Adjoining the Pabst is

THE IRON KING,

one of the most valuable mines in the Gogebic range. It has been involved with the others of the so-called Burton group of mines to which it belonged, in the long controversy that grew out of Mr. Burton's financial embarrassments. It is now held by the Bessemer Consolidated Mining Co., which has become the owner of the Burton mining properties, consisting of the Iron King, Bonnie, First National, Blue Jacket and Valley.

Dan'l Mc Garry, President, Cleveland, Ohio; Mason W. Burt, General Manager, 164 Bank Street.

The Iron King is the only producing mine in the lot, and as all the others are, and have been, only sources of expense, the resources of the Iron King are taxed to meet the outgoes on these non-paying properties. Lack of funds and uncertainty as to final ownership kept the mine practically idle during the winter, and even now the work is not strongly pushed. They are only working two shafts, Nos. 1 and 2, which are in the north deposit and are 209 feet apart. They are 340 feet deep, being to the 3d level, which is just opening up. The body of ore gives a working length of 1,000 feet and a width of from 40 to 100 feet. The main thing to be apprehended is the "soap rock," which may be found strong enough to cut out the ore. I noted it as several points in the mine, and it seems to dip southwesterly, instead of easterly, as is the case elsewhere. Thus it will tend to shorten the ore body on the east, leaving it to lengthen west. The ore is of the very best found in the range, averaging 62% in iron and about .030% to the .035% in phosphorus.

The shafts are numbered from the west to the east, 1, 2, 3, 4 and 5. In my last report is a full description of these shafts of the mine generally, and there has been so little change since then in much of the mine, that I note little to add to what I have previously stated.

In the south vein, or on the quartzite foot wall, there is a good body of ore 135 feet long and 60 feet wide. The shaft is 210 feet deep. The ore, I am told, is of poorer quality than the north vein ore. Certainly it is, much of it, highly manganiferous. They are not mining this ore.

The company is raising this summer 500 tons of ore per day. About 150 men are employed, mostly miners.

The mine is timbered after the usual manner, 21 foot pillars are left, and the headings are of the same width—3 sets. The machinery, etc., has received no change.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1886	27,343	1887	74,609
Total			101,952

The description is the N. W. ¼, Sec. 24, 47, 47. E. H. Jones, Sup't, Ironwood, Mich.

THE BONNIE IRON MINING COMPANY'S

property joins the Iron King on the east. I described the min in considerable detail in my last report from notes taken a year ago, and there has been little in addition developed since then, except that ore was found in the north vein.

A shaft, which had been previously sunk 75 feet, was carried down to a depth of 135 feet, and a body of ore found which Capt Jones tells me is 35 feet wide. The Bonnie is a property which affords indications of possessing ore in sufficient quantity to be workable.

It is held by the Bessemer Consolidated. M. W. Burt, Gen'l Manager; Daniel McGarry, Pres't, 164 Bank St., Cleveland, Ohio.

Product, 1887, 1,003 tons.

THE FIRST NATIONAL IRON MINING CO.

has also passed to the control of the Bessemer Consolidated Mining Co. Daniel McGarry, President, Cleveland, Ohio.

The mine is idle and there has been no work done for a year past. The description given in my last report, 1886, written in 1887, suffices now as well as then.

Ore shipped in 1887, 1,997 tons.

And precisely the same may be said of the

BLUE JACKET MINE,

which lies east of the former, and remains now precisely as it was when I saw it and described it one year ago. Work was soon after discontinued and none has since been done. The estate consists of a ¼ section of land—the S. E. ¼, Sec. 18, 47, 46, and four shafts have been sunk to the maximum depth of 160 feet. It is one of the Burton group of mines that has passed to the control of the Bessemer Consolidated Mining Co. Daniel McGarry, President, 101 St. Clair street,Clevelend, O.

Product for 1887, 2,070 tons.

Joining the Blue Jacket is

THE RUBY IRON MINING CO.,

which is the new title of the Puritan, the mine having passed to other owners.

President, M. A. Hanna; S. W. Folsom, Trustee; C. S. Russell, Agent; W. P. Bice, Superintendent, Bessemer, Mich.; S. Hitchcock, Secretary, 101 St. Clair street, Cleveland, O.

The description of the land is the S. W. ¼, Sec. 17, 47, 46. The Ruby was one of the most promising mines of the range. There was a fine showing of ore and the indications were very favorable for the development of ore in much greater quantity. The surface has been pretty thoroughly test pitted and the pits all show very similar results—rich jasper, or jasper and ore. One cannot but think all the while that somewhere clean ore will be found. I can see no better way to determine whether there is any value in the property but to sink deep, near the foot wall; go down, if possible, through the capping. There may be lenses of ore lying deep. The fine body of ore at the east end, which was divided between the Ruby and the Ironton, has been entirely exhausted, as have also all the other deposits that were working a year ago. I described the mine with unusual fullness in my last report, having given considerable attention to examining it. The only work doing at the mine now is mining a surface pocket of ore and sinking No. 4 shaft, which has been carried down 80 feet and is sinking. The shaft is now 200 feet deep and is in rock, as is also a cross-cut north at the bottom, in 30 feet.

The company works 25 men in its exploring work. The Ruby has received a pretty large expenditure of money in the aggregate.

The following is the product:

Year.	Tons.	Year.	Tons.
1886	16,388	1887	42,065
Total			58,453

THE BELMONT

is an exploring shaft just north of the north line of the Ruby which Capt. Mat Fitzsimons of Ironwood, Mich., has been engaged in sinking for more than a year, and which work he is still prosecuting.

Capt. Fitzsimons is also prosecuting the exploring work at

THE NORTH AURORA SHAFT

and expresses much confidence in the final outcome. He states that the shaft is 300 feet deep, vertical, and that he is cross-cutting north in the bottom where, at about 25 feet in, he has cut a deposit of slate ore which had also previously been intercepted further up the shaft. The shaft is very wet. I did not go down into it. Its location is in the southeast corner of the property, being near the Aurora and the Pabst lines, the latter being the adjoining property west. If a valuable discovery of ore is made, it will, probably, prove to be equally as important to the Pabst company as to the North Aurora.

There are other explorations in progress, north of the Iron King and Pabst, as

THE NEWBERRY,

but no ore in quantity has been found yet.

THE IRONTON IRON MINING CO.

has also the misfortune to have exhausted its ore. All the ore the mine has produced has been obtained from the deposit at the west end, the one crossed by the boundary line, and that is completely worked out. The shafts that were sunk west towards the Tontine did not lead to the discovery of any ore.

At 50 feet below the bottom of the west pit, a drift east cuts a vein of ore, which, beginning at 5 feet in width, expanded to 12'. It is good ore, analysis showing it to be above 60% in iron, and .030% Phos.

Two drill borings have lately been made from the bottom of No. 1 shaft near the west end of the mine, one to the north 100 feet long, through hard ground, but no ore. The second hole was bored down at an angle of 60°, 106 feet long, and ended in ore. They will sink the shaft 100 feet; it is now 141 feet.

They feel quite confident of finding a body of ore.

The machinery and all the other shafts, etc., remain as they were at the date of my last report.

The mine produced the following:

Year.	Tons.	Year.	Tons.
1886	16,307	1887	27,887
Total			44,194

President, Dan'l McGarry, 164 Bank St., Cleveland, Ohio; M. W. Burt, V. P.; Geo. H. Abeel, Sup't, Bessemer, Mich.

THE FEDERAL LAND AND IRON CO.

is the new title given to the Tontine, the company whose mine lies next east from the Ironton. The property was sold out last winter and was bought at a nominal price by the present owners. The shaft was 145 feet deep; they started a drift east, and at 60 feet cross-cutted north 80 feet, and claim to have gone through in this cross-cut, 41 feet of good ore. They have, along the foot, 6 feet of mixed stuff, and then come into clean ore. I did not go into the drift. They have the ore in stock pile; it looks a little ocherous; is, they state, well up in iron, and also is high in Phos. At 30 feet from the shaft east, another cross-cut was driven north 25 feet and a rise made in ore, but they found too much water to proceed. They have also sunk the shaft to a depth of 175 feet, and it is nearly all in ore.

They are having a good deal of water, and only one boiler and one No. 7 Knowles pump to keep it out; an accident to either, and the mine would soon be flooded.

The force employed is 18 men. Gage E. Tarbell, Sec. and Gen'l Manager, Milwaukee; D. A. Bennett, Sup't, Bessemer; Wm. Knowles, Mining Capt., Bessemer.

Adjoining the Federal, between it and the Colby, is

THE VALLEY MINE,

the property of the Valley Iron Mining Co., or rather, perhaps, of the Bessemer Consolidated Mining Co., since the Valley is one of the Burton group of mines that went to the possession of the Bessemer Consolidated.

So far, however, the Valley has not proved to be of any value. Considerable money has been expended in mining and exploring work, and a large sum paid for the control to start with, all of which, it would seem, is a dead loss to the owners. It is entirely idle, and it is not likely that more work will be done very soon.

The mine furnished for shipment, in 1887, 322 tons.

Dan'l McGarry, Pres't, 164 Bank St., Cleveland.

THE COLBY MINE,

the great bonanza of the Gogebic Range, the Jumbo of iron mines, gives every present indication of having reached the limit of its capacity of production, in fact it is apparent that unless other discoveries of ore are made, the mine must be ere long exhausted.

The Colby mine was an immense deposit of clean ore lying against a quartzite foot wall on the south and an eruptive dyke on the north. This dyke cuts the formation at about right angles, but also inclining east at about 30°. This dyke has formed the bottom of the mine in all the levels, that is, it has crowded the mine further east constantly, as greater depth is attained.

At first the mine was divided into two deposits by reason of an upward bulge in the undercutting dyke and a corresponding downward sag in the rock capping, which overlies the ore; but in the process of mining the north deposit has constantly approached the south, being carried there by the dip of the dyke in that direction.

This separation of the ore into two deposits gave rise to the theory of two distinct veins of ore traversing the whole length of the range. A cross section of the mine shows the ore in a triangular trough, the sides of which are the quartzite and the “soap rock.”

At first the south deposit had great width, but naturally it is narrowing and also shortening, since the rock underlying at the west end goes down at an angle of 30°, and the capping at the east end, which limits the ore in that direction, dips down at about 45°. The two deposits are connected in the third level. There are four levels opened, and the east shafts sunk to the 5th level. No. 1 shaft was the outlet at the west end of the open pit, and No. 2 is a skip road that ascends the foot wall at the east end of the open cut, and Nos. 3 and 4 shafts are further east; both go down under ground. No. 2 is 130 feet long, and the others, respectively, 250 feet and 300 feet. No. 3 is 300 feet east of No. 2, and No. 4, 300 feet east of No. 3. The length of the ore body is 650 feet in the 3d level, and the width in the 4th level averages, perhaps, 35 feet, but No. 3 shaft at the 4th level is to the rock. The ore reaches about 25 feet west of the shaft and extends 180 feet east of No. 4, making a length of 500 feet.

