013	1,000	1883.....	3,006	239
1868.....	727	1,000	1884.....	2,825	436
1869.....	1,208	1,365	1885.....	2,924	497
1870.....	1,248	1,777	1886.....	2,961	1,529
1871.....	1,204	1,501			
Total.....				44,059	151

## THE PEWABIC MINE

is still idle and matters regarding it remain as stated in last report.

## THE FRANKLIN MINE

affords continued evidence of the effects of good management. The mine is in a prosperous condition, a dividend-paying mine, notwithstanding the low price of copper; whereas, years ago, before Capt. Vivian took charge of the mine, it did not pay expenses. And this, too, with copper at double its present price, and with the same machinery and outfit as are still used at the mine. A few years ago, after the mine had been worked on tribute until the stopes were all exhausted, and the

machinery, railroad, buildings, stamp mill, etc., were all out of repair, the company resumed work, with an empty treasury; and without calling upon the stockholders for a penny of assessment, the mine has been brought to a prosperous, independent position. All the requisite funds have been ultimately derived from the sales of the copper produced.

Of course, money had to be used before copper could be mined and sold. To obtain these necessary early advances, Messrs. Demmon and Vivian pledged their personal credit to an extent that their private estates were completely identified with the success of the mine.

They demonstrated the value of the Franklin mine, and their eminent ability to manage it successfully.

There is not much to be said that is new. The shaft houses have all been built over new. This was accomplished without delaying the hoisting. In going over the location one sees many small changes that are excellent, alteration of boilers, of machinery, etc., that are both economical and effective. One sees the evidence of a management that looks after every detail, and makes machinery, etc., do effective duty that some managers would think it necessary to discard as obsolete, worn out, and worthless.

The following is the complete financial statement, etc., of the company:

MINING EXPENSES.	
Number of men.....	126
Mining captains, timbermen.....	\$12,331 29
Miners on day account.....	1,523 97
Machinists, engineers, firemen.....	12,019 10
Blacksmiths, carpenters.....	3,328 32
Trammers, laborers.....	32,272 96
Total.....	\$61,473 73

STATEMENT OF SHAFTS AND WINZES SUNK AND COST OF THE SAME.	
Number of men.....	9
Number of feet of shaft sunk.....	489
Average price per foot for sinking shafts.....	\$14 84
Total amount paid for sinking shafts.....	\$7,390 48

STATEMENT OF DRIFTING AND CROSS-CUTS MADE AND COST OF SAME.	
Number of men.....	30
Number of feet drifted.....	2576 3-10
Average price paid per foot for drifting.....	\$9 81
Total amount paid for drifting.....	\$25,188 04

MINING EXPENSES.	
Special contracts.....	\$52 50
Extras.....	1,240 14
Main engine, wood supply and royalty.....	4,614 10
Diamond drill.....	842 03
Survey in mine.....	199 00
Total.....	\$6,977 82

STATEMENT OF STOPING AND COST OF SAME.	
Number of men.....	112
Number of fathoms stoped by air drills.....	9174 302-1000
“ “ “ “ hand drills.....	0
Average price paid for stoping with air drills.....	\$9 97
Total amount paid for stoping.....	\$91,541 94

STATEMENT OF SUPPLIES, FUEL, ETC., AND COST OF SAME.	
Supplies.....	\$12,139 36
Wood, coal and iron.....	30,722 69
Total.....	\$42,862 05
Less profit on miners' supplies.....	18,504 40
Total.....	\$24,357 65

RECAPITULATION OF MINING EXPENSES.	
Company account labor.....	\$61,473 73
Sinking shafts and winzes.....	7,390 48
Drifting and cross-cutting.....	25,188 04
Stoping.....	91,541 94
Sundry labor.....	6,977 82
Supplies, fuel.....	24,357 65
Total.....	\$216,929 06
Number of men on company account.....	126
“ “ “ “ contract.....	150½
Total.....	276½
Number of tons of rock hoisted to surface.....	175,130
“ “ “ “ rejected.....	36,745
“ “ “ “ sent to mill.....	138,385
Per cent of rock rejected.....	20.98
Total number of feet drifted.....	2576.30
“ “ “ fathoms stoped.....	9174.302
“ “ “ feet sunk.....	498

SURFACE EXPENSES.	
Number of men.....	34
Total amount of wages paid.....	\$16,198 64
Teaming and supplies.....	5,540 05
Wagons, sleighs, harness, repairs, etc.....	443 95
Total.....	\$22,083 54
Less house rent and other charges.....	7,929 22
Net total.....	\$14,154 26

STAMP MILL EXPENSES.	
Number of men.....	58
Number of cords of wood.....	11,777.50
Cost of wood.....	\$33,398 83
Foundry expenses.....	3,797 03
Cost of other supplies.....	4,701 34
Cost of labor.....	21,728 39
Total.....	\$63,595 59

STATEMENT SHOWING RESULTS OF STAMPING.	
Number of days run.....	240
Number of tons stamped.....	138,385
Per cent per ton.....	1.29
Number of pounds of copper produced.....	3,572,064
Number of tons of rock stamped per cord of wood used.....	11.75
Cost of stamping one ton of rock.....	\$0.4595

No. 2 shaft sunk 210 feet below the 27th level	3	110	28th
“ “ “ “ “ “ “ “ “ “ “ “ “ “	5	178	24th

TRAM ROAD EXPENSES.	
Number of men.....	15
Cost of labor.....	\$6,774 99
Cost of supplies.....	1,582 95
Total cost.....	\$8,357 94
Number of tons of rock run over the road.....	138,385
Cost per ton to transport.....	\$0.603
Insurance, etc.....	9,507 28

ROCK HOUSE EXPENSES.	
Number of men employed.....	36
Cost of labor.....	\$14,310 28
Cost of supplies.....	865 14
Total cost.....	\$15,175 42
Number of tons of rock passed through breakers, etc.....	138,385
Cost per ton for breaking and delivering.....	\$0.10.96
Cost of hauling one ton of rock hoisted.....	0.0866
Office expense, clerks, etc.....	2,505 97

CONSTRUCTION AND REPAIRS, ETC.	
Repairing houses.....	\$620 71
New dock and bulk head.....	2,088 06
Building fence.....	29 60
Addition to house—mining captain.....	179 46
Moving warehouse.....	217 63

SUMMARY OF EXPENDITURES.	
Number of men.....	422
Mining expenses.....	\$216,929 06
Surface expenses.....	14,154 26
Stamp mill expenses.....	63,595 59
Tram road expenses.....	8,357 94
Rock house expenses.....	15,175 42
General expenses.....	9,807 29
Office expenses.....	2,505 97
Construction account and repairs.....	3,136 06
Total.....	\$333,162 19
Total number of pounds of mineral produced.....	5,224,794

FRANKLIN MINE REPORT.

To the Stockholders of the Franklin Mining Company:

Annexed we hand you the usual annual statement of the affairs and doings of your company for the year 1886, with our agent's reports of the workings for that year, of the condition of the mine January 1, 1887, and its probable prospects for the future, which certainly seem as fair as a year ago.

The entire plant is in better condition, there is more rock broken in the mine and ready for hoisting, the openings are fully as large as they were January 1, 1886, the machinery in all its details is in first-class order, and all seems to promise as well for 1887 as could reasonably be expected. The price of copper, seemingly, being the only question for at least as successful a year as 1886. The present position, however, if we may judge by statistics, is in favor of an advance in price of the article.

Captain Johnson Vivian still has charge of our property at the Lake, and the result of the year's doings gives the facts as to his fitness for the situation.

There is in the mine, broken and ready for hoisting, 27,518 tons of rock, which is not valued as an asset.

During the year, 138,385 tons of rock were treated at the mill, a gain over 1885 of 1,109 tons, producing 5,228,400 lbs. of mineral, which gave a yield of 81 623-1000 per cent, of refined copper, or 4,264,297 lbs., being a gain over 1885 of 265,125 lbs. of refined copper.

The amount of mineral per ton of rock stamped was 1 88-100, or 13-100 per cent, more than 1885.

The percentage of copper in a ton of rock hoisted was 1 21-100, which is an increase of 8-100 over 1885.

The total cost of mining and manipulating per ton of rock hoisted was \$1.90, or five cents per ton less than 1885.

Total amount of rock hoisted was 175,130 tons, again over 1885 of 1.514 tons.

Respectfully submitted, for the directors,  
D. L. DEMMON, *Treasurer.*

AGENT'S REPORT.

Hancock, Mich., Jan, 20, 1887.

D. L. DEMMON, ESQ., *Treasurer.*

Dear Sir:—I beg leave to submit the following report of the work performed for the year ending December 31, 1886, with map of the mine showing the extent of the openings, stopes, etc., together with inventory of supplies, tools and machinery. Also tabular statements which have been very carefully and neatly compiled by the clerk, Mr. Arno Jaehnig, giving in detail the cost of each department of our business, etc.

SURFACE.

In this department we have for many years paid considerable attention to repairs and improvements which have put it into such good condition that little remained to be done in the year just closed. The improvement of importance was a dock built at the Lake for landing general merchandise on, and one for receiving coal. Both have been constructed in a very substantial manner, and will last for a great many years.

MACHINERY.