In the 5th and 6th levels the ore will be taken from No. 4 shaft, as that will be the only one in the ore.

They are scramming some ore in the open pit; otherwise, with the exception of No. 2, all the ore comes from three shafts; the two above mentioned, and a third one in the north pit. No. 4 is the 5th level and opening out. It will probably reach the “soap rock” at the 6th. The capping will come down at the end terminating the ore deposit. A few borings have been made through the “soap rock” but only mixed ore and rock found under it. However the borings were made vertical. It would have been better, I think, to have bored at right angles with the dyke and so have kept away from the foot wall. Possibly it might be well to go over on the side hill west of the mine and drive in a tunnel under the “soap rock.” It would be a better test than boring. Of course there is yet a great deal of ore in sight.

The company expects to ship this season 300,000 tons. There are 100,000 tons in stock at the mine, and at the time of my visit they had begun to load the cars from the stock pile with a steam shovel; it was doing the work satisfactorily. They estimated the cost at 4 cents per ton, were loading a car of 20 tons in 7 minutes.

The north deposit has afforded very cheap ore, undoubtedly. It has been so simple a matter to drop the overlying rock down on the dyke. They claim to have got 90% of the ore. The plan pursued has been to take out all the ore, as nearly as possible, and let the top come down.

The lease on which the mine has been worked, so far, expires in November next. Mr. Jos. Sellwood leaves soon for the Vermillion range and the mine then will be more exclusively in charge of Capt. Harry Roberts.

The shaft on Section 15 east of the main mine is not turning out so large as was anticipated when the mine was first opened. The deposit has a length of 120 feet and a width of 40 feet. They mine it on the “soap rock,” the same manner as in the north deposit.

West of No. 4 shaft the ore is narrow, 15 to 20 feet wide, and between the shafts averaging about 30 to 40 feet.

An explosion of giant powder occurred at the mine in May, 1888, destroying the engine house and the lives of two men. It is not known how it occurred. The powder was in the engine house to be kept warm and by some unknown cause was made to explode.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1885	84,312	1887	258,518
1886	257,433		
Total			600,263

Jos. Sellwood, Manager, Bessemer, Mich; Pickands, Mather & Co., leasees, Cleveland, Ohio.

THE PALMS MINE

is the next one east of the Colby, being the N. W. ¼ of Sec. 14, 47, 46.

I described the mine, machinery, etc., very fully in my last report, and there is not much to add. It is one of the best equipped mines, in the matter of machinery and shafts, on the range.

The mine is really looking better than it was a year ago; they have a better deposit of ore than I have ever before seen in the mine. When Capt. Christopher took charge of the mine he found it completely exhausted; there was no ore, of any value, anywhere; he wisely decided to sink No. 3 shaft, and has lowered it 87 feet. He opened a level at 50 feet, and drove east 120 feet, all the way in ore, part of it 3 sets wide, 21 feet; but found no ore west. At 37 feet further down, the ore deposit appears still better than it did above; since they find a good showing of ore west of the shaft 7 or 8 feet wide. The shaft is 270 feet deep. The company has done a good deal of drifting, cross cutting, etc., that, in the nature of things, could be of little value; it was done too near the surface. In the first level, 78 feet below the surface, is a drift 500 feet long, connected three shafts. The drift is all the way in "cap rock." If made at much greater depth it might have cut some ore. Also there are many cross-cuts, one that is 100 feet long, at the 180 foot level.

From No. 3 shaft, and out of a chimney of ore near No. 2 shaft, they are raising now about 150 tons per day. The indications favor the plan of sinking deeper, following the foot wall.

Also I should think it would be a good plan to explore the west part of the property. About the mine, and east to the Anvil and north, the ground has been pretty well test pitted without finding any deposit of clean ore. The ground west has not been tested much. There was shipped from the mine, in 1887, 1,600 tons of ore. Corporate title is the Palms Iron Mining Co. Wm. Irvine, Treasurer, Chippewa Falls, Wis.; J. P. Christopher, Sup't, Bessemer, Mich.

The ore averages above 60% in iron; is Bessemer, but is about at the limit, being comparatively high phosphorus.

The Palms has admirable arrangements for handling ore economically; both railroad tracks extend along on the foot wall side, and the pockets, which receive the ore from the skips, discharge directly into the cars.

The surface is high, unbroken ground.

THE ANVIL MINING CO.

has made considerable change for the better at its location adjoining the Palms. The railroad companies, the Wisconsin Central and the Milwaukee Lake Shore and Western, have built tracks along on the foot wall side of the mine, to accomplish which a long high trestle across the ravine next to the Palms mine has been made.

A new engine house has been built and a suitable plant of machinery secured.

The mining is all confined to No. 1 shaft near the west side of the property. They are stoping there in the deposit of ore that is described in my last report, and which had then been recently discovered.

Capt. J. H. Johns has the contract of mining out the ore above the 1st level, taking it all to the surface dirt. His method is by making innumerable "rises" through the ore; starting with a main rise, which is provided with a shute to receive the ore and to discharge it into the tram cars. Connected with the main rise are numberless branches so made as to leave finally nothing but arches of ore. When a block of ground has been sufficiently perforated in this way, the arches are blasted, and the whole made to come down, when as much of the ore is saved from the dirt as possible. The ore is dry and firm and has no tendency to crumble and fall away, and as the deposit is not a very large one, the method of mining is cheap and effective. The bottom of this level is 175 feet below the collar of the shaft, and another level has been opened 50 feet below, in which the ore body seems to hold its bigness and the ore to improve in quality. This main ore body is apparently about circular in horizontal section, that is, about as great in diameter in one direction as in another. I do not know the dimensions. Capt. Johns could not inform me, but I judge it to be from 80 feet to 100 feet east and west, possibly a little larger north and south, with the axis inclining down to the northeast. It is separated from foot wall ore by a belt of rock about 25 feet thick; the latter deposit of ore along the foot wall has a width of about 10 feet, and has been opened east under No. 2 shaft, which will be connected soon, and will also be used for hoisting. They are mining and shipping now, June, 1888, about 150 tons per day, working 35 men. Capt. Johns receives 60 cents per ton, and the additional cost at the present time, I was told, is 20 cents, that is for the present mining cost—royalty and other more remote charges to be added.

The ore is mixed slightly with sand which reduces the percentage of iron and increases the amount of silica. I made an average of 16 analyses of ore that had been sampled and shipped this season, and this proved to be iron, 59.41%, silica, 7.66%, phos. .038%.

M. H. Brand, President; G. E. Tarboll, Secretary and Treasurer and General Manager, 377 Broadway, Milwaukee, Wis.; D. A. Bennett, Superintendent, Bessemer.

The new buildings, comprising engine house, shop, change house, dwellings, &c., give the location a much improved and prosperous appearance. A transfer in ownership was made on the 25th of January last, the Anvil Iron Mining Co. selling all its property to the Anvil Mining Co. The mine produced in 1887, 10,076 tons of ore.

East of the Anvil there is no other mine that has produced any ore for market until

SUNDAY LAKE

is reached, a distance of upwards of three miles. From the Anvil mine that ground descends steeply for half a mile across the west half of Sec. 13, to the Black River, a stream, the main body of which runs north and south, cutting through the Grange. At about the north quarter post of Section 13, the stream makes a junction with a branch running westerly from Sunday Lake. After crossing Black River there is a decided change in the formation, mainly apparent through the absence of the conspicuous foot wall belt of quartzite, which, until this point, has uniformly held easterly from the west end of the range.

Between Black River and Sunday Lake a great amount of exploring work has been done and many locations made, and in the aggregate much money has been expended; but at none has ore been found in quantity sufficient to constitute a mine. At the Mikado and a few others they have ore, but have found no large body of it. All effort has been discontinued for the present, at least, at every one of these mines, except a slight tendency to keep on at the Mikado and the Pilgrim.

At many of these mines, The Iron Prince, Ironsides, Norway, etc., they have jasper mixed with a little ore, occasionally a small pocket of clean ore but not enough to be of any commercial value. So that east of the Anvil the first mine to produce ore in appreciable quantity is

THE BROTHERTON,

which is holding its own admirably. The Brotherton is not a large mine, but proves to be a good one, having a fair amount of ore, of the best quality.

The company holds on a lease the N. ½ of the S. E. ¼ of Sec. 9, T. 47, R. 45. The property is fractional on Sunday Lake, the southwest corner of the land being covered by water.

There are three shafts which are 500 feet apart, and all are worked and are supplying ore. The west shaft, No. 1, is down 210 feet to the 4th level; two levels below the depth of one year ago. This shaft is sunk in the rock between two deposits of ore, called the north and the south veins; in the latter, in the 3d level, they have gone west 500 feet to the margin of the lake, and in so doing encountered a bar of rock which, for a time, caused the suspension of work in this direction; but, it being determined to push on, they were soon rewarded for their efforts by coming into a fine body of ore, which afterwards continued and still exists at the west end. But as the ground descends from the collar of the shaft to the west, it is deemed best to discontinue in the present level, and go under the lake in a lower level.

The length of the ore is about 350 feet, with a width of from 20 to 40 feet. The shaft has been sunk 60 feet further, and they have already begun to drift west. They are also driving a cross-cut north to intersect the north vein, to see if further west than they have gone in the north vein, there is any important amount of ore.

Work in the north vein was discontinued in rock.

No. 2 shaft is also between two deposits and is 160 feet deep. The cross-cut from the shaft to the vein is 20 feet, and there is opening all the way to No. 1, 500 feet west. The ore for 200 feet in length is 12 to 15 feet wide, and in places 30 feet, and seems likely to hold its own at greater depth.

No. 3 is on the high ground, 500 feet east of No. 2, and is 175 feet west of the east line of the land. The ore body in No. 3 is about 300 feet long, and 15 to 20 feet wide, the best ore in the mine, and it is costing $1 per ton to mine it.

They work the mine so as to take out all the ore and let the top come down, using only light timbers.

Capt. Bawden is a good miner and is doing the work safely and cheaply. Few mines are getting their ore more cheaply than the Brotherton.

The following analyses of average samples of the ore show its quality:

No. 1	62.23 % iron.	6.86 % silica.	.034 % phos.
No. 3	66.47 " "	2.07 " "	.036 " "
No. 3	66.82 " "	2.04 " "	.036 " "
No. 1	63.80 " "	4.50 " "	.051 " "

All the water is pumped from No. 1 shaft by a No. 9 Knowles.

The other matters about the mine remain as stated in my last report. The mine produced in 1886, 8,880 tons, in 1887, 21,721 tons.

Joseph Sellwood, President, Bessemer, Mich.; Richard Bawden, Superintendent, Wakefield, Mich.

THE SUNDAY LAKE MINE

joins the Brotherton on the east; in fact the No. 3 shaft of the latter is opened into the Sunday Lake; both mines are working in the same deposit.

No. 1, the west shaft, is down to the 5th level, 100 feet deeper than it was a year ago, being now 250 feet deep. They are now opening in the 5th level and it is claimed that the ore is improving in quality. When I was in the mine a year ago I found a good deal of sand rock in the ore; in this respect the mine has improved, the ore being cleaner than formerly.

They are troubled a good deal with water and the new company has not yet got matters in perfect shape, but apparently the mine is improving. There is more encouragement for ore than existed formerly. In fact Capt. McLeod states that they have a body of ore 650 feet long, 20 to 35 feet wide, and that at No. 3 shaft the ore is 45 feet wide. The ore runs from the west line to a distance of 150 feet east of No. 3 shaft. No. 1 is 80 feet east of the line and No. 2 187 feet east from No. 1.

The company is now sinking No. 3, the east shaft, which is about 200 feet east of No. 2.

At my last visit I did not go underground but felt satisfied of the improved character of the outlook.

The Sunday Lake mine was until recently one of the so-called Moore & Benjamin properties, but through the failure of the proprietors to meet their obligations the mine has reverted to the fee owners, Messrs. Geo. M. Wakefield and Henry Fink, of Milwaukee.

The company is working a force of 50 men and mining and shipping 100 to 120 tons of ore per day—June, 1888.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1886	14,270	1887	18,[illegible]
Total			32,[illegible]

Duncan McVichie, Superintendent, Wakefield, Mich.; John McLeod, M'g Capt.

THE IRON CHIEF MINE,

owned by the same parties that hold the Sunday Lake., joins the latter on the east. It is in low ground, very wet, and is not at present worked. The shaft was only 100 feet deep and the ore which had been found was exhausted. It is possible that by sinking deeper better results will be obtained. It is the intention to proceed with this work at a future date.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1886	9,500	1887	2,[illegible]
Total			11,[illegible]

D. McVichie, Superintendent, Wakefield, Mich.

East of the Iron Chief, half a mile, in the W. ½, S. W. ¼, Sec. 11, 47, 45, is

THE PITTSBURGH,

a property that has been explored for about a year with, it is thought, a fair prospect of finding ore enough to make a workable mine. Mr. Dan Kloeckner and others of Hancock, Mich., I think, are parties chiefly interested. Capt. M. L. Tallon, Wakefield, Mich, has charge of the work.

THE COMMERCIAL

joins the Pittsburgh on the east, being the E. ½, S. W. ¼, Sec. 11, 47, 45. These properties promise well; the indications are good for the developing of ore sufficient in quantity to be of commercial value. The quality of the ore that has been found is first-class.

People are not so ready to concede the existence of a large body of ore, even where the indications are unusually good, as they were a year or more ago.

Contiguous with these properties and equally favorable is

THE ECLIPSE.

There are also other locations west in Sec. 12, but there is not much doing at any of them just now, May, 1888.

WAKEFIELD GOLD DEPOSITS.

Quite little has been said and printed relative to the gold and silver bearing deposits found at

THE WASHBURN,

about 2½ miles southeast from Wakefield, to wit, in the N. E. ¼ of Sec. 23, 47, 45, and adjoining properties. It is stated that Minneapolis and St. Paul parties are preparing to work here, systematically, for the precious metals; that their examinations by persons qualified to decide have proved entirely satisfactory.

Capt. D. F. Strobeck, Superintendent, Washburn Mining Co., Wakefield, Michigan.

THE PILGRIM,

just west of Wakefield, is still explored in a small way, but no body of clean ore has been found yet, and a party is still boring with a diamond drill south of the village, but as yet with indifferent success.

PIG IRON.

DESCRIPTION OF BLAST FURNACES.

THE SPRING LAKE IRON CO.'S

furnace at Fruitport, in Muskegon county, has an excellent record. The stack is 46 feet high, and a diameter of bosh 10' 8". The wood used for charcoal is ¾ hard, ¼ soft. The coal weights 20 lbs. to the bushel of 2,748 cubic inches.

For the sake of comparison, I give the record for three years:

Record of Fruitport Furnace.	1885.	1886.	1887.
Bushels of charcoal used	1,444,675	1,610,550	1,721,330
Gross tons of ore used	28,684	29,551	31,432
Gross tons of limestone used	386	1	468
Number of tons of pig-iron made	17,217	17,776	18,381
PARTICULARS.			
Number of charges run	57,787	34	
Number of bushels per ton of iron made	84	90½	93¾
Per cent of yield of ore in the furnace	60¾	60	58
Number of pounds of limestone used per ton of iron	50	½	57
Number of days run	321	324	347
Average daily product		4.85	53
Temperature of hot blast		800	700

The increase in the number of bushels of charcoal used in the past year is accounted for by the superintendant, on the ground that the furnace has only lost 100 days in three years' time, and they find it more difficult to get up the requisite degree of heat now than formerly. The hot blast ovens are out of repair, and naturally leak somewhat. This is shown by the falling off in the temperature of the hot blast.

J. C. Ford, Sec. and Gen'l Supt.

BANGOR FURNACE,

also operated by the Spring Lake Iron Co., has the following record from June 1, 1887, to Dec. 31:

No. days run	204
No. bushels charcoal used	866,775
No. tons of ore used	14,206
No. tons of limestone used	281
No. tons of pig iron made	8,361
No. bushels coal per ton of iron	103
Yield per cent of ore	59
Pounds of limestone per ton of iron	75
Average No. tons of iron made per day	41

D. C. Lameroux, Supt., Bangor, Mich.

The stack is 43 feet high and 9½ feet bosh.

THE VULCAN FURNACE CO.

has a well equipped furnace at Newberry, in the Upper Peninsula. The stack is 53'x10'8".

No. days run in 1887	276
No. tons of pig iron made	11,854
No. bushels charcoal used	1,247,977
No. tons of ore used	21,834
Yield of ore in furnace	54 3-10%

The ore used were in L. S. mine, Suffolk, Detroit, Wetmore, Marquette, Michigamme, Cliff and Salsbury.

Royal A. Jenney, Superintendent.

THE ELK RAPIDS FURNACE

Was in blast 314 days in 1887, in which time it made 14,888 tons of pig iron, an average per day of 47½ tons.

H. H. Noble, General Manager.

ANTRIM IRON CO.

furnace at Mancelona, Mich., produced in 1887, 16,241 tons pig iron.

No. days in blast, 351.

Daily average, 46¼ tons.

No. bushels charcoal used, 111,288, 20 lbs. to the bushel.

No. bushels charcoal used per ton of iron, 87.

Limestone per ton of iron, 183 lbs.

Average yield of ore in furnace, 60.70%.

E. Fitzgerald, Manager.

THE GAYLORD IRON CO.

operates a furnace at Detroit. It was built in 1856; it is a stone stack 40'x9'.

The following is its record for 1887, kindly furnished me by Mr. N. Wood, Clerk of the Co., Wm. Gaylord, Treasurer:

No. days run 1887	300
No. tons pig iron made	6,760
No. tons iron ore smelted	11,146
No. bushels charcoal used	617,250
No. bushels charcoal used per ton of iron	91.3
Average yield of ore in furnace	60.6%

THE UNION IRON CO.'S

furnace in Detroit has the following record for 1887:

No. of days run	312
No. of bushels of charcoal used—(20 lbs to bushel)	797,579
No. tons of ore used	14,592
No. bushels charcoal used per ton of iron	91
Yield of ore in the furnace	59.9%
Product of pig iron	8,753 tons

Wm. Gerhauser, General Manager.

PIONEER FURNACES

owned by iron Cliff Co., Negaunee, Mich.

There are two stacks. No. 1, 52'x10', built 1858. No. 2, 56'x9', built in 1859, re-built in 1877.

Only one stack operated, in which were made 18,787 tons of pig iron in 1887. The best work done was during the week ending February 11, 1888, when No. 1 stack turned out 458 tons of pig iron, being 65 and three-sevenths tons per day, using 94 bushels of charcoal to the ton.

GOGEBIC FURNACE

located at Iron River, Mich., John Reis, General Manager.

The stack is 56'x11', went into blast in 1886, and was subsequently burned and rebuilt. I have only the record since October, 3,700 tons of ore, using 90 bushels charcoal per ton, 35 kilns, hold 50 cords average. The furnace is in a fine hard wood section, also conveniently situated for obtaining its ore cheaply, but they do not seem to have made suitable provision for the charcoal supply yet.

EUREKA IRON AND STEEL WORKS CO.

has two stacks at Wyandotte, No. 1, 50'x12', rebuilt in 1885. No. 2, 45'x9', built in 1863.

Record for 1887. Days run	256
No. tons of pig iron made	12,484
Bushels charcoal used	1,238,445
Average furnace yield of the ore	60%

J. S. Van Alstyne, Agent.

DEER LAKE IRON CO.'S

furnace, near Ishpeming, was in blast in 1887 336 days, making 10,165½ tons of pig iron.

W. H. Rood, President.

THE JACKSON IRON CO.

had one of its furnaces at Fayette, Delta county, in blast 320 days in 1887, during which time there were made 13,325½ tons of pig iron, using 1,463,144 bushels of charcoal. The average weight of charge was 950 lbs., and the yield of the ore in the furnace was 60%.

Wm. Pinchin, Superintendent.

MARTEL FURNACE CO.

operated its fine furnace at St. Ignace, in the upper peninsula, 200 days, making in that time 10,830 tons of pig iron, using 87.5 bushels of charcoal per ton of iron made. The per cent of yield ore was 58.6. The furnace was built in 1881, is 53' high, 10½' diameter of bosh, 2 Whitwell hot blast stoves each 60'x15'. Use Mathews retorts for making the charcoal.

W. B. Vance, Secretary and Treasurer.

THE PINE LAKE IRON CO'S. FURNACE "CHAMPION,"

at Ironton, Mich., was in blast during 1887 for 190 days, producing 10,342 tons of pig metal, charcoal car-wheel iron. The furnace only runs in the summer, will go into blast again at the opening of navigation.

H. Duvall, Secretary, 92 Dearborn St. Chicago.

DETROIT IRON FURNACE CO.

Furnace in Detroit, stack 52'x10½'; built in 1870 as a Bitumenous furnace, made into a charcoal in 1879. Iron made in 1887, 15,272 tons, in 330 days. E. C. Wetmore, Secretary.