We have not added anything of importance to the machinery during the past year. All repairs necessary have had prompt

Per cent ingot to mineral.....	81.61
Total number of pounds of refined copper produced.....	4,264,297
Cost of the mineral per pound at smelting works.....	\$0.0637
“ “ ingot “ “ “ “ .....	0.0781
Number of fathoms of rock hoisted.....	9729
“ “ tons “ “ .....	175,130
Cost of rock per ton.....	\$1.90
Number of pounds of mineral in each fathom of ground.....	537
“ “ “ ingot “ “ “ “ .....	498
“ “ “ mineral “ “ “ ton of rock hoisted.....	29.83
“ “ “ ingot “ “ “ “ .....	24.34
Per cent of mineral in ton of rock hoisted.....	1.49
“ “ ingot “ “ “ “ .....	1.21
Pounds of mineral in each ton of rock stamped.....	37.75
“ “ ingot “ “ “ “ .....	30.81
Per cent of mineral in tons of rock stamped.....	1.88
“ “ ingot “ “ “ “ .....	1.54
Total running expenses for the year.....	\$333,162 19
Tons of rock on hand January 1st, 1886.....	25,008
“ “ mined during year.....	177,610
“ “ hoisted “ “ .....	175,130
“ “ on hand January 1st, 1887.....	27,518

MEMORANDA.

Pounds of mineral in fathoms of rock hoisted.....	537
“ “ ingot “ “ “ “ .....	498
“ “ mineral “ ton “ “ “ .....	29.83
“ “ ingot “ “ “ “ .....	24.34
“ “ mineral “ “ “ stamped.....	37.75
“ “ ingot “ “ “ “ .....	30.81
Per cent of mineral in rock stamped.....	1.88
“ “ ingot “ “ “ “ .....	1.54
“ “ mineral “ hoisted.....	1.41
“ “ ingot “ “ “ “ .....	1.21
Cost of mineral at smelting works.....	\$0.0637
“ “ ingot “ “ “ “ .....	.0781

INVENTORY.

Machinery at Mine.

- 1 hoisting engine and 9 boilers.
- 1 pumping engine and 1 boiler.
- 1 pumping engine in machine house.
- 1 pumping engine in carpenter shop.
- 3 underground pumping engines.
- 3 underground hoisting engines.
- 1 saw mill.
- 1 fire pump in compressor house.
- 1 fire pump in hoisting engine house.
- 1 fire pump in locomotive engine house.
- 2 Burleigh compressors.
- 1 Double Allison compressor.
- 1 air receiver.
- 1 boiler in compressor house.
- 2 heaters in compressor house.
- 34 Band air drills.
- 3 rock breakers.
- 1 spare engine 14" x34" in ware-house.
- 9,000 feet water works pipe from mill to mine.
- 1 small engine and boiler.

Stamp Mill Machinery.

- 1 Corliss engine and 4 boilers.
- 1 pumping engine.
- 1 pumping engine.
- 1 pumping engine, old one.
- 4 heads Ball stamps.
- 48 Collum washers, shafting, belting, etc.
- 4 shelve tables.
- 2 percussion tables.
- 2 20" lifting pumps.
- 1 Worthington pump.
- 1 engine for hoisting coal.
- 1 10x44x10 Worthington pump for the water works.

Tram Road.

- 2 locomotives. 50 rock cars. Road from mine to mill, gauge 3' 3", laid with T rail; renewed in 1884.

The following is the company's published statement of the year's business:

attention, and nothing of a serious nature has happened to anything connected with it causing any hindrance over a few hours, and all at this time is in good condition and running smoothly and regularly.

**STAMP MILL.**

We have treated 138,385 tons of rock, which is in excess of 1885 1,109 tons. For a mill that is so old as this, it is in very fair condition, and will not require any very heavy repairs for the ensuing year. We shall put in six new washing machines at an early day to take the place of the same number that are too badly decayed for further use, the extra cost of which will not exceed two hundred and fifty dollars.

**MINING WORK.**

The following openings have been made:

Shafts sunk .....	498 feet.
Drifting .....	2,576 feet.

The total amount of ground broken was 9,868 918-1000 fathoms, or 177,640 tons of rock, of which 175,130 tons were hoisted to the surface. The amount of rock rejected was 36,745 tons, at 20 98-100 per cent, of the amount taken out of the mine. The quantity of rock on hand

January 1, 1886 was .....	25,008 tons.
Broken during the year .....	177,640 tons.
	<hr/>
	202,648 tons.
Hoisted as above stated .....	175,130 tons.
	<hr/>
Leaving on hand Jan. 1, 1887 .....	27,518 tons.

The cost of manipulating a ton of rock, and delivering the mineral to smelting works, was 1 30-100, which is a saving of five cents per ton over 1885, or a total for the year of \$8,680 80-100. The percentage of copper in a ton of rock hoisted was 1 21-100, which is an increase of 6-100 over 1885.

The shafts have been sunk as follows: No. 2 from the twenty-eighth to the twenty-ninth level; No. 3 from the twenty-sixth to the twenty-seventh level; and No. 5, from a point 30 feet above the twenty-fifth, to the twenty-sixth level. Openings, by drifts, have been regularly made from the above mentioned shafts, from the twenty-third to the twenty-eighth level. The appearance of the lode exposed in these openings seems to be, on the whole, a fair average of what we have had for the last two or three years. The depths of our shafts are as follows: No. 2, 2,350 feet; No. 3, 2,125 feet; No. 5, 2,000 feet.

**PROSPECTS FOR 1887.**

After a careful survey of the ground now available for stoping, and what we can reasonably expect to open, we are satisfied that, at least, 2,400 tons of mineral can be produced for 1887. As there is nothing in the shape of new machinery or other improvements required, the expenses for the ensuing year will not be materially increased over the past, if any.

I again take pleasure in saying that my assistants, Capt. Thomas Dennis, Mr. Arno Jaehnig, the clerk, and Mr. James Moore, the engineer, continue to promote the best interest of the company.

I am, yours respectfully,  
J. VIVIAN, Supt.

**FRANKLIN MINING COMPANY, CASH ACCOUNT, FOR THE YEAR ENDING DECEMBER 31, 1886.**

Cash on hand January 1, 1886 .....	\$140,782 97
Cash received from sales of copper, 3,651,160 lbs., at 10 373-1,000c .....	396,975 13
Cash received from sale silver .....	1,113 47
Cash received from interest .....	850 29
	<hr/>
	\$548,721 96
	<i>Contra.</i>
Cash paid dividend, January 1, 1886 .....	\$40,000 00
Cash paid dividend July 1, 1886 .....	40,000 00
Cash paid Mine Agent's drafts .....	348,609 15
Cash paid insurance .....	923 00
Cash paid storage .....	107 34
Cash paid smelting .....	41,708 29
Cash paid freight .....	16,384 93
Cash paid expense, brokerage, taxes, legal expenses, etc. ....	8,658 55
Cash paid loans .....	30,000 00
Cash on hand December 31, 1886 .....	22,330 70
	<hr/>
	\$548,721 96

**FRANKLIN MINING COMPANY, PROFIT AND LOSS ACCOUNT, FOR THE YEAR 1886.**

	<i>Receipts.</i>	
2,943,794 lbs. copper sold at 10 707-1,000c .....	\$915,185 10	
1,321,625 lbs. of copper on hand at 10 1/2c .....	138,766 62	
Silver sold .....	2,001 20	
Received for interest .....	850 29	
	<hr/>	
	\$456,807 31	
	<i>Expenditures.</i>	
At mine, as per yearly cost sheet .....	\$333,162 19	
All other expenses, including smelting, freight, insurance, etc., etc. ....	65,190 65	
Profit and loss. Profit for 1886 .....	58,454 47	
	<hr/>	
	\$456,807 31	
	Highest price in 1886, 12 cents.	
	Lowest price in 1886, 9 75-100 cents.	

From which a dividend of one dollar per share, or \$40,000, was paid January 1, 1887.

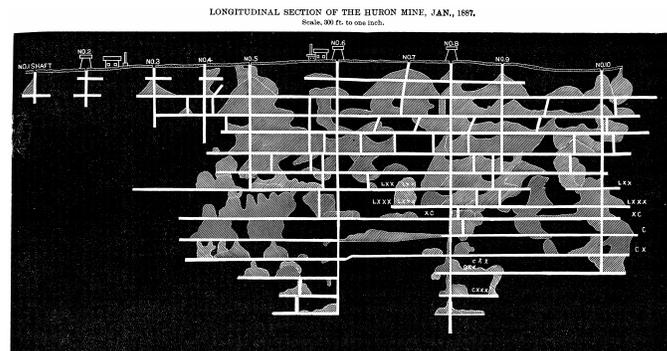
D. L. DEMMON, Treasurer.

- Yield in 1881, 2,667,953 lbs. refined copper.
- Yield in 1882, 3,284,120 lbs. refined copper.
- Yield in 1883, 3,489,308 lbs. refined copper.
- Yield in 1881, 3,748,653 lbs. refined copper.
- Yield in 1885, 3,999,172 lbs. refined copper.
- Yield in 1886, 4,264,207 lbs. refined copper.

The Franklin mine has produced as follows:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	3	699	1872	186	
1858	56	1,104	1873	183	
1859	116	1,211	1874	283	1,730
1860	157	1,860	1875	583	800
1861	783	43	1876	963	641
1862	733	645	1877	1,169	1,817
1863	639	684	1878	1,299	1,528
1864	605	1,335	1879	1,414	1,703
1865	779	1,481	1880	1,168	466
1866	819	994	1881	1,338	1,932
1867	701	455	1882	1,632	120
1868	737	1,323	1883	1,744	1,308
1869	779	970	1884	1,882	1,697
1870	589		1885	1,969	1,172
1871	300	1,000	1886	2,132	297
Total				25,782	478

D. L. Demmon, Sec. and Treas., Boston, Mass.



## HURON COPPER COMPANY.

It is surprising how well the Huron mine sustains itself, considering the price of copper and the somewhat restricted scale on which it is worked. A few years ago and the Huron was an abandoned mine, while now, without much additional outlay, it is, considering the circumstances, a large producer of copper, and is producing it, too, at a margin of profit. This much has been demonstrated regarding the Huron: if it were provided with machinery and stamp mill facilities equal to those found at the other important mines in the district, it would undoubtedly produce as much copper, and produce it as cheaply as the others. That is, it would be an entirely self-supporting and dividend-paying mine. Open it as extensively, and work it as largely as other mines are penetrated and worked, and it is reasonable to conclude from the facts already determined, that it would be as successful. The so-called Isle Royal lode, in which the Huron belongs, is like most other amygdaloid belts, irregular and pockety, rich and poor in places. It must be extensively opened and worked to give any profit. In this way enough good ground will be developed to afford all necessary stopes, and the poor may be left standing. It is well understood now, that copper mining in Michigan cannot be conducted successfully on a small scale. The only way that the depression in price has been met by the companies that continued to operate, is by pushing the work more vigorous, opening the mine more largely, and increasing the output. They lessen the cost by increasing the magnitude of the operations.