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

Name of Company.	1884.	1885.	1886.	1887.
Eureka Iron and Steel Works, Wyandotte	6,000	10,904	11,668½	12,484
Gaylord Iron Company, Detroit	7,200	4,803	8,093	6,760
Detroit Iron Furnace Company, Detroit	6,205	13,619½	6,741	15,272
Union Iron Company, Detroit	8,000	3,303	6,000	8,753
Peninsular Iron Company, Detroit	7,200	7,439	5,263	.....
Bangor Furnace Company, Bangor	.....	6,891½	12,941	8,361
Elk Rapids Iron Company, Elk Rapids	.....	16,077½	17,434½	14,888
Spring Lake Iron Company, Fruitport	.....	17,217	17,768	18,381
Jackson Iron Company, Fayette	.....	8,456	10,581	13,325½
Vulcan Iron Company, Newberry	.....	11,426	17,360	11,854
Deer Lake Iron Company, Ishpeming	.....	9,245½	10,898½	10,165½
Iron Cliff Company, Negaunee	.....	15,718	11,079	18,787
Antrim Iron Company, Mancelona	.....	.....	9,414	16,240
Pine Lake Iron Company, Ironton	.....	.....	5,070	10,342
Martel Furnace Company	.....	.....	7,666	10,830
Gogebec Furnace Company	.....	.....	.....	3,700
Total	.....	125,190	148,952	.....

GYPSUM.

For particulars relating to this important industry reference is made to the Commissioner's Report to the year 1881, wherein I have described the deposits, mills and quarries fully.

TABLE showing the Amount of Land and Calcined Plaster produced in Michigan, for each year since 1866, and the aggregate in previous years.

Years.	Land Plaster, Tons.	Stucco—Barrels 300 lbs. each.
Years previous to 1866	100,000	80,000
1866	14,604	
1867	17,439	
1868	28,837	34,996
1869	29,996	41,187
1870	31,437	46,179
1871	41,126	48,685
1872	43,536	59,768
1873	44,972	82,457
1874	39,126	82,449
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	33,178	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
1887	28,794	170,145
	848,936	1,856,614

TABLE Showing the amount 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.	1887.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Godfrey & Bro.	9,117	9,000	6,421	6,080	5,682	4,593	4,467	4,560	3,937	.....	23,000	27,500	30,374	37,000	30,433	30,942	28,273	30,284
Grand Rapids Plaster Co.	8,970	12,000	6,375	7,512	5,013	3,044	4,143	3,832	4,517	.....	23,500	20,400	32,654	40,000	24,200	26,498	28,627	32,386
Wyoming Mills	7,000	10,000	6,093	6,801	4,400	3,052	4,059	3,714	3,565	.....	.....	.....	.....	12,000	13,108	11,193	11,327	15,175
Union Mills	4,500	7,500	6,716	8,298	5,500	3,185	3,663	3,687	3,102	.....	35,000	34,913	23,074	30,000	23,176	15,654	18,027	21,979
D. Noble & Co.	10,585	9,570	6,572	6,037	4,000	3,202	3,900	1,947	3,106	.....	24,504	30,000	27,893	28,000	30,288	26,344	28,760	34,235
Smith, Bullard & Co	1,586	1,500	1,000	2,993	4,000	4,122	4,316	6,039	5,589	.....	.....	.....	11,817	30,961	23,961	20,797	27,113	21,152
Alabastine Co.	.....	.....	.....	.....	4,632	6,690	3,606	5,608	4,958	.....	.....	.....	.....	13,172	11,321	10,147	11,167	14,804
Geo. H. White & Co.	1,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	43,658	49,570	33,178	37,821	33,225	27,888	28,181	29,398	28,794	.....	106,104	112,813	135,655	201,133	156,677	141,575	153,274	170,145

SALT.

The salt production of Michigan, as reported to me by the State Salt Inspector, for 1887, was as follows:

Fine. Barrels.	Packers. Barrels.	Solar. Barrels.	Second Quality. Barrels.	Common Coarse. Barrels.	Total Production. Barrels.
3,198,070	19,385	13,903	73,905	17,378	3,944,309

Fine salt in bulk, 621,668, making total production as above.

The average price was 68 cents. There were 285 wells pumped.

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.	Fine.	Packers.	Solar.	Second Quality.	C. coarse.	Total.
1869	513,908	123,908	15,264	19,177	.....	561,288
1870	568,326	17,869	15,507	19,650	.....	621,352
1871	655,923	14,677	37,645	19,930	.....	728,175
1872	672,034	11,110	31,461	19,876	.....	724,481
1873	746,702	23,671	32,267	20,706	.....	823,346
1874	960,757	20,090	29,391	16,741	.....	1,026,976
1875	1,027,866	10,233	24,336	19,410	.....	1,081,856
1876	1,402,410	14,233	24,233	21,668	.....	1,462,729
1877	1,590,841	20,839	22,818	26,818	.....	1,660,997
1878	1,770,361	16,267	33,544	32,615	.....	1,855,884
1879	1,997,350	15,641	18,020	29,027	.....	2,058,040
1880	2,589,037	16,691	22,237	48,623	.....	2,676,588
1881	2,673,910	13,885	9,633	52,821	.....	2,750,299
1882	2,928,542	17,208	31,335	60,222	.....	3,037,317
1883	2,828,987	15,424	16,735	33,526	.....	2,894,672
1884	3,087,034	19,308	16,957	38,508	.....	3,161,806
1885	3,230,626	15,480	19,840	31,428	.....	3,297,403
1886	3,548,731	22,221	31,177	71,235	3,893	3,677,257
1887	3,198,070	19,385	13,903	73,905	17,378	3,944,309
Total						38,000,778
Salt manufactured prior to 1869						3,782,117
Total amount of Salt produced in Michigan to date, barrels						41,782,895

The capital employed in the Michigan industry is estimated at $2,150,000; the number of hands employed averages 5,000, and they are mostly men, and the wages paid $550,000.

The average price of Michigan No. 1 fine salt per barrel for a series of years is as follows:

Year.	Price Per Barrel.	Year.	Price Per Barrel.
1866	$1 80	1877	$
1867	1 77	1878	
1868	1 85	1879	1
1869	1 58	1880	
1870	1 32	1881	
1871	1 46	1882	
1872	1 47	1883	
1873	1 37	1884	
1874	1 19	1885	
1875	1 10	1886	
1876	1 05	1887	

The great majority of the "blocks" are run in connection with a lumber-mill, and hence the cost of production is very small.

The cost of salt "blocks," for the production of, say 300 barrels per day, is about $30,000, including the boring of the wells, the depth of which ranges from 650 to 1,100 feet. The manufacture of salt is, briefly, as follows: The brine is pumped by steam from the wells and stored in cisterns, where it is allowed to stand for four hours. A small quantity of a mixture of lime and water is then thrown into it to settle the iron in the brine. As the lime sinks it carries the iron with it, leaving the brine perfectly clear. It is then carried off into a settler provided with steam-pipes, where it is heated to a point of saturation. It is next drawn into the grainers, which are about 150 feet long, 10 to 12 feet wide, and 16 inches deep, and provided with five rows of three-inch steam-pipes. As the brine becomes heated it causes the salt to crystallize and come to the surface. Then it is raked to the sides of

the grainer and lifted out with shovels and placed on platforms, where it is allowed to drain for about four hours, when it is wheeled into bins for storage where it must remain, pursuant to the State law, for at least fourteen days before being packed for sale. This is ordinary salt and is used mostly for curing meats, fish, etc. It is known as No. 1 fine, and the bulk made at Saginaw is of this quality.

COAL.

I have written up the Michigan coal interests, in the State Commissioner's report, 1881, especially. I find no important changes. Some "banks" have been exhausted and abandoned, and new shafts opened. It not unfrequently happens that there is an excitement awakened in some locality over the alleged discovery of a valuable coal vein in the vicinity. But investigation generally proves that the deposit, if one there be, is of little or no practical value. Coal is found in Michigan in many places, but it is of too poor quality. It is light and friable, sometimes slaty, making a good deal of slack. The deposits or coal seams are thin, exceeding nowhere 3 to 4 feet in thickness; generally much less. The roof is frequently poor, and the ground wet. Some of the best coal shafts that have been opened have proved too wet to work with any profit. The formation is liable to be curved and faulted, which adds to the difficulty in getting rid of the water.

The coal is said to be excellent in making steam, and is liked for locomotive boilers; but the difficulty in making contracts with the railroad companies has been the uncertainty of the product, arising mainly from the difficulty which the companies have in securing and holding their laborers.

The miens are so low and wet that men do not like to work in them; and as the mining is done on contract, the miners must understand how to work to advantage, or they cannot make wages.

They must learn how to mine here, as new miners cannot take the place of experienced ones.

Jackson and Corunna are the only coal mining points of any importance; at the latter, several new shafts have been opened in the past year, 1887. One near Trumbull Station, five miles west of the city, in which they commenced taking out coal in July last, having previously, in the same year, abandoned, is exhausted, the Merrill shaft, half a mile north of the city.

The Bennett Sewer Pipe Co. has opened a shaft and mines coal exclusively for its own use, for fuel in its manufacture of sewer pipe, etc.

The Spring Arbor Co. is also a new concern at Jackson. The Standard Coal Co. and the Star have been mining since 1885.

At Corunna there is nothing new, but at Grand Ledge considerable impetus has been given to the business. Mr. H. J. Stark opened a mine there in September last, and has been getting it into shape to work. He reports a product to the close of the year of 64 tons.

	Years previous to 1877.	1877.	1878.	1879	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Williamston							10,454	884			1,000	100
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	8,000
Other mines		1,500	1,000	800							1,000	
R. H. Emerson & Co.					66,780	61,666	60,103	40,412	13,712	15,553	21,363	13,200
Eureka Coal Co.					30,000	37,477	25,000					
Michigan Coal Co.					20,021	23,987	25,000					
Porter Coal Co.							6,158	21,000	15,000	13,000		
Star Coal Co.										5,123	5,821	7,333½
Standard Coal Co.										15,000	4,743	5,000
Spring Arbor Coal Co.												500
Bennett Sewer-pipe Co.												2,317
H. J. Stark, G'd Ledge												64
Total	350,000											

GOLD.

Quite an impetus has been given to the interest felt in the Michigan gold deposits in the past year through the discovery of the extraordinary rich rock found on the Lake Superior Company's land. This company sank a shallow pit in a quartz vein at a point 275 feet west of the east line of the N. E. ¼, N. W. ¼, Sec. 35, 48, 28.