The Huron, if it is to continue to work, needs a considerable outlay of money to provide all the facilities for working the mine as the other mines in the vicinity of Portage Lake are worked. There is no mine under better management, none where more has been accomplished under such, adverse conditions. Capt. Vivian has put a world of energy in the work of rehabilitating this old mine. He knows perfectly well what is necessary to render it a success, and knows that what he is able to do is far from adequate to accomplish such a result. Still, he does not relax any effort. In fact, it requires the greatest watchfulness, the best management—and no management could be better than his—to hold to the position already achieved. He illustrates that Johnny Bull perseverance and tenacity of purpose that in so many ways have done so much for the world's advancement.

There are a number of mining men in the copper district, and Capt. Vivian is of the list, who are very valuable men. They combine thorough practical mining experience and energy of character with the best of executive ability. They are equal to any department of the work.

Some accidents, serious ones, to the stamp mill have occurred lately, to add to the perplexity. The first was the explosion of one of the boilers, and lastly, the total destruction of the mill by fire. It was generally supposed that this latter catastrophe would cause the total

suspension of work of the mine, but, on the contrary, the mill was speedily rebuilt, and is again in operation.

### HURON MINE REPORT.

*Boston, Mass., March, 1887.*

*To the Stockholders of the Huron Copper Mining Company:*

Herewith we hand you the usual statements of the doings of your company for the year 1886, including our agent's report of the condition of the mine and its prospects for the future.

The ruling or average price of copper for the year (10 989-1000 cents per lb.) was a much lower price than we had reason to expect, and that, together with our limited amount of openings to produce rock from, are the principal causes for an unsuccessful year.

The property of the company, or rather the vein we are working, is one of the master lodes of the copper country, and for permanency and uniformity of show of copper, no other vein has exhibited stronger characteristics for so great a distance, and at all points opened, extending as it does from quite a distance on the north shore of Portage Lake to Evergreen Bluff, and beyond in Ontonagon county, some thirty or forty miles, and somewhere in this lode a very large development is to be expected. At the Huron, the vein has improved as depth was attained, the bunches of good ground have been larger, more frequent and richer, and no one familiar with the characteristics of the lode can doubt that more extensive openings and larger mill and hoisting facilities would soon put the mine in a strong position as a permanent and paying institution. Our length on this vein being amply sufficient, if fully opened, to supply eight to ten heads of stamps, or four or five times our present capacity, and it is believed by those fully posted in the matter, that your mine worked on as large a scale as its nearest neighbor, the Atlantic, would surely pay as well as that mine, even with copper at ten cents per pound.

In brief, the mine has an abundance of good copper ground, and will pay a good profit to work, if proper development and equipments are provided, and a reasonable price can be had for our product.

The situation of copper seems to be such that the price can hardly go lower, but that it should advance somewhat in price.

Captain Johnson Vivian still has charge of the mine, and has done all possible things to promote the best interests of the company.

For the directors,

D. L. DEMMON, *Treasurer.*

Below we give a detailed statement of expenditures at Lake and Boston for the past year:

Mining expenditures, labor, etc.....	\$42,024 82
Sinking 312 1-10 feet shafts, and 216 1-10 feet winzes.....	9,181 11
Drifting and cross-cutting 1,381 5-10 feet at \$11.53.....	15,283 43
Stoping 5,427 fathoms.....	55,433 12
Sundry labor, etc.....	249 00
Supplies and fuel.....	16,798 76
Surface expense.....	8,439 25
Stamp mill expense, 90,130 tons at 52 70-100c.....	47,503 16
Tram road expense, 90,130 tons at 2 90-100c.....	2,616 38
Rock house expense, 90,130 tons at 10 43-100c.....	13,465 58
General expense at mine and office.....	8,591 50
Or a total of.....	\$219,586 11
To which is to be added smelting, freight, insurance, expense, etc., paid in Boston.....	51,256 20
Or a grand total of.....	\$270,842 31

The total production of mineral for the year was 2,512,675 lbs., which gave a yield of 79 707-1000 per cent, refined copper, or 1,992,695 lbs. The highest price obtained during the year was

12 cents. Lowest, 9¾ cents. The average price was 10 989-1000 cents per lb.

HURON COPPER MINING COMPANY, CASH ACCOUNT FOR THE YEAR ENDING DECEMBER 31, 1886.	
Cash on hand January 1, 1886 .....	\$689 16
Cash received from sales of copper, 5,059,206 lbs. at 10 989-1,000c.....	226,281 85
Cash received from sale silver.....	200 0
Cash received from interest.....	28 65
Cash received from loans.....	511,270 40
	\$738,470 06
<i>Contra.</i>	
Cash paid loans.....	\$463,283 36
Cash paid drafts.....	234,603 38
Cash paid smelting, freight, copper charges, brokerage.....	38,043 21
Cash paid interest, expense, insurance, storage.....	11,380 42
Cash on hand December 31, 1886.....	1,159 69
	\$738,470 06

HURON COPPER MINING COMPANY, ASSETS AND LIABILITIES, DECEMBER 31, 1886.	
<i>Assets.</i>	
Cash on hand .....	\$1,159 69
Copper on hand, 238,423 lbs. at 10½c.....	25,034 41
Supplies at mine .....	28,085 20
Notes receivable .....	8,090 40
1886, silver (sold).....	160 10
Rock broken in mine ready for hoisting, say 10,400 tons valued at.....	10,000 10
	\$72,529 80
<i>Liabilities.</i>	
Drafts accepted and in transit.....	\$19,790 02
Loans and bills payable.....	181,023 06
Liabilities at mine.....	26,939 29
Due for smelting and freight.....	4,727 46
	\$233,484 83
Less assets.....	72,529 80
Balance liabilities December 31, 1886.....	\$159,955 03

To offset which we have machinery, buildings, etc., (exclusive of the mine) valued at \$151,852.71.

#### AGENT'S REPORT.

HURON COPPER MINING COMPANY, HOUGHTON COUNTY, MICH.  
*Houghton, Mich., January 25, 1887.*

D. L. DEMMON, ESQ., *Treasurer.*

*Dear Sir:*—As the time for making the annual report of the operations and expenditures of this mine has arrived, I beg leave to submit the following, with inventory of supplies, tools, and machinery. Also tabular statements, showing in detail the cost of each department of our work, together with map of the mine, which has been carefully surveyed and plotted, for the year ending December 31, 1886.

#### SURFACE WORK.

On account of the unprecedented low price of copper that ruled during the summer months, nothing in the shape of improvements has been done in this department. All repairs required have had proper attention, which has kept everything connected with it in good condition.

#### MACHINERY.

We have not added anything to our plant for the past year; but it will be necessary for more economical working, to remove at least two of the old "hog nose" boilers at the hoisting engine next spring, and substitute therefor one large fire-box boiler. The cost of making the change will soon be paid for in the saving that will be made in fuel.

#### STAMP MILL.

We have treated 90,130 tons of rock, which is a falling off of 5,346 tons from the amount treated in 1885; which was on account of the breaking of two stamp-shafts and the explosion of one of the boilers, etc. At this writing the mill is in good condition, running regular and doing better duty than at any time for the last six months.

The following openings have been made:

Sunk in shafts.....	312 1-10 feet.
Sunk in winzes.....	216 1-10 "
Drifting.....	1,381 5-10 "

The total amount of ground broken was 7,170 644-1000 fathoms, or 120,073 tons of rock. The amount of rock hoisted was 129,437 tons, of which 38,943 tons was rejected, or 30 10-100 per cent, of the amount taken out of the mine. The total cost of manipulating a ton of rock hoisted was 1 70-100 dollars.

No. 6 shaft has been sunk from the thirteenth to the fourteenth level. With the exception of a few feet just below the former level the lode in this opening is showing copper in paying quantities. The fourteenth level has been opened fifteen feet south and twenty feet north of the shaft. The lode, at this point, is large and well filled with all grades of mineral. There seems to be a large and good block of ground between this and the thirteenth level which will pay well to remove by stopes. The twelfth and thirteenth levels, north of this shaft, have exposed some good stoping ground. In the latter, for a distance of about one hundred and twenty-five feet, the lode is from thirty to thirty-six feet in width, and carrying some copper throughout. In a winze sinking below the thirteenth level, in this run of productive ground, the lode is showing some good stamp rock and a fair amount of barrel copper. No. 8 shaft has been sunk from the thirteenth to a point thirty feet below the fourteenth level. For the whole distance the lode is large, and in some places quite rich in stamp rock. The fourteenth level has been opened south one hundred and twenty feet, the greater part of which will pay to stope. The ground north of this shaft is not showing anything of value. Owing to some of the stopes not producing as well as we had reason to believe they would at the date of our last annual report, and the suspension of the openings last spring on account of the low price of copper, etc., we have not done as well in way of product as we expected. But at this writing everything seems to show, and especially the openings at the bottom levels, that there is something better in store for us. This lode, like all other amygdaloids that have been extensively worked on Lake Superior, will doubtless improve as depth is attained. And all that is necessary to place the Huron on the dividend list is more extensive openings, additional machinery, and a larger output.

Captain T. Whittle and Mr. Alex. Loranger, the clerk, are still with us, and I take pleasure in saying that they have worked earnestly to promote the best interest of the company.

I am, yours respectfully,  
J. VIVIAN, *Supt.*

Table of product of Huron mine:

Year.	Tons.	Pounds	Year.	Pounds.	Tons.
1855	3		1871	134	1,453
1856	12		1872	276	1,684
1857	35		1873	237	1,883
1858	24		1874	125	1,005
1859	22	1,387	1875	31	1,289
1860	4	1,000	1876	31	1,857
1861	49		1877	41	161
1862	69	1,305	1878	32	1,100
1863	69	236	1879	14	1,760
1864	50	1,745	1880	35	285
1865	238	11	1881	127	515
1866			1882	182	579
1867	683	1,164	1883	360	213
1868	740	80	1884	963	1,660
1869	841	863	1885	1,135	1,163
1870	42	183	1886	906	995
Total				7,612	1,556

D. L. Demmon, Sec. & Treas., 19 Congress street, Boston, Mass.; Johnson Vivian, Superintendent, Hancock, Mich.

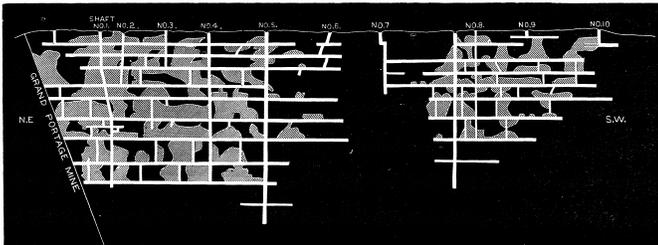
**THE ISLE ROYAL**

mine, north of the Huron, remains without change, as does also

**THE GRANDE PORTAGE.**

I have been through the latter several times and have examined it carefully. I felt satisfied that, opened and worked largely, the mine could be safely operated. That is, it would be sure to pay expenses. Both are in the same lode with the Huron.

LONGITUDINAL SECTION OF THE ISLE ROYAL MINE, 1887.  
Scale, 300 ft. to one inch.



**THE ATLANTIC MINING CO.**

I have written very fully regarding the Atlantic in previous reports, and, as I find nothing new at the mine, all that I can say must be, in the main, a repetition of what I have heretofore stated.

The Atlantic rock yields the lowest percentage of copper of any mine worked in the State. And yet it is operated at a profit—annually returning to the shareholders a dividend. It will be seen by referring to the statement that the average yield of rock for the year was less than 14¼ lbs. to the ton, with an average gross value of \$1.53, but it is so mined and manipulated as to leave a profit of 15.3 cents on each ton of rock. The stamp mill expense of 26½ cents per ton is astonishingly low. There is not much of a margin for extravagance and

mismangement in a total cost, mining and stamping, etc., per ton of rock of \$1.38. This includes mining the rock, raising it from 1,000 to 1,300 feet to the surface, tramping to the rock house, breaking it, transporting it 3½ miles by railroad to the lake, stamping and working, taking to smelting mill, smelting, etc.

An examination of the map and the accompanying figures will lead to a clearer understanding of the problem.

ATLANTIC MINE REPORT,

The directors present the following report of operations during the year 1886.

The production of mineral was 4,850,179 pounds, which yielded 72½ per cent., or 3,503,670 pounds of refined copper. The shipments to market during the year amounted to 3,488,790 pounds, for which,—estimating the copper unsold at the close of the year at 10½ cents per pound,—has been realized an average price of 10 92-100 cents per pound.

The following is a summary of the year's business:

PRODUCTION.		
Copper sold	2,922,996 lbs., av. 11 c.	\$321,754 98
" on hand	565,794 " at 10¼c.	59,408 37
	3,488,790 lbs., averaging 10 92-100 c.	\$381,163 35
Copper at smelting works Dec. 31st, 1885,	364,981 lbs., valued at 9 cents, net.	\$32,848 29
" " " " " 1886,	379,861 " " " 8 " "	30,388 88
		2,459 41
Net value of product of 1885		\$378,703 94
Add balance of interest account		3,640 47
		\$382,344 41

COSTS.		
Working expenses at mine as per clerk's tables		\$273,942 04
Freight	\$13,967 90	
Smelting	36,873 97	
Expenses	6,451 23	
Brokerage	1,009 54	
Insurance	993 95	
Storage	8 00	
	59,004 59	333,846 63
Showing a mining profit in 1886 of		\$48,407 78

There has also been expended for addition to plant, as per detailed statement hereinafter	\$2,394 49	
And for 160 acres of land controlling part of watercourse which supplies the stamp mill with water	4,800 00	7,094 49
Leaving a net gain for the year		\$41,403 29
The surplus from 1885, after payment of dividend, was		262,696 80
Making the net surplus December 31st, 1886		\$304,100 69
as shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of one dollar per share (\$40,000) was paid January 28th, 1887.		

For details of the work performed, and its cost, we refer to the subjoined tables and summary of results. The usual financial statement and report of agent at the mine are also submitted.

JOSEPH E. GRAY,  
JOHN J. CRANE,  
GEO A. HOYT,  
JOHN STANTON,  
J. R. STANTON,  
*Directors.*

ASSETS AND LIABILITIES, ATLANTIC MINING COMPANY, DECEMBER 31ST, 1886.

Assets.		
Cash		\$18,208 50
Loans		100,000 00
Accounts receivable		9,075 52
Copper on hand, sold, 331,807 lbs.		40,011 27
" " " unsold, 565,794 lbs at 10¼ cents.		59,408 37
" " " at smelting works, 379,861 lbs at 8 cents net.		30,388 88
		\$257,092 54
At Mine.		
Cash	\$2,845 25	
Coal	7,201 94	
Wood	12,702 65	
Supplies	26,461 32	
Merchandise in store	35,370 66	
Total assets		\$4,581 82
		\$341,674 36

<i>Liabilities.</i>	
Indebtedness at mine .....	\$13,268 44
Agent's drafts outstanding .....	11,774 03
Accounts payable .....	12,581 80
	37,574 27
Balance of assets .....	\$904,100 00
Less dividend payable January 28th, 1887, \$40,000.)	

STATEMENT OF WORKING EXPENSES AT THE ATLANTIC MINE FOR THE YEAR ENDING DECEMBER 31st, 1886.

<i>Underground Expenses.</i>	
Sinking 97 feet, averaging \$22.94 net .....	\$2,225 00
Drifting 3,623.1 feet, average \$4.28 net .....	15,507 17
Stoping 14,186 92-216 fathoms, averaging \$4.74 net .....	67,260 51
Timbering, tramping and labor .....	50,282 96
Timber, materials and supplies .....	8,519 95
	\$143,795 59

<i>Surface Expenses.</i>	
Superintendence, and labor of all kinds, less sundry credit items .....	\$27,623 95
Supplies and materials .....	4,614 60
Fuel .....	22,998 55
Feed for teams, etc .....	1,138 17
Fire insurance .....	460 00
Taxes .....	2,676 39
Canal tolls .....	279 24
Expenses .....	367 59
	\$60,158 49
Less amount received for rents .....	4,153 25
	56,005 24

<i>Railroad Expenses.</i>	
Labor .....	\$5,333 75
Fuel .....	2,406 50
Supplies .....	1,282 50
	\$9,022 75
Less received for hauling 320 tons freight .....	410 00
	8,612 75

<i>Stamp Mill Expenses.</i>	
Labor .....	\$26,847 45
Fuel .....	28,329 75
Supplies .....	10,637 79
Insurance .....	662 50
Taxes .....	652 00
Teaming, mineral, etc .....	398 97
	65,528 46
Total running expenses .....	\$273,942 04

CONSTRUCTION ACCOUNT.

<i>At Mine.</i>	
Four dwellings .....	\$549 40
<i>At Mill.</i>	
Five slime tables .....	\$1,000 00
Four iron body jigs .....	420 00
Addition to house .....	200 00
Log house .....	125 00
	1,745 00
	2,294 49
Total expenditures .....	\$276,236 53

SUMMARY OF RESULTS.

Ground broken in openings and stopes .....	14,724 cubic fathoms
Rock stamped .....	247,036 tons
Product of mineral .....	4,850,179 lbs
Product of refined copper .....	3,503,870 "
Yield of refined copper per cubic fathom of ground broken .....	238 lbs
Yield of rock treated, 14 18-100 lbs. copper per ton, or .....	709 percent
Gross value of product, per ton of rock treated .....	\$1,5330
Cost per ton of mining, selecting and breaking, and all surface expenses, including taxes, .....	.8088
Cost per ton of transportation to mill .....	.0348
Cost per ton of stamping and separating .....	1.1089
Cost per ton of freight, smelting and marketing product, including New York office expenses .....	.2425
Cost per ton of working expenses .....	1.3514
Total expenditures per ton of rock treated .....	1.3801
Net profit per ton of rock treated (exclusive of interest earned) .....	.1529

AGENT'S REPORT.

*Atlantic Mine, L. S., Mich., January 1, 1887.*

JOHN STANTON, Esq., *Treasurer Atlantic Mining Co., New York:*

*Dear Sir:*—The following report of operations at the Atlantic mine for the year 1886 is respectfully submitted:

No. 2 shaft has been extended from the 9th to the 11th level, and put in running order to that point. The 3d, 8th and 10th levels, north of this shaft, have been operated with fair results.

The 5th, 7th and 9th levels have been extended north of No. 1 shaft, and rising stopes have been carried to the line of the shaft. With very little expense this shaft can be put in running order to the 9th level.

No. 3 shaft has been sunk to the 16th level. Drifting and stoping has been done in the 12th, 13th, 14th, 15th and 16th levels north, and the 15th and 16th levels south of the shaft.

No. 4 shaft has been put in running order from the 13th to the 14th level. Drifting and stoping has been done in the 10th, 11th, 12th, 13th and 14th levels south of this shaft. As we extend 1,000 feet south of this shaft, the lode seems to get leaner, and will not pay to operate.