Some of the quartz obtained in this pit assayed upwards of $40,000 in gold to the ton of rock. It is full of free gold. I saw a large piece that, crushed by a heavy blow, the fragments held together by the gold which the rock contained. Some of the quartz may be seen at the company's office in which are seen "strings of gold" and particles of the size of a shot and of a small pea. Nothing further was done. The shaft was covered up and the ground about it enclosed with a high fence so as to debar all access to the pit. What action the company may conclude to take is not known.

Since the foregoing was written the Lake Superior Iron Co. has arranged to work its gold deposit. The shaft has been uncovered and the company is sinking it deeper.

The company is working 6 men at the shaft now, June, 1888. At a depth of 22 feet a very rich pocket was encountered from which several hundred pounds of rock have been secured that will yield, it is estimated, $10,000 in gold, or at the rate of $40,000 to $60,000 to the ton.

THE MICHIGAN GOLD CO.

holds the "40" adjoining the above on the east, that is the N. W. ¼, N. E. ¼, Sec. 35, 48, 28. The officers are Jas. Pickands, President; S. L. Mather, Secretary and Treasurer, Cleveland, Ohio; F. P. Mills, Agent, etc.

Richard Trevarthen, Superintendent. Capital stock $1,000,000, divided into $40,000 shares.

The mineral is quartz vein matter in a formation of diorite. The main vein is the continuation east of the one in which the rich pocket was found on the Lake Superior Co.s' land. The mine runs east and west and Mr. Mills has uncovered it across the property, 1,320 feet. Not only has he trenched this entire distance, but also he has dug a trench along the line between the properties north and south 600 feet, and at several other points has also trenched north, at one place a length of 610 feet. Wherever in these trenches a quartz vein is uncovered it has been followed in the same manner east and west until it disappeared.

The company has opened several exploring shafts on the property. No. 1 of these is 160 feet east of the west line, being thus 435 feet east of the Lake Superior Co.'s "rich find." No. 1 is, Dec. 10, 60 feet deep. At surface the vein was split, the two parts separated by 7 feet in thickness of diorite, but at the bottom the veins are united, making the vein 8 feet wide; the shaft is 5 feet wide and dips south 80°. The vein is continuous but is split a portion of the distance. A recent assay of rock taken from No. 1 gave $1,400 per ton. On the main vein south vein are 3 shafts.

No. 5 is 360 feet east of No. 1, and is about 15 feet deep. The quartz has a width of 2½ feet. No. 2 is idle, the vein is 8 feet wide. No. 3 is 120 feet northeast of No. 2, on a separate vein. No. 4 is 300' feed N. and 200' E. of No. 1, also on a separate vein and is about 15 feet deep. All the work is of an exploratory character. The company is a strong one; the property will be thoroughly tested, and if found sufficiently favorable, it will be worked to the fullest extent.

There is litigation pending regarding the matter of the lease of the land, another party than the Michigan Co. claiming to have leased it.

There are other gold explorations in progress.

SECTION 36.

Mr. A. B. Miner and others are examining a vein of quartz which they report to contain gold in paying quantity. Also in same section Mr. Grummett has sunk a shaft 40 feet.

THE ROPES GOLD MINING CO.

is deserving of a good deal of credit in one respect, at least, for its persistence in continuing to work, even under some very discouraging conditions. The experience of this company, the facts disclosed by its work, are of great value to the country. The company has been only moderately successful, but it is seen that it might have been far more so if the conditions had been better understood, and the affairs of the company more thoroughly managed, characterized by greater experience, and closer supervision in the practical work. For instance, the twenty-five stamps have, until recently, only crushed 18 to 20 tons of rock per day; now they are manipulating 1,000 tons per month. They have had to learn how to do it. It has been up-hill work from the beginning. There was, of course, plenty of rock, but the mining has been limited to the capacity of the mill; that is, to the amount of rock that they could treat in the mill.

The company will be able soon to dispose of double the quantity of rock that it can now. They have the building nearly completed for a second mill, in which will be placed twenty stamps, which will increase the number to forty-five, and they will work up 70 or 80 tons per day. No. 1 shaft is sunk nearly to the 8th level, about 450' down. The 7th level has been opened west 100 feet. There is gold-bearing rock in this level for a width of 90 feet, though the true quartz vein seems to be about 8 feet wide; 360' east of No. 1 they have begun the sinking of another shaft which, at this writing, is 60 feet deep. This, so far, seems to be a narrow vein.

In the bottom of the shaft some rich rock has been found, which assays $80 per ton. Probably this would not be the mill average, but it all seems good. This fact is certainly an encouraging feature. The best rock they have ever obtained in the mine, was in the 1st level, and to find it still rich in the bottom at 450 feet down, is important. The Ropes is in a fair way of success, with the new mill in operation, with rock that averages a good percentage of gold, it only needs enterprise and efficient management to make it a paying mine.

Even in the small way in which it has been operated, the mine has yielded $115,000 in bullion.

There is a plan on foot to sell a controlling interest in the mine, placing the shares disposed at $3. I understand that the matter is likely to be consummated, and will be if enough of the stock is furnished. The company that now controls the Ropes is lacking in funds. The main stockholders have faith enough in the mine, but have no money to "push things." I think that the Ropes can be made a paying mine, and ultimately will become so.

It seems to have rock enough for far more extensive working, and it is favorably situated for economical working.

The following is taken from the company's report:

The number of feet of winzes sunk is 50; number of feet of drifting, including cross-cuttings, 352.

To recapitulate the data pertaining to ore bodies:—We have in the Curry shaft, from the sixth level to its present depth, a continuous body of rich ore—at points of extraordinary richness—as at a depth of 35 feet below the seventh level to its present depth, covering the entire width, 10 feet. On the second level, east of the shaft, a fine stope of rich ore is being broken down on the north vein. To the south, 12 feet, is a fine vein of quartz, the intervening slate and quartz being good milling ore. West of the shaft is an 18 to 30-inch stope of good ore.

On the third, fourth and fifth levels, to the east, are still good reserves of rich ore standing between the shaft and that stoped out from the winzes; both to the north and south of the stoped

out bodies of rich ore, in places stand large bodies of low-grade ores. To the west of the shaft, on these levels, no stoping of any account has been done; the veins being smaller they have been left for future work.

On the sixth level the lode from here down stands in its entirety (barring the drift and winze). The bodies here are large and of good quality, as shown by the shafts and drifts on the seventh. The ore bodies on the sixth and seventh levels, west of the shaft, are by far the best encountered, extend the farthest west, and would seem to indicate that the ore shute of 300 to 400 feet is pitching in this direction.

With regard to the amount of ore in sight, in the several levels of the mines, we concur in the estimate of Capt. Williams, that it is not less than 80,000 to 90,000 tons.

At the Ely shaft, while small veins of rich gold quartz are frequently cut in the slate dike, the existence of a rich, 12-inch vein of ore at the surface in the country, close to the contact, and a thin vein of gold quartz at the contact, no body of any account of gold-bearing material has been encountered until the last 20 feet, when considerable low-grade rock has come in. It is confidently expected, on reaching the depth of the third level, where cross-cuts will be run north and south to the foot and hanging of the dike, and the drift extended west, to connect with the old workings, ore bodies of large size will be encountered.

By reference to the last annual report, it will be seen that the opinion was ventured, being based on the favorable geological conditions of the sixth level of the hanging country dipping away flatly from the foot, that below it would be the repository of valuable ore bodies. The rich bodies of ore developed by the work below the sixth level, fully corroborate the views expressed, and these views are shared in by experts who have visited the mine the past year. Every indication gives promise that the lode will continue in depth in all its strength to a point beyond which it cannot profitably be mined. The diversity of minerals that have hitherto characterized the deposits still continues, and we enumerate: free gold, native silver, gray and yellow copper, iron pyrites, chromic iron, a little galena, zinc and antimony, at points in croppings of dolomite, nickel and cobalt occur an array of minerals giving great strength and permanency. The gold continues as free in the great bulk of the matrix as near the surface.

By reference to the secretary's report, you have given the result of the year's product, and but for a knowledge of the fact that the mine and mill are capable of achieving, as proven by the past, the same might be regarded as unsatisfactory.

That the favorable statement of the condition of the mine embraced in last year's report gave reason to expect higher results, is true. To a combination of circumstances is the failure due.

The chief factor was the continual milling, for a number of months, of low-grade ore alone from the large stope on the fifth level. It was not from a paucity or quality of ore in the mine. Some of the stopes of good ore had become inaccessible, others neglected; sinking of the shaft, which had furnished good ore, had ceased. To these facts, coupled with unskilled labor in the mill, are attributable the low results. The largely increased production (after the several stopes in the mine were got at) $1,200 in January and $1,500 in February, over December, bear out the statement. It required some time to make accessible some of the stopes and produce good ore; now that all are in good shape, continual paying results are looked for.

The capacity of the mill has been largely increased the last half of the year by improvements introduced, and the adoption of methods found in general use in the mills in the Black Hills during a sojourn there of three months.

The rock crushed the past five months has averaged 1,028 per month, against 700 to 800 tons per month previously. The loss in tailings has ranged from $0.90 to $1.50 per ton.

The average number of men and miners employed in and about the mine is 42; number of men about the mill, 7.

The number of tons of rock crushed, 10,187; yield per ton, per secretary's report, $3.42.

The cost of milling the ore for the past four months has been $1.20 per ton, a large reduction from that of any previous period.

Acting in accordance with the expressed views of a majority of the shareholders at the last annual meeting, the directors, in July last, levied an assessment of fifty cents per share on the capital stock of the company, for the purpose of erecting additional reduction works. The call was responded to with great promptness, and the management at once set about securing proposals for the necessary material and machinery.

Satisfactory bids were received from Frazer & Chalmers, of Chicago, Ill., for its completion January 1, and the contract was awarded them.

The additional plant consists of a 6x16-foot boiler, a 235 horse power Corliss engine, 20 heads of 850-pound stamps, with all the auxiliary machinery, parts and pieces in such plants necessary for a complete mill. A new building, 40x85 feet, and vanner room, 36x84 feet, are up and completed. The mill will accommodate 20 stamps more (40 in all) whenever needed; all of which, together with the present mill of 25 stamps, the engine will easily run.

A new boiler house, 49x66 feet, with corrugated iron roof, a dwelling house two stories, 14x20 feet; a supply house, 18x26 feet, and a new foundation and floor to the vanner room have been put in, comprising the surface improvements for the year.

To insure the greatest economy in running expenses for the future, a large engine and shafting were purchased, so that both mills could be run from the same center. It has cost $4,000 to $5,000 more to begin with than it would have just for engine to run the new mill, but figures show that the running expenses in a year or so will fully compensate for the additional outlay.