The shafts and pumping machinery are in very good working order.

The map shows the extensions of the workings to date. You will notice that the 12th and 13th levels have passed the line of No. 2 shaft, and it is necessary to operate these levels through this shaft, and also the 3d, 5th and 7th levels through No. 1 shaft in order to save the expense of tramping the rock so great a distance through these long levels.

STAMP MILL.

The stamp mill has been operated very successfully. The rock has been treated cheaper than in any previous year.

Considerable repairs and additions to the dressing machinery have been made during the year. Some of the old wooden jigs have been removed and replaced with new iron ones, and four new iron ones added. Ten of the slime tables, which have worked for years and become unfit for use, were taken out and replaced with ten new double tables, having about double the capacity of those removed. A launder 1,000 feet long and twenty inches wide has been laid to convey the waste sands towards Cole's creek, and prevent the sand running so far out in the old channel.

The mill is in very good condition and capable of treating more rock than we can possibly give it with our present hoisting capacity.

RAILROAD.

The railroad has been operated very successfully. The cost of transporting the rock to the mill was only 3.48 cents per ton. The road and rolling stock is in fair condition. There were 1,830 new ties put in during the last season.

MACHINERY.

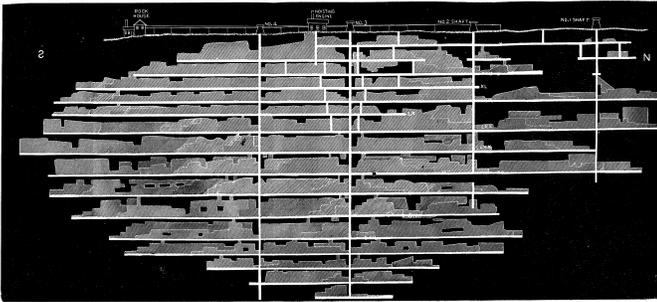
The plant at the mine has done the work very satisfactorily. It has become necessary to operate No. 1 shaft, and to do so we shall have to extend the trestle road from No. 2 to No. 1 shaft, about 800 feet. This road will then convey the rock from these two shafts to the rock-house. The trestle-road will also have to be extended about 600 feet, connecting No. 3 with No. 4 shaft, and this road will take the rock from these shafts to the rock-house.

I would refer you to the tables made by Mr. Van Tassel, which show the cost in every department, and also the map filled out to date.

Allow me to recommend to your favor the different officers who have labored faithfully for the best interests of the company.

Yours truly,  
WM. TONKIN, *Agent.*

LONGITUDINAL SECTION OF THE ATLANTIC MINE, JAN., 1887.  
Scale, 80 Ft. to one inch.



The following table gives the important results of the mine's operations for the past 11 years:

	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Number of tons of rock stamped.....	80,000	96,696	105,780	121,700	112,068	109,285	176,555	189,800	195,069	209,310	241,030	247,635
Yield of ingot per ton, in pounds.....	19.58	18.90	19.42	18.50	19.60	14.27	14.28	13.86	13.78	15.1	14.86	14.18
Number of fathoms broken in mine.....	5,628	6,500	7,091	8,290	8,665	9,529	9,240	10,110	11,163	12,210	13,603	14,224
Yield of ingot per fathom, pounds.....	278	290	290	243	209	244	2,735	259	240	259	267	258
Cost in cents per ton for stamping and washing.....	87.96	67.69	87.79	68.85	62.44	88.13	62.54	67.67	66.36	69.36	60.36	60.53
Total cost per ton of rock mined, etc.....	3.90	3.38	3.08	2.78	2.26	2.25	1.96	1.66	1.79	1.51	1.59	1.29
Average price per pound received for copper.....	\$0.2212	\$0.1885	\$0.1887	\$0.1868	\$0.2229	\$0.1884	\$0.1886	\$0.1825	\$0.1856	\$0.1897	\$0.1927	\$0.1928
Dividends paid.....	2247	2123	1854	1615	1620	1897	1712	1756	1850	1181	1116	1092
Net profit per ton of rock.....	44	51	141	87	200	471	493	2483	9919	2295	2295	1529
Per cent of copper in rock.....	.379	.349	.371	.325	.35	.713	.748	.638	.685	.735	.712	.719

The following table gives the product for each year:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1866.....	6	1,475	1877.....	1,027	304
1867.....		1,760	1878.....	1,132	1,592
1868.....	764	258	1879.....	1,152	1,822
1869.....	823	857	1880.....	1,170	1,195
1870.....	186	617	1881.....	1,264	9
1871.....			1882.....	1,315	1,708
1872.....			1883.....	1,341	197
1873.....	431	1,336	1884.....	1,586	1,585
1874.....	686	403	1885.....	1,791	533
1875.....	783	1,036	1886.....	1,751	1,670
1876.....	917	1,041			
Total.....				18,130	1,431

John Stanton, Treas., New York; Wm. Tonkin, Agent, Houghton, Mich.

## THE ONTONAGON DISTRICT

presents little that is new to record. I have written very fully of this section of the copper region heretofore, and have taken occasion to express myself very favorably regarding it. I see no reason to retract, or to in any way modify what I have formerly said as to my belief in its metallic richness. Sometime, when the country is more accessible, when there is greater interest in copper discoveries, Ontonagon county will again come to the front as an important mining district.

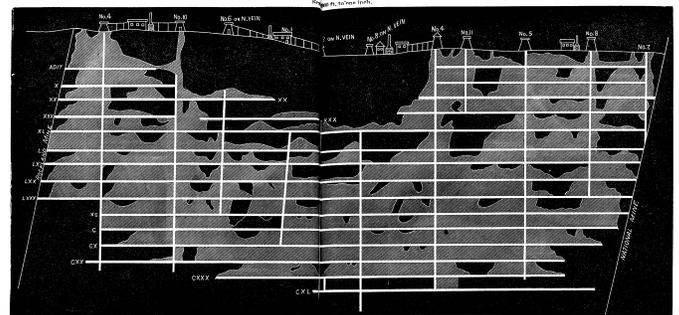
Just now, also, some interest is taking in the Iron River Silver District, which ten years ago was very active. All work was suddenly abandoned in about 1877, and nothing has since been done. These silver deposits were described in the Commissioner's Report for 1877-78. A few tons of the rock have been sent to Chicago to be treated, and the result is awaited by the parties interested. The Gogebic Iron Range was formerly embraced in Ontonagon county, but was recently detached by the last Legislature to form the new county of Gogebic.

The most important of the Ontonagon mines is

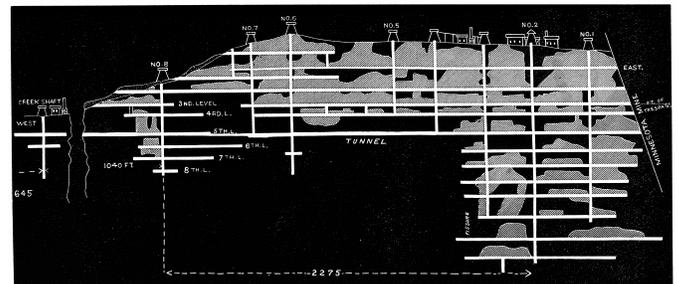
## THE NATIONAL,

which now includes the once famous Minesota, also. They are contiguous mines, the openings, even, intersecting one another. The National company has been engaged during the past year in driving an adit from the Ontonagon river through the mine. The purpose and location of this tunnel is fully explained in my last report. It is now about completed. The greatest difficulty has been experienced in making the final connection between the entrance portion and the creek shaft. Instead of its being rock, which would have given little trouble, the ground is sand, gravel, boulders, and quicksand. Sometimes it would run clear to the surface, letting in the water of the creek and everything else upon the men and work. This trouble happened several times through the effects of blasts.

LONGITUDINAL SECTION OF THE MINNESOTA MINE, 1887.  
Scale, 80 Ft. to one inch.



LONGITUDINAL SECTION OF THE NATIONAL MINE, JAN., 1887.  
Scale, 80 Ft. to one inch.



The rate of driving has been rapid. It maybe briefly stated as follows: Commencing June 13 1886, since which time hoisting and pumping machinery have been set up at the creek, and at No. 8 shafts, and both shafts have been freed of water and repaired, and 500 feet of skip road put in No. 8, and 3,900 feet of tunnel completed May 1, 1887. The whole length of tunnel from the western extremity easterly to No. 2 shaft, is 3,950 feet. With the exception of the west 640 feet, it is driven in the conglomerate vein, starting in the face of the bluff 188 feet above the river, and about three-fourths of a mile distant from it.

It is, of course, on a uniform grade. The rock driving was done with power drills, of which six were used until some of the connections were made. The compressor is in the stone building near No. 2 shaft, and the air was carried in the pipes from there to the point of attack. The main pipe from the compressor is 3" diameter, and is placed along the surface to creek shaft; thence the pipe used is

1½" diameter. The expansion points are put in at intervals of 500 feet, and notwithstanding they had nearly a mile in length of pipe along the surface, with offsets at every point, aggregating, before they finished much more than the extent of surface pipe, there was not at any time any delay, at any point, by reason of interruption of the flow of air. Four blowers, driven by steam, were used to aid in ventilation, in the long drifts.

The average number of men employed was 52, all told. No stoping was done on the line of the tunnel, though some apparently good ground was cut through. About 15 tons of copper were obtained in the work. The average dimensions of the transverse section of the tunnel are eight feet high and seven feet wide.

The work now will be to cross-cut the ground between the adit and the amygdaloid belt described in previous reports. Capt. Parnell is now, May, driving a cross-cut, starting from the adit near old No. 6 shaft, and another between it and No. 2 shaft. When the cross-cuts are completed, the amygdaloid will be driven in east and west 1,200 feet, in the same horizon as the adit.