With increased reduction works came an increased demand for water, the present source of supply being only adequate for the present plant. The only available source of supply the Carp river, some 5,000 feet east of the mill, and 45 feet below the dam, the ground was examined, and it was thought feasible to dam the stream and utilize the power to do the pumping. The matter having been presented to Director W. H. Rood, President of the Deer Lake Company, he kindly granted permission to build a dam on their land. Estimates, by a competent engineer, showed that there was sufficient water, with the 5 to 6-foot head he could get, to force the required supply into the dam with a turbine wheel. Work was begun in October, the pipe (6-inch-wood) laid and, the wheels set in position in December. The wheel is a 20-inch Victor turbine, and a 5½-inch duplex Knowles pump completes the plant, which commenced pumping February 13. The first cost cannot exceed that of a steam plant, and the running expense will be merely nominal, effecting a saving of $2,000, to $3,000 per annum over steam.

The cost of the several improvements enumerated is given in the secretary's report.

It is expected to have new mill ready to run in April. The delay in the work has been solely for want of lumber. As soon as plans were secured orders were sent in for it, but owing to the rush of building the past season, the markets far and near were depleted of the required sizes, deferring the work until snow came, when it could be got from the woods. The work has been pursued under some disadvantages on account of the delay, by throwing it into inclement weather. On the other hand, the great advantage of placing all the material, and especially the very heavy machinery, on the ground at this season of the year (at a minimum cost, and with little trouble) fully compensates for the disadvantages.

The matter of treating, by chlorination, on the ground the low-grade concentrates too poor to ship is presented for consideration at this time. The bodies of mineralized rock on the property that it may be found profitable to mill on a large scale (provided they can be treated cheaply on the spot) are practically inexhaustible. Concentrates of this character are treated in California at a cost of $12 per ton, 95 per cent. of the gold being extracted. The principal cost of treating is for material and labor. At points where the cost is $12 per ton, wood is $6 per cord, labor $3.50 per day and chemicals doubtless proportionately high. With the difference in cost of these items here and there, treatment ought to be effected here at $8 to $9 per ton. At these prices $15 to $20 can be realized on concentrates that will not pay to ship.

Regarding cost of plant, to handle 3 or 4 tons per 23 hours, figures cannot be given; it was expected to have them before this, they having been promised but not received. Three thousand to four thousand dollars is regarded as ample for plant.

With a mine that is developed to no greater extent than this, it is uncertain and precarious to predict what reward awaits the pick and drill beyond the limits of present large and rich bodies. We have enumerated and placed before you the existing conditions of your mine, mill and other property.

J. ROPES, President.
GEO. WEATHERSTON, Supt.

ISHPEMING, MICH., March 12, 1888.

SECRETARY'S ANNUAL REPORT.

March 1, 1887, last statement	$723 74	
Rec'd on 50c assessment	40,000 00	
" for interest	222 49	
" bullion 12 months	25,939 88	
" concentrates 12 months	3,001 62	
" wood, rent, etc., at mine	196 16	
" Ishpeming National Bank	6,000 00	
Contra.		
Paid for new machinery		$19,994 2
" " labor, new mill		5,783 33
" " water works		4,048 7
" " wood and coal		9,126 80
" " exp'osives		1,323 08
Supplies		4,573 89
Labor		25,667 95
Insurance		410 50
Assaying		179 00
Taxes		590 60
Freight		898 23
General expense		$1,161 51
Office		662 15
Interest		161 26
New Buildings and repairs		1,225 16
On hand		1,277 37
Total	$76,083 89	$76,083 89
Available Assets.		
March 1, 1888, cash	$1,277 37	
Supplies at mine	1,346 63	
Horses, sleighs, etc.	785 00	
1,442 cords wood @ $2.50	3,605 00	
30 tons coal @ $4.00	120 00	
Accounts receivable	199 94	
Laboratory	150 00	
Office supplies	125 00	
February bullion	2,535 00	
Concentrates	3,000 00	
		$13,143 84
Unavailable Assets.		
Old mill, machinery and buildings	$49,495 63	
New mill, including building, cost	25,388 10	
Water works, cost	4,048 78	
		$78,932 51
Total assets exclusive of mine		$92,076 35
Liabilities.		
Accounts payable	$9,424 52	
Notes, not due	6,000 00	
Due on labor and wood	6,752 56	
		$22,177 08
Product of Mine for year, March 1, 1887, to March 8, 1888.		
Gross bullion	$26,031 57	
Gross concentrates	8,899 09	
		$34,930 66
Number tons quartz treated for year		10,216
Average yield per ton		$3 42

Recapitulation.

	Gold.	Silver.
From statement to March 1, '86	$29,452 11	$3,558 59
From statement to March 1, '87	38,499 93	4,653 92
From statement to March 1, '88	32,338 63	2,592 03
	$100,290 67	$10,804 54
Total Gold and silver produced		$111,095 21

C. R. ELY, Secretary.

COPPER.

THE COPPER MINES.

It is pleasant to meet the smiling faces of those engaged in copper mining, these days. The contrast between the prosperity of the business now and what it was a few months ago, and in fact what it has been for two years past, is indeed gratifying. During the years 1885, '86 and '87, the average price at which Lake Superior copper sold was within a fraction of 11 cents per pound; but suddenly, in about December, 1887, the price advanced from 12 cents to 18 cents. More recently arrangements have been made by all the leading copper mining companies, with what is known as the French Copper Syndicate, for the sale of all the copper produced for several ensuing years at a minimum price of 13½ cents per pound, or rather at the fixed price of 13½ cents, with the agreement that if copper shall be worth more than this fixed amount, the excess shall be divided equally between the syndicate and the producers.

Much confidence is felt in the financial strength of the syndicate, and its ability to meet its agreement for the purchase of the copper. If carried out, as no doubt it will be, it places the mining companies in an assured position.

Their experience for the past three years has demonstrated the fact that they can produce copper, nearly all of them, for 10 cents a pound. For three years, the Atlantic, Franklin, Osceola, etc., have mined copper and sold it at an average of 11 cents, and have made a little money; but it has been too close a business; the margin is too small; they are exhausting the mines, using up machinery, etc.; in fact, borrowing of the future.

Not that they have been running into debt, but in various ways there has been a degree of economy exercised that may, no doubt, be likened to borrowing of the future:—changes and improvements, etc., that were desirable, have been put off to the future. It has been necessary "to make things do" until a more prosperous season, and thus there are deferred expenditures.

In times of depression such as the copper mines have suffered for the past three years the necessity of diminishing expenditures to the lowest possible point, creates a tendency to put off until a future season construction, repairs, opening and exploring work, etc., that ordinarily are estimated an essential part of each year's burden.

With copper selling permanently at 10 cents per pound, the larger number of our copper mines could have little value. It would become with most of the companies a mere struggle for existence. The managers would find it necessary to exercise all their wits to make ends meet.

Leaving out the Calumet and Hecla, Tamarack and the Quincy, the others must have copper at more than 10 cents to be valuable mines. Some of them can produce copper for less than 10 cents, with good luck; but they need all the surplus they can accumulate to provide for future contingencies.

The metal from the Lake Superior copper mines is of surpassing value. There is none other in the world comparable with it for intrinsic purity and excellence. It is a pity that a metal so adapted to the superior purposes should be degraded to inferior uses, to the manufacture of common, cheap utensils. It is a pity that the world should not be so made aware of the superior excellence of our pure native copper that it should rank far in advance in price of the inferior foreign metal. It seems strange that Lake copper should sell at the price of Chili bars, or that Chili bars should be the standard of price in the copper market, and rank equal in price with the purest native copper in the world.

No doubt but it will be the business of the Syndicate that now controls the copper market to grade the metal according to its intrinsic value; giving to the Lake Superior copper its rightful place, and making known to the world the important uses to which this finer metal is naturally adapted. Under the control of the Syndicate, Lake copper is already selling at a higher price in Europe than electrolytic copper, a grade which our native product naturally assumes, and one to which the impure metal of South America and Spain is only brought at considerable cost.

Naturally the rise in the price of copper has occasioned a considerable increase of activity in the working of the mines previously in operation, and has caused steps to be taken to put into operation some that were idle. The low price that prevailed so long in the copper market, and the fear that it would continue, caused the suspension of work at several important mines, nearly all of which are again in operation, or soon will be, under the stimulus of the advanced price.

With copper at 13 to 17 cents a pound these mines can be made to produce at a profit under good management, and perhaps a better opportunity for resumption of work may not occur again.

Besides these there is a large number of old mines that were once largely worked, and a few with profit, that under the new order of things may be again undertaken to advantage.

Some of these old mines that have been idle for many years it is certain are valuable; that is, they could now be worked with every assurance of success, if managed with the same intelligent skill, care and economy that characterizes the conduct of operations at other mines, which have continued to be worked.

I refer only to such as have copper bearing deposits of known magnitude but low grade. But the methods of working have so greatly advanced since these mines were shut down that, with the price that now prevails, there is reason for the hope that a much better outcome would result now than formerly.

With the rise in the price of copper, there was a corresponding rise in the stocks of the companies. Some of them have doubled in market value in a few weeks' time, and the fortunate possessors have been enriched accordingly. So that while stocks in portions of the iron region have immensely depreciated in fact while they, in part, have become, in the newest of the iron ranges, practically worthless, no one need have met with any loss recently in the matter of copper stocks. For they have all advanced so greatly that the gain has much exceeded any previous depreciation in value in the stocks of all the leading mines in the district. Some of the stocks will go still higher. A few are quoted, comparatively, below their intrinsic value; some, probably, sell for more than they are worth, and will recede in price as others may advance.

At any rate there is a pleasant prospect spread out for the copper mining industry, and those engaged in it certainly needed the relief and are entitled to the good fortune which has come to them.

The laborers and miners participate in the prosperity; wages have been advanced and general good feeling prevails.

The relation existing between the men and the mining corporations in our state is most harmonious and cordial. I have taken much pains to inquire into the matter, not only in the past year, but during many previous years, and I know of no laboring men better treated or more contented than those in the iron and copper mines of Michigan. There are no strikes, no threatening of strikes, and it is very seldom in all the years gone by that a strike, of any extent, among the men has occurred.

It was charged that at the election held recently, for Congressman in the 11th district, great constraint was exercised over the men at certain mines in the iron region to practically compel them to vote as the managers wish.