The amygdaloid is a stamp lode, and so far as it has been proved, is a good one. If it continues to show up favorably, as it probably will, the future of the National will be assured. A stamp mill of the modern class will be required, and the National will again merge into the ranks of first-class mines.

I believe that there is still a prosperous future in store for the National. The plan of the management, as now carried out, is to prove the mine, to make sure that there is plenty of good milling rock in the mine before going to any larger expenditure in plant.

The adit gives a "back" of over 500 feet for a length of 2,600 feet. All the material will find an outlet through the adit to the river, where the mill will be built. There is no doubt that if copper were at the price it usually holds, it would be safe to predict the work for the coming year; but, certainly, there is not much encouragement to push things at a copper mine when the circumstances are as at the National.

Capt. Wm. E. Parnell, who took charge of affairs on the resumption of work six years ago, still continues Superintendent. D. L. Demmon, Secretary and Treasurer.

The National has produced, in the aggregate, 5,449 tons 1871 lbs. of refined copper.

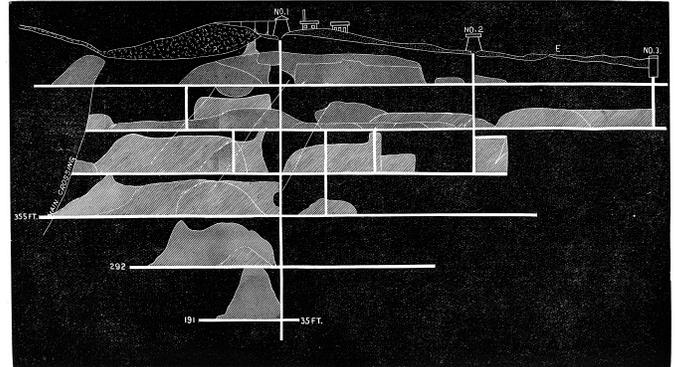
## THE MASS MINING COMPANY

continued to operate its mine on company account, until September, 1884, when it was leased by Mr. Benj. F. Clay mouth *et. al.*, who worked it under the title of the Mass Tribute Company, until the spring of 1887, when they shut down and ceased work altogether. They could not make any money with copper at 10 cents a pound. The Mass has of late years been well managed, having been of late years in the hands of one of the most

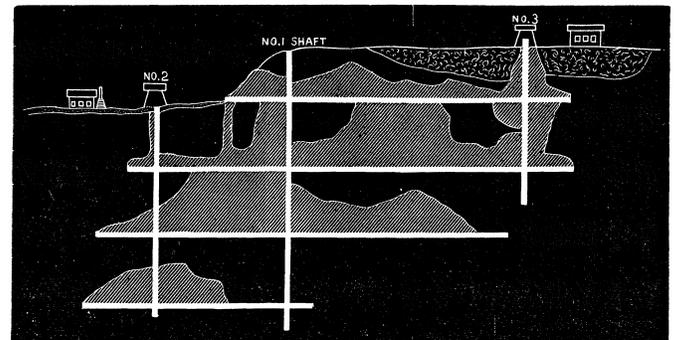
intelligent and experienced miners in the country. But it is too small a mine, and worked on, too limited, a scale, to achieve any great success. It should be combined with the Knowlton and with the Ogima. I explained all this very fully in my last report, and it is not necessary to reiterate here my former statements.

The work at the Mass has demonstrated the great value and the characteristics of one of the important copper-bearing belts of the Evergreen Range., the Knowlton vein, and the experience thus here obtained, will be of great value in other mines in all future working.

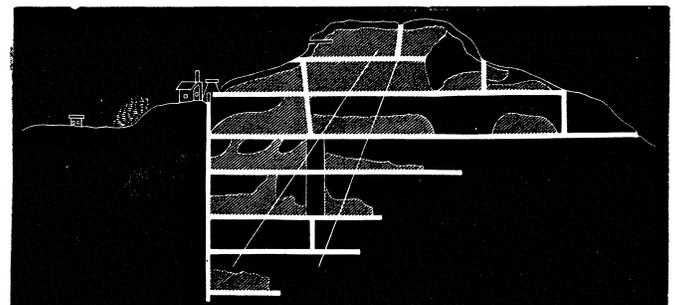
LONGITUDINAL SECTION OF THE MASS MINE, JAN., 1887  
Scale, 100 ft. to one inch.



LONGITUDINAL SECTION OF THE KNOWLTON MINE, 1887.  
Scale, 100 ft. to one inch.



LONGITUDINAL SECTION OF THE EVERGREEN BLUFF MINE, 1887.  
Scale, 250 ft. to one inch.



**Table of product of Mass mine:**

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	8	228	1872		1,406
1858	6		1873	4	265
1859	26	682	1874	5	1,925
1860			1875	1	1,014
1861			1876	40	1,932
1862			1877	54	238
1863			1878	206	339
1864	4	1,452	1879	228	294
1865	6	936	1880	258	1,159
1866	5	112	1881	233	1,684
1867	5	40	1882	368	1,446
1868	9	639	1883	329	1,474
1869	1	1,213	1884	281	718
1870	1	1,408	1885	181	1,500
1871	9	692	1886	123	1,179
Total				2,408	786

In the

**KNOWLTON**

and other of the Evergreen Range mines, the usual amount of tributing has been done, with the customary results.

**THE RIDGE COPPER COMPANY.**

The year's work at the Ridge is set forth in the following report. The description of the mine, etc., I have given as fully as necessary in former reports.

**Table of product of the Ridge mine:**

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	30		1871	175	150
1856	35	631	1872		
1857	36	1,874	1873		
1858	29	790	1874		
1859	39	690	1875		
1860			1876		
1861			1877		
1862			1878		
1863			1879		
1864	8	917	1880		
1865	85	433	1881		
1866	71	711	1882		
1867	94	1,537	1883		
1868	86		1884		
1869	126	1,840	1885		
1870	122	1,700	1886		

**RIDGE MINE REPORT.**

The product of the mine for the year 1886 has been:

Barrel copper	147,413 lbs.
Mass copper	64,902 lbs.
	212,315 lbs., or 106 315-2,000 tons.
Which has realized	\$17,188 75

**The expenditures for the year have been:**

Mine expenses	\$14,471 65
Other expenses as per treasurer's account	4,923 72
	\$19,400 37
From which deduct total receipts	17,188 75
Loss on business of the year	\$2,211 62
The statement of assets and liabilities in last report showed a balance of	\$7,419 05
Assessment called	9,938 50
	\$17,357 55
Deduct loss on business of 1886	2,211 62
Balance on January 1, 1887, as per statement	\$15,145 93

**BALANCE SHEET FROM THE BOOKS OF THE RIDGE COPPER COMPANY, JANUARY 1, 1887.**

<i>Expenditures.</i>	
Real estate—cost of property	\$203,541 00
Expenditures as per published statement to January 1, 1886	1,123,574 81
<b>1886.</b>	
Mining account	\$13,531 11
Smelting	1,539 27
Expenses, taxes and copper charges	2,486 24
Transportation	903 21
	18,459 83
Dividend account:	
Paid February 24, 1873	\$50,000 00
Paid February 23, 1874	20,000 00
Paid February 8, 1875	20,000 00
Paid February 10, 1880	9,784 50
	99,784 50
Company's stock, costing	304 40
Treasurer's account—cash on hand	15,460 00
	\$1,461,124 54

*Receipts.*

Capital stock:	
Paid in for property	\$200,000 00
Assessments	219,938 50
	\$419,938 50
Copper account:	
Sales to January 1, 1886	\$1,007,361.37
Sales in 1886	17,188 75
	1,024,550 12
Interest account:	
Collected to January 1, 1886	16,635 92
	\$1,461,124 54
Shipments in 1886	212,315 lbs.
Yield	74.551 per cent.
Ingots	158,272 lbs.

**STATEMENT OF LIABILITIES OF THE RIDGE COPPER COMPANY, AND OF AVAILABLE ASSETS, JANUARY 1, 1887.**

<i>Liabilities.</i>	
Dividends unpaid	\$215 50
Drafts outstanding	1,416 04
Balance	15,145 93
	\$16,777 47
<i>Assets.</i>	
Treasurer's account	\$15,460 00
Cash on hand at mine	72 01
Supplies at mine	1,245 46
	\$16,777 47
Balance of available assets over liabilities	15,145 93

**AGENT'S REPORT.**

RIDGE MINE, Feb. 1, 1887.

*Philip Highley, Esq., Secretary and Treasurer.*

*Dear Sir:*—Herewith I submit a report of operations at the mine for 1886, with statement of accounts, inventory of supplies, tools, machinery, etc.

Tribute work has been continued during the year with satisfactory results. The production has been 106 tons of copper, all of which has been shipped to the Detroit smelting works, and consisted of one hundred and forty-three (143) barrels and eighty-nine (89) masses of copper.

On May 1 the tributors hoisted their copper, cleaned it and weighed it in to the company. I purchased from them one hundred and one thousand four hundred fifty-nine (101,459) pounds copper at a cost of \$4,928.67.

Most of the miners went to work again on tribute until October 1, when their copper was again hoisted, cleaned and weighed, and they delivered to me 110,856 lbs. at a cost of \$5,507.05. The total amount purchased of the tributors for the year was 212,315 lbs., of this amount 178,304 lbs. cost 5 cents per lb.—

\$8,815.20, and 36,011 lbs. at 4½ cents— \$1,620.50, or a total of \$10,435.72.

On November 1 I again let tribute for the winter months at 4½ cents per lb. upon conditions, however, that if the copper they produced sold for 12 cents per lb. they should receive 5 cents per lb., the former tribute price.

We have now 16 miners at work on tribute, and I estimate that they have taken out about 18 tons of copper so far this winter, and I estimate we shall have between 40 and 50 tons to ship in May.

The great bulk of the copper taken out by tributers the past two years, has been taken from the old abandoned ground at and above the thirty fathom level, in ground long since abandoned by the former manager of the mine. It has also come almost exclusively from the west end of the mine. This would seem to prove beyond a shadow of doubt that there is a rich shoot of copper ground from the surface downward.

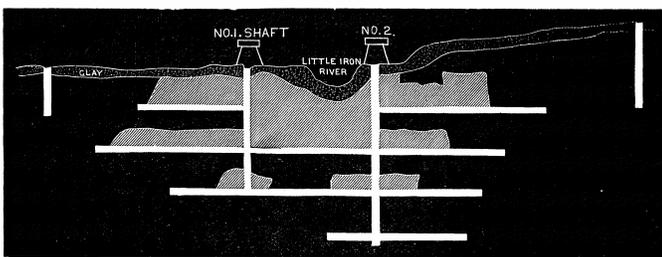
It would seem that one of the first efforts of the company should be to sink the No. 1 shaft from its present bottom in the 10 level to the 50 level at least, and extend the 20, 30, 40 and 50 levels in the western boundary line to the Evergreen Bluff mine. As near as I can estimate these levels can be driven yet from 150 to 250 feet to reach the boundary line. The shaft could be sunk very rapidly by sinking and rising from the different levels, and very cheaply, too, as the ground is of such a nature as to permit of being drifted and blasted easily. The sinking of this shaft would enable us to open a large body of ground, keep a moderate force of miners at work several years, and produce many hundreds of tons of copper.

Great care has been taken during this tribute work to see that no injury has been done to the mine, its shafts, or the accumulation of rock in any of the drifts.

During the year considerable work has had to be done in replacing old and decayed timber in the shafts, drifts and stulls. It was also found advisable to make new gutters in the adit level, and clean away considerable dirt and rock so as not to prevent the drainage of the mine, and stop any water flowing into the mine from the surface. The cost of the work was \$250.

During the summer I made a thorough exploration of the property so as to locate the five veins supposed to cross it. The five veins are known as the Evergreen, Ogima, Butler or Champion, Mass and Knowlton veins; they were all found, located and opened on. The exploration was confined to the western portion of the bluff where our present mine is opened.

LONGITUDINAL SECTION OF THE NONESUCH MINE, 1887.  
Scale, 200 ft. to one inch.



The Evergreen vein is the one on which our present mine is opened, and has been wonderfully productive of mass and barrel copper wherever worked. The distance from this vein, north, to the Ogima vein is 260 feet; from the Ogima to the Champion or Butler vein is 100 feet; from the Champion to the Mass vein 300 feet; from the Mass to the Knowlton vein is 140 feet. Thus we find we have on the property, within the space of 800 feet, five distinct copper bearing veins, all of them

locally known to be rich in copper, and all of them could be reached and worked through the present mine by driving a cross-cut north from one of the lower levels, which I have no doubt will eventually be done. The cost of the exploratory work was \$178.30.

Owing to the improved outlook of the copper market and the advance in the price of copper last fall, I started to unwater the mine. From the start we were beset with many drawbacks, delays and obstacles, the facilities for the work were not at hand, the machinery was out of order; but we finally got to work, the mine is now unwatered below the 50 level in the No. 2 shaft, but owing to a difference in the level (of which I was not aware) between the No. 2 and 3 shaft the drainage is west of No. 2 instead of east, as it is in all the levels above, so that there is water in 50 level west of the No. 2 shaft, but it will take but a few days in the spring to take it out. If thought advisable the water then can soon be taken out of the 60 and 70 levels through the No. 3 shaft. We have sufficient dry wood left over for the work, and everything is ready. The cost of this work, repairs to machinery, wood, etc., was \$730.10; this includes, however, about 40 cords of dry wood at the engine house.

In December the east side of No. 2 shaft between the 10 and 20 levels came in and put a stop to our work of unwatering the mine. The timbers used were hemlock and were completely rotted, and the only wonder was that they lasted so long. Considerable difficulty was experienced in clearing and keeping away the rock, but heavy cedar timbers were put in and a good substantial job done. The cost of this work was \$181.

I would advise the continuance of tribute work, for the reasons before given, that it helps to keep the mine open. The mining captain is continually underground, and much of the time is employed in keeping everything in repair and good shape.

If, however, the condition of the copper market should improve, and promise a reasonable price for copper, I renew my advice to prepare ourselves for it by equipping the mine with modern machinery, power drills and other appliances to enable us to mine readily and cheaply procure copper.

In the meantime it will be my aim to keep the mine, and everything on the surface in good repair and condition, ready to commence work at any time.

Very respectfully,  
ALFRED MEADS, *Superintendent*,

## THE BELT COPPER COMPANY, LIMITED.

There is nothing new to record regarding the Belt. The mine and property are in charge of Hon. James Mercer, agent and resident director, Ontonagon, Mich.

This mine was the subject of much interest a few years ago from several causes, prominent among which was the high standing of the gentlemen who inaugurated the new enterprise. The parties who organized the company are Englishmen, and the general office is in London.

For upwards of a year past the mine has not been worked. The company paid for the mine in 1882, in cash, \$121,500; in fully paid up shares \$680,400 — \$801,000. Since which time there has been expended upwards of \$400,000.

The amount of copper produced is as follows:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
Prior to 1882.....	216	475	1884.....	89	351
1882.....	2	1,624	1885.....	13	1,433
1883.....	8	402	1886.....	3	1,486
Total.....				333	1,772

## THE JOHN DUNCAN LAND AND MINING CO.

has a large body of mineral lands that are esteemed valuable. These lands are mostly in Ontonagon county, in the Gogebic range. They are offered for sale or to lease.

Daniel Kloeckner, Secretary, Hancock, Mich.

## COPPER PRODUCTION OF THE WORLD.

The following figures are taken from a recent publication by Henry E. Merton & Co., London, Eng.

They give as the record of the output of the world for the last eight years, taking alone the three greatest producing countries.

The figures are in gross tons:

	United States.	Chil.	Spain and Portugal.
1879.....	23,000	49,318	33,361
1880.....	27,009	42,916	36,313
1881.....	32,000	37,989	39,258
1882.....	40,467	42,909	39,560
1883.....	51,547	41,099	44,607
1884.....	63,555	41,648	46,515
1885.....	74,053	38,500	47,873
1886.....	69,809	35,025	49,653

Since 1883 the United States occupy the position, undisputed, of being the greatest copper producing country of the world. Since 1879 the output has tripled, while that of Spain has increased only 50 per cent., and the make of Chili has considerably declined.

For the last three years the output of the different countries of the world has been as follows, the figures for 1884 and 1885 being those of Henry Merton & Co., modified by the United States geological survey, and those of 1886 being the data collected by the former:

Countries.	1886.	1885.	1884.
<b>EUROPE.</b>			
Great Britain.....	2,500	2,773	3,350
Spain and Portugal—			
Rio Tinto.....	24,700	23,484	21,564
Tharsis.....	11,000	11,500	10,800
Mason & Barry.....	7,000	7,000	7,500
Sevilla.....	2,135	1,800	2,000
Portuguesa.....	1,258	1,655	2,300
Other mines.....	3,500	2,424	2,251
Germany.			
Mansfield.....	12,595	12,450	12,582
Other German.....	1,870	2,800	2,200
Austria.....	550	585	670
Hungary.....	700	800	800
Sweden.....	600	775	682
Norway.....	2,220	2,560	2,706
Italy.....	900	835	1,325
Russia.....	4,875	5,100	4,700
Total Europe.....	79,463	76,551	75,410
<b>NORTH AMERICA.</b>			
United States.....	69,805	74,053	63,555
Canada.....	2,000	2,500	2,236
Newfoundland.....	1,125	778	668
Mexico.....	850	375	291
Total North America.....	73,780	77,706	66,750
<b>SOUTH AMERICA.</b>			
Chili.....	35,024	38,500	41,648
Bolivia.....	1,100	1,500	1,500
Peru.....	75	229	302
Venezuela.....	3,708	4,111	4,600
Argentine Republic.....	180	233	259
Total South America.....	40,088	44,573	48,239
<b>AFRICA, ASIA AND AUSTRALIA.</b>			
Algiers.....	110	250	290
Cape of Good Hope.....	6,015	5,450	5,000
Japan.....	10,000	10,000	10,000
Australia.....	9,700	11,400	14,100
Grand total.....	216,156	225,930	219,785

## GOLD.

A great impetus has been given to the explorations for gold by the development at the Lake Superior find in section 35, N. W. ¼ of T. 48, R. 28. Some very rich rock was found here two years ago that created no little excitement. Recently again some further work has developed still better results.

Mr. Julius Ropes, of Ishpeming, makes the following report regarding an examination by himself of some of this rock:

C. H. HALL.

*Dear Sir*.—I have completed the examination and assay of the average sample (12 oz.) of the rich gold quartz we selected at the company's office the 7th inst. and herewith give the result:

The 12 oz. were pulverized and an average taken out for assay, and the gold pounded out of the balance.

The assay gave 2,446.99 troy bullion per ton of ore. The bullion is 868 fine, gold, 187 fine, silver. This gives 2,112.85 oz. gold per ton, silver 334.64.

Value of gold at \$20.67 per oz.....	\$43,662 27
“ “ silver “ .95 “ “.....	317 90
Total value per ton ore.....	\$43,980 17
Value of bullion per troy oz. gold.....	\$ 17 83
“ “ “ “ “ “ silver.....	14
	\$ 17 97

The gold from the portion assayed added to the amount pounded out (less 12 grains, chipped off for assay) gives button of bullion herewith enclosed weighing 346 grains, 301 grains gold and 45 grains silver.

Value of gold in button.....	\$12 96
Value of silver in button.....	10
Total value of button.....	\$13 06

Very respectfully,  
J. ROPES.