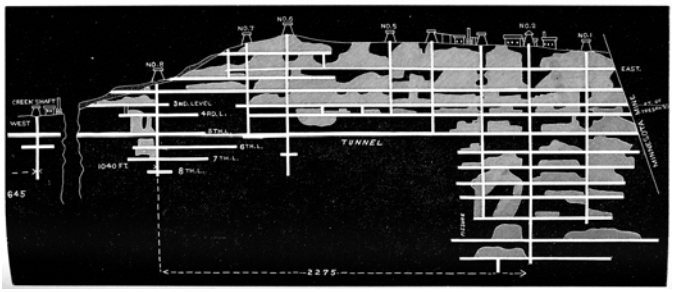
The assertion of such action being taken by mine managers and of compliance by the men is all wrong. Such statements as applicable to the companies against which they were made are entirely false. I know the managers and I know the men, and I have been at the mines on election days, and I know that the officers would not be guilty of such action, and that the men are too independent to submit to it if it were undertaken. I have observed on election days at the mines as much freedom of choice exercised by the voters, as much absence of all undue influence, as will be seen elsewhere.

I must also bear testimony to the general good order of the towns throughout the mining region of our State. Good schools, good social life, opportunity for pleasure, and for mental and moral culture exist in the chief towns, comparable on a basis of equality, with corresponding towns elsewhere. The people in the mining portions of our State average equally in all commendable qualities with those of any other portion of the State. While prohibition could not be enforced in the upper peninsula, it is a fact that the present State tax law is nearly as well observed in the older and better settled portions of that section as it is in the most orderly parts of the lower peninsula. The State law taxing the sale of liquors, has had great influence in limiting the traffic in the mining regions, and is the only State law on the subject that was not entirely ignored.

In describing the copper mines in this report I shall be brief. I have been over this matter so fully in previous reports published since 1880, that I do not deem it necessary to go over the same details now. The work in the copper mines is so systematized, is so regular and uniform that there is but little change from year to year; the mines get a little deeper from year to year. The lode usually remains about the same; sometimes a little richer, sometimes a little poorer; but such changes are usually only temporary; the average percentage is about the same one year with another. There are, of course, occasional improvements, additions to machinery, to stamp mills, etc., but on the whole the average work in the copper mines shows little change.

With the exception of the mines in the vicinity of Portage Lake, there has never been a year within the period since copper mining was begun when so little was done elsewhere in the copper range as during 1887. With the exception of the Central, all the mines in Keweenaw county were nearly idle, and up in Ontonagon very little but tribute work was done.

LONGITUDINAL SECTION OF THE NATIONAL MINE, JAN., 1888.
Scale, 300 ft. to one inch.



AT THE NATIONAL MINE

they have begun the work of erecting a stamp mil, which will contain one head of stamps. The mine will have a present capacity of 150 tons of rock per day. The purpose of the mill will be to prove the amygdaloid lode, to make sure what percentage of copper there is in the rock, and what amount of the rock they can depend upon. There are fully 20,000 tons of stamp rock on hand, derived from the openings that have been made in the amygdaloid in the past few years. Like all amygdaloid belts this, at the National, is variable in quality; it is rich and poor in places, occasionally making out into wide pockets of good stoping ground.

It will be remembered that the National Company has lately been engaged in driving an adit from the bank above the river east in the conglomerate vein. All this I have fully described in my last two reports. The adit is 3,950 feet in length, and gives 500 feet of "back" or of vein above the adit for two-thirds of the way. The mouth

of the adit is 188 feet above the river, and about 4,000 feet east of it. The location of the new stamp mill is below the mouth of the tunnel, and will receive the drainage of the mine, which, with the water that accumulates in the valley between the bluffs, constituting a small stream, will nearly suffice for one stamp head. Capt. Parnell estimates that hey may have to pump one-fourth of the water required, from the river.

The accompanying map shows the mine in the conglomerate, or mass vein, the one that has produced all the copper that made the National mine once famous. The amygdaloid is 140 feet north of the former and parallel with it, both run with the formation.

In former times when the National was a large producer of copper the two lodes were found to be connected by cross fissures which in some instances were highly rich. At the intersection of the main cross fissure with the conglomerate vein was especially good ground.

The rise in the price of copper is stimulating work at the National and Capt. Parnell is pushing things as fast as possible.

The officers are J. C. Watson, President; D. L. Demmon, Secretary and Treasurer, Boston, Mass.; Wm. E. Parnell, Superintendent, Rockland, Mich.

The National is one of the oldest mines in the state, having been started in 1848, 40 years ago. It was also one of the most profitable mines having cost in assessments only $110,250, and returned in dividends $360,000.

The mine has produced in toto 5,462 tons and 1058 lbs.

The product in 1887 was 12 tons 1,187 lbs.

The mill will be at the creek shaft. The mine water will be gathered into this shaft and be pumped 79 feet up into the mill. The shaft that is sunk in the amygdaloid is down to the 6th level. They have drifted in this belt 1,100 feet, and on the average it is looking favorable. Apparently it will all go to the mill.

No. 1 Amygdaloid shaft is located 250 feet from No. 2, the shaft in the Conglomerate which Capt. Parnell re-opened and re-fitted.

I understand that this No. 1 will be the main hoisting shaft, close to it will be the rock house, and thence the rock will be run to the stamp mill 2,200 feet over a graded track, 2½ feet grade to the 100, to the head of a "gravity incline;" down which the cars will descend 1,000 feet to the mill.

It is the intention to have all at work by November, 1888.

Joining the National on the east is the still more celebrated min,

THE MINESOTA.

But the Minesota is of the past great; what it may become again is only conjectural. During a portion of its history, about thirty years ago, it was a very rich mine, one of the most remarkable mines ever discovered, and was a very profitable one. I have heretofore given, in former reports, a full history of the company and description of the mine. It is now owned by the same parties who own the National, and if the latter prospers, the work will be carried, probably, into the Minesota. These two mines are at Rockland, one of the most inviting localities in the upper peninsula.

For many years the Minesota yielded annually a small amount of copper to tributers. The aggregate of the mine's production is 17,352 tons, 668 lbs.

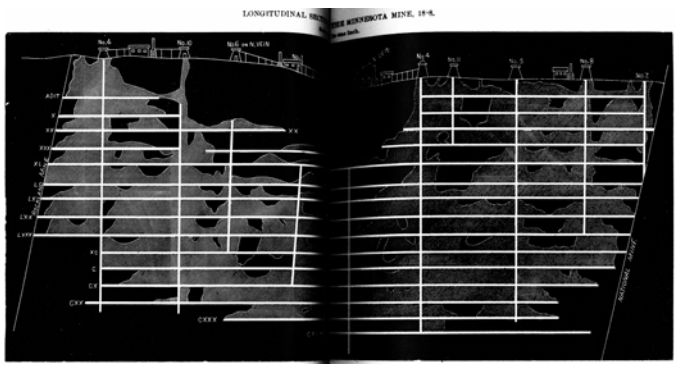
D. L. Demmon, Sec. and Treas., Boston; Wm. E. Parnell, Su'pt, Rockland, Mich.

THE MASS MINE

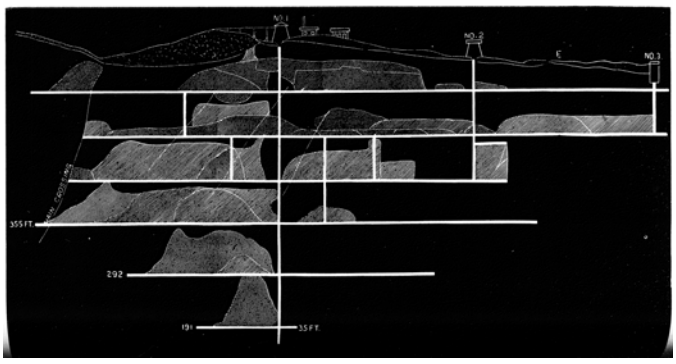
is worked now in a very small way by tributers. The Mass has proved to be a good mine, and has been very excellently well worked and managed; but it is too small. I still adhere to the plan set forth in my report of 1885, for combining the Mass and Knowlton mines, etc. At present there are 12 miners at work on tribute. Benj. F. Cheynoweth, Agent, Greenland, Mich.

Table of product of Mass mine:

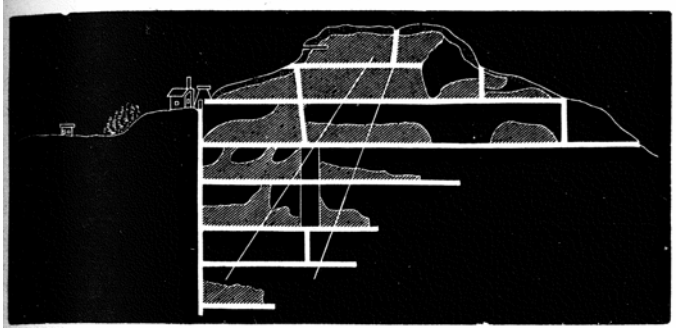
Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	8	228	1873	4	265
1858	6		1874	5	1,925
1859	26	682	1875	1	1,014
1860			1876	40	1,952
1861			1877	54	238
1862			1878	206	339
1863			1879	228	294
1864	4	1,452	1880	258	1,159
1865	6	936	1881	233	1,684
1866	5	112	1882	368	1,446
1867	5	40	1883	329	1,474
1868	9	939	1884	281	718
1869	1	1,213	1885	181	1,500
1870	1	1,408	1886	123	1,179
1871	9	692	1887	8	
1872		1,403			
Total				2,411	786



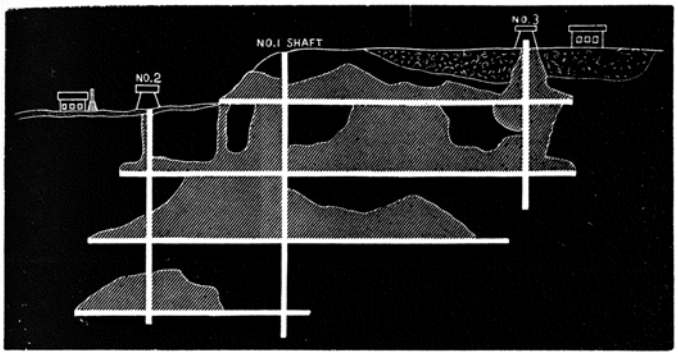
LONGITUDINAL SECTION OF THE MASS MINE, JAN., 1888.
Scale, 100 ft. to one inch.



LONGITUDINAL SECTION OF THE EVERGREEN BLUFF MINE, 1888.
Scale, 250 ft. to one inch.



LONGITUDINAL SECTION OF THE KNOWLTON MINE, 1888.
Scale, 180 ft. to one inch.



THE EVERGREEN BLUFF MINE

has been recently freed from water by tributers, who intend to explore it for copper. The mine is in the Evergreen Range joining the Ridge mine, and was once quite largely worked, from 1853 down to about 1870.

It has yielded, altogether, 678 tons, 1,870 lbs.