This rock is obtained in a fissure vein at a depth 22 feet from the surface. The vein matter has a width of about 3½ feet which includes the slaty incasings of the quarter.

The land is owned by the Lake Superior Iron Co.

C. H. HALL, *Ag't.*

## THE ROPES GOLD MINE.

I went underground through the Ropes mine about the middle of April and it impressed me very favorably. The quartz vein is well defined and persistent. Certainly the mine could furnish far more rock if there were facilities for working it up.

The mine is to the 7th level 380 feet deep. First level has been opened 76 feet W. and 145 E. of shaft, 2d level 54' W. 135 E., 3d level 87' W. 133 E., 4th level 25 feet W. 195 E., 5th level 96 W. 168 E., 6th level 15 W, 96 E., 7th about 10 feet each way from the shaft and 7 feet wide. The richest pocket found was in the 1st level, which showed considerable free gold, I extract from the last annual report of the superintendent, S. S. Carry.

The entire report is of interest, but I omit all but the most essential facts.

A peculiarity of the ore bodies on the several levels, is their continuance on the foot wall 40 to 80 feet east, terminating in slate, then shifting to the south contact where there are uniformly reached by a cross-cut from 12 to 18 feet, the intervening ground of slate and quartz being a good milling ore. A reference to the vertical and horizontal plan of the mine by the captain, *herewith shown*, clearly indicates their position.

It is estimated that not to exceed one-third of the ground opened up has been stoped out on the series of lenses thus far worked upon, and that there stands in sight that cheaply and safely mined, as estimated by Capt. Trevarthen, above the 5th level, 38,000 tons.

While but little work or exploration has been done to prove the extent of paying ore bodies both north and south of the present workings, indications show their existence in considerable quantities all through the mine. A cross-cut was driven south from the vein 138 feet east of the shaft on the 3d level (shown on the plan), 43 feet through slate and quartz, the former assaying \$10 to \$15 in gold, the latter showing coarse free gold running very high. If this condition exists on ore level, it is reasonable to expect that the same horizon on the others will give as good results. The shaft has been sunk 92 feet since the date of last report.

The number of feet of winzes sunk between the several levels is 50. Number of feet of drifting, including cross-cutting, 747.

The only explorations done on the surface was the sinking of two pits in the swamp, 800 feet east of the Curry shaft on the strike of the lode. Owing to the influx of water and the lateness of the season the work was discontinued.

In the way of surface improvements there has been added to the plant and mine-equipment, for the payment of which funds were provided by an assessment of 10 cents per share on the capital stock, levied by the board of directors in April last, one 80-horse power boiler, 1 Merritt's 6 feet hoisting drum, 1 Duplex Rand air compressor, capacity 4 power drills, 4 Rand power drills, 5 Tullock automatic ore feeders, 700 feet of wire rope, 1 exploding battery, besides many other appliances.

There has been built one dry house, 12x20 feet, hoisting drum house, 20x25 feet, one blacksmith and carpenter shop, 20x40 feet, addition to and raising boiler house, 20x48 feet, one barn, two stories, 20x24 feet, sided and repaired frame house, house purchased, 20x25 feet, of Julius Tallene, boarded and roofed shaft house.

The additions to the plant for mill and mine have required considerable expenditure of labor and money to place in position and working order, but their advantage is shown in the rapidity with which developments have been carried forward in the mine, keeping in reserve large blocks of ground. The mine is in excellent condition and the reserves can be very cheaply extracted. This factor must be borne in mind and a portion of the year's expenditure credited with these reserves.

Early in the season the management contemplated several modifications, changes and improvements in the mill. These have been carried into effect as time and opportunity would allow. Most of them are completed and at a small cost. An increase in the amount of ore crushed has been the great desideratum. It has been accomplished, and we are now crushing from 33 to 35 tons to-day, against 17 tons a year ago—results that correspond, to mills elsewhere when it is

considered that we crush our ore much finer, using a 50-mesh screen, our gold, being finer, requiring it.

The first week in July, owing to the excessive and unprecedented drouth, the sources from which a sufficient supply of water had been obtained gave out, causing a stoppage of the mill for a time. Steps were immediately taken to bring in two small rivulets rising in a series of hills a mile or so to the west of the mill. Dams were built at a point on them which would give a head of 18 feet, which would bring it over an intervening hill and drop it into the swamp to the west of the mill; 1,200 feet of 3-inch pipe was laid west from the outlet, and the dams connected with this by 700 feet of 2-inch and 800 feet of 24-inch pipe. Work was started on the 8th and the water got to the mill on the 18th, causing a suspension of ten days of milling. But for the supply from this source the mill could not have been run two months since July 1.

Number of men employed has averaged 49 per month.

With the promising condition of the mine, and the increased capacity of the mill, the outlook is more promising for the future.

The loss in the tailings ranges from 95 cents to \$2.50 per ton, according to the grade of ore, averaging \$1.90 per ton, 80 or 90 per cent, of the value being gold.

We have crushed 6,959 tons the past year, giving a product as shown by the secretary's report.

Our mining captain, Mr. Trevarthen, and mill superintendent, Mr. Weatherston, have been untiring in their efforts to make their respective departments a success, and profitable to the company.

As a summary of the above facts the following is pertinent:

With the existence of large bodies of ore below the present levels as proved by the shaft, the body between the 5th and 6th levels, not included in the estimate, which are in sight (no winze between to the east as yet), a much larger reserve stands in the mine than the 38,000 tons reported, the larger part of which has been developed by the expenditure of the past year. While a year ago small bodies were in sight with promising indications, they remained to be proved up. The 38,000 tons at least should now be credited as a resource at \$1 to \$2 per ton net.

Though a close estimate of the value of these bodies, say 48,000 tons, would not be attempted, taking the results of the past year's work as a basis, at \$5 to \$7 per ton they approximate to a value of from \$200,000 to \$250,000 at the lowest. With the increased capacity of the mill, the skill and knowledge of the work acquired in the past both in the mine and mill, insuring a reduction of expenses, with no interference or interruption from causes as in the past, the outlook for a profitable year's run is certainly promising.

S. S. CURRY, Superintendent.  
JULIUS ROPES, President.

ISHPEMING, March, 1, 1887.

The following directors were elected for the ensuing year:

Julius Ropes, S. S. Curry, William F. Swift, W. H. Rood, Ishpeming; Dr. W. F. Carpenter, Stambaugh.

Twelve months ago there was but little ore in sight, and while everything underground presented a "healthy" appearance the mill was keeping pace with the miners, even though averaging but 19 tons per day. The introduction of a more powerful hoisting plant, air compressors and power drills provided

means for more rapid advance in mining work, and the fact that there are now 38,000 tons of ore ahead of the mill above the 5th level furnishes ample proof that satisfactory progress in the way of mine development has been made.

#### THE YEAR'S PRODUCTION.

The following facts regarding the product of the mine in concentrates and bullion we take from the company's books. With the exception of the February yield the figures are exact. The amount of the latter month are estimated, by careful assay, and will be found substantially correct, varying but little from the returns of the mint which have not yet been received by the company:

CONCENTRATE PRODUCT FOR YEAR ENDING MARCH 1, 1887.

1886.	Ounces.	Price.	Silver.	Gold.
March .....	269.75 silver at	\$1.01	\$272 45	.....
	41.148 gold "	20.67	.....	\$850 53
April .....	100.73 silver "	98.04	98 98	638 88
	31.879 gold "	20.67	.....	.....
May .....	211.17 silver "	96	202 72	.....
	27.127 gold "	20.67	.....	560 72
June .....	305.89 silver "	95	290 60	.....
	43.477 gold "	20.67	.....	898 67
July .....	370.85 silver "	96½	362 23	.....
	39.714 gold "	20.67	.....	696 87
August .....	275.61 silver "	1.03%	280 09	537 44
	28.001 gold "	20.67	.....	.....
September .....	381.56 silver "	1.01%	386 81	.....
	26.377 gold "	20.67	.....	544 39
October .....	216.93 silver "	98½	219 68	.....
	30.283 gold "	20.67	.....	625 95
November .....	291.54 silver "	99½	290 08	.....
	39.51 gold "	20.67	.....	816 67
December .....	152.04 silver "	1.01%	154 51	.....
	32.411 gold "	20.67	.....	669 94
1887.				
January .....	198.35 silver "	1.01%	201 32	.....
	153.60 silver "	1.01%	155 94	.....
	66.33 gold "	20.67	.....	1,371 04
February .....	.....	.....	.....	607 50
Total .....	.....	.....	\$3,062 29	\$8,838 00

BULLION PRODUCT FOR YEAR ENDING MARCH 1, 1877.

Year.	Month.	Silver.	Gold.
1886 .....	March .....	\$120 47	\$1,774 06
1886 .....	April .....	81 21	1,887 35
1886 .....	May .....	152 33	2,487 44
1886 .....	June .....	222 55	4,116 54
1886 .....	July .....	101 95	1,690 96
1886 .....	August .....	168 74	2,602 48
1886 .....	September .....	114 40	1,822 60
1886 .....	October .....	104 52	1,928 26
1886 .....	November .....	144 43	3,101 12
1886 .....	December .....	163 57	3,133 74
1887 .....	January .....	111 95	2,733 91
1887 .....	February .....	105 51	2,382 87
Total bullion .....	.....	1,591 63	29,961 33
Concentrates for d .....	.....	3,062 29	8,838 00
Total .....	.....	4,653 92	38,499 93

#### SUMMARY.

Amount silver produced .....	\$4,653 92
Amount gold produced .....	38,499 93
	\$43,153 85
Number tons quartz treated .....	6,959
Average yield per ton, over .....	\$6 20
On hand including February bullion and concentrates .....	\$3,972 50

There was expended the past year for permanent improvements the sum of \$12,000; \$8,000 were raised by an assessment of 10 cents per share.