Rich'd Cheynoweth, lessee, Greenland, Mich.

THE KNOWLTON MINE

joins the Mass on the west or north, since the range runs here more nearly north and south than otherwise. The mine is idle still; it has yielded in all 323 tons, 1,993 lbs. The product obtained in 1887 was 19 tons, 870 lbs. There are no men working in the mine now.

F. W. Capon, Sec. and Treas., New York.

THE OGIMA MINE

joins the Mass on the south; 952 lbs. of copper were sent from the mine in 1887. It is also in Evergreen Bluff Range, as are the others above mentioned.

THE RIDGE MINE

is quite largely worked now for an Ontonagon mine. Preparations are making for an active year's work in 1888.

The mine has a good record, though it needs better machinery, a larger stamp mill, etc.

The following table shows the product for every year:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	30		1872	128	1,910
1856	35	631	1873	115	1,140
1857	36	1,874	1874	187	112
1858	29	790	1875	164	447
1859	39	690	1876	145	19
1860			1877	148	815
1861			1878	125	1,837
1862			1879	107	1,469
1863			1880	111	1,353
1864	8	917	1881	117	1,606
1865	85	433	1882	51	936
1866	71	411	1883	30	155
1867	94	1,537	1884	37	180
1868	86		1885	31	1,360
1869	126	1,840	1886	79	272
1870	122	1,700	1887	42	902
1871	175	150			
Total				2,570	1,066

Philip Highley, Treasurer, 60 Devonshire St., Boston, Mass.; Alfred Meads, Agent, Ontonagon, Mich.

The following report of the officers of the company give the facts of the working for the year:

RIDGE MINE REPORT FOR THE YEAR 1887.

The product of the mine for the year has been:

Barrel copper	86,470 lbs.
Mass copper	25,236 "
	111,706 lbs., or 53 tons, 853 lbs.
Which has realized	$8,789 49

The expenditures of the year have been:

Mine expenses	$7,137 17	
Other expenses as per treasurer's account	3,297 45	
		$10,434 62
From which deduct total receipts		8,789 49
Loss on the business of the year		$1,645 13
The statement of assets and liabilities in last report showed a balance of	$15,145 93	
Deduct loss on business of 1887	1,645 13	
Balance on January 1, 1888		$13,500 80

BALANCE SHEET FROM THE BOOKS OF THE RIDGE COPPER COMPANY, JANUARY 2, 1888.

Receipts.

Capital Stock—Paid in for property	$200,000 00	
Assessments	219,938 50	
		$419,938 50
Copper account—Sales to Jan. 1, 1887	$1,024,550 12	
Sales in 1887	8,789 49	
		$1,033,339 61
Interest account—Collected to Jan. 1, 1887		16,635 92
Shipments of 1887	111,706 lbs.	
Yield	76,095 per cent.	
Ingots	84,902 lbs.	
		$1,469,914 03

Expenditures.

Real estate—Cost of property		$203,541 00
Expenditures, as per published statement, to Jan. 1, 1887		1,142,034 64
Mining account	$7,110 96	
Smelting	813 44	
Expenses, taxes and copper charges	1,930 75	
Transportation	553 26	
		10,408 41
Dividend account—Paid Feb. 24, 1873	$50,000 00	
Paid Feb. 23, 1874	20,000 00	
Paid Feb. 8, 1874	20,000 00	
Paid Feb. 10, 1880	9,784 50	
		59,784 50
Company's stock, costing		304 40
Treasurer's account—Cash on hand		13,841 08
		$1,469,914 03

STATEMENT OF LIABILITIES OF THE RIDGE COPPER COMPANY AND OF AVAILABLE ASSETS, JANUARY 2, 1888.

Assets.

Treasurer's account	$13,841 08
Cash on hand at mine	2 30
Supplies at mine	1,315 17
	$15,158 55

Liabilities.

Unpaid dividends	$215 50
Drafts outstanding	1,442 25
Balance	13,500 80
	$15,158 55
Balance of available assets over liabilities	$13,500 80

RIDGE MINE, January 25, 1888.

Philip Highley, Esq., Secretary and Treasurer Ridge Copper Company:

Herewith I beg leave to submit a report of our operations at the mine for the year 1887. Tribute work has been continued through the year on a limited scale with satisfactory results, when we consider the small force employed and the limited amount of ground available in which tributers can work, for it must be remembered that this system of tributing has been carried on now for four years in ground many years ago abandoned as too poor to work, and confined almost entirely to the upper levels of the mine. The results, however, have shown different, and proven that the ground opened in the Ridge mine is capable of producing more copper per fathom of ground than any mine opened on the lake.

The production for the year has been 83 barrels of copper weighing 86,470 lbs, and 34 masses of copper weighting 25,236 lbs., a total of 111,706 lbs. Of this 106,448 lbs., or 55 tons and 853 lbs. Of this 106,468 lbs. were purchased of the tributers at 4½ cents per lb., $4,791.05, and 5,912 lbs., taken from the mine on company account, at a cost for labor, powder, fuse, etc., of $100.

The total cost of the copper, including the labor, teaming, barrels, etc., was $5,255.76, and all has been shipped to the smelting works at Detroit as heretofore.

The limited amount of ground now available for tributing, and the great demand for miners at remunerative wages in the iron mines in the south part of the country (just set off as the county of Gogebic) has caused such an exodus from the copper range as to amount to almost a desertion; for this reason all our houses are vacant (except two), causing quite a decrease in our revenue. All of the houses have been boarded up and taken care of, and all other property is being well watched and taken care of. As copper has ruled so low through the year (until the past few weeks), no development work of any consequence has been done, and my aim has been to keep all expenses down to the lowest point consistent with true economy in taking care of the property.

Underground in the mine everything is watched and kept in condition; decaying timbers have been replaced by sound ones, falling and caving ground removed and supported by timbers, and all dangers or obstructions to the free drainage or access to the mine removed. The mine is unwatered to below the fifty fathom level, and as it can be kept there at small expense, it will be advisable to do so; for the purpose of keeping the mine open and making any repairs to keep the shafts and drifts in good condition.

It would seem that the price of copper has been permanently advanced to a point at which there can be no doubt the Ridge mine can be worked at a profit. I therefore renew my advice that the mine be equipped and worked for the production of copper at a reasonable outlay.

SUPPLEMENTARY REPORT.

BOSTON, MASS., February 28, 1888.

Philip Highley, Esq., Secretary and Treasurer:

DEAR SIR:—I beg leave to submit this supplementary report in order to give you facts, figures and estimates in reference to starting our stamp mill to work.

The mill has been idle many years and will require a general overhauling, and repairs; the trestle work approaches to the mill will require some new timbers and repairs, and the tram road from the mine to the mill will require new ties and a general overhauling; the hoisting engine, before it will be fit for continuous duty in hoisting the stamp rock from the mine, will require a general repairing as no repairs have been made on it for several years. The timber, logs, ties, cordwood, etc., should be got out at once before snow leaves the ground. If this is done the repairs to the machinery can be made in the spring so that we can be ready to start the mill by June 1. I estimate the cost of these necessary repairs at about $1,000.

I estimate that we have about 5,000 tons of good stamp rock in the mine broken by the tributers, ready for hoisting. The Ridge stamp rock has usually yielded 2 or 2½ per cent., but as our rock has been more or less mixed with poorer rock by the tributers it may not be quite as clean, but I think it will run about 1½ per cent. The 5,000 tons would yield us 150,000 lbs., or 75 tons of 80 per cent. mineral or 60 tons of ingot, which at 16 cents would realized us $19,200. Should the percentage be 2 per cent. it would give us 100 tons of 80 per cent. mineral, or 80 tons of ingot, which at 16 cents would yield us $25,600. If we place the cost of manipulating the rock at $2, the highest figure, it would cost us $10,000, leaving us a profit of $9,200 if the percentage should be 1½; and if it should be 2 per cent., it will leave us a profit of $15,600.

The capacity of the mill is about 20 tons per day of 12 hours, or say 500 tons per month. A yield of 1½ per cent, would give us a monthly yield of 15,000 lbs. of 80 per cent. mineral, or 12,000

lbs. of ingot, which at 16 cents would be $1,920; deducting cost $2 per ton, there would be a monthly profit of $920. Should the percentage be 2 per cent, we would have 20,000 lbs. of 80 per cent. mineral, or 16,000 lbs of ingot at 16 cents, or $2,550; deducting cost would leave us a monthly profit of $1,560.

If preparations are made at once we could commence stamping by June 1; we would be able to ship in the fall the products of the months of June, July, August, September and October, and our treasury be replenished five times $920 or $4,600; or five times $1,560=$7,800.

I think all these estimates and figures can be verified by actual word; should the result of work prove as anticipated the mill could be worked night and day and stamp this season the accumulated sock with correspondingly increased results.

I estimate that our tributers have about 12 or 13 tons of copper, and as some of them are now working in rich ground we may reasonably hope to have about 18 or 20 tons of copper ready for shipment on the opening of navigation.

Very respectfully,

ALFRED MEADS, Superintendent.

THE RIDGE MINE.

At the annual meeting lately held, it was determined to call a special meeting on the 16th of April to authorize an increase of capital from 20,000 to 50,000 shares, 10,000 of which are to remain in the treasury, and the balance to be offered share for share at the market prices on the 16th of April. The following shows the financial condition of the company:

Assets.

Cash on hand	$13,814 08
Cash at mine	2 30
Supplies at mine	1,315 17
	$15,158 55

Liabilities.

Unpaid dividends	$215 50
Drafts outstanding	1,442 25
Balance of available assets	

In 1887 this mine produced 111,700 pounds of mineral, equal to 84,902 or 76 per cent. ingot. Mr. C. H. Andrews was elected President, and Mr. Philip Highley as Secretary and Treasurer.

THE ADVENTURE

is a well knwn mine, though it has not been much worked since the early days of mining on Ontonagon. It remains entirely idle. It lies south of the Ridge, being in the N. W. ¼, Sec. 35, 51, 38. I have given a full description in the Com. Report, 1880.

A. Meads, Agent, Ontonagon, Mich.

THE HILTON

is also idle. It joins the Adventure on the south or east, being in the E. ½, Sec. 36, 51, 38. It is owned by the same parties that own the Adventure, etc. William Stanaway & Son are now working the mine on tribute.

W. F. Mason, President; A. Meads, Agent, Ontonagon, Mich.

THE ASTEC

is the next east, but there is nothing new to be said of it, and the same is true of

THE BELT,

which remains without change. The property is in charge of Hon. James Mercer, resident trustee, and Capt. Trevarrou, who lives at the mine.

A full description will be found of this mine in former reports, particularly in the reports of 1882 and 1885.

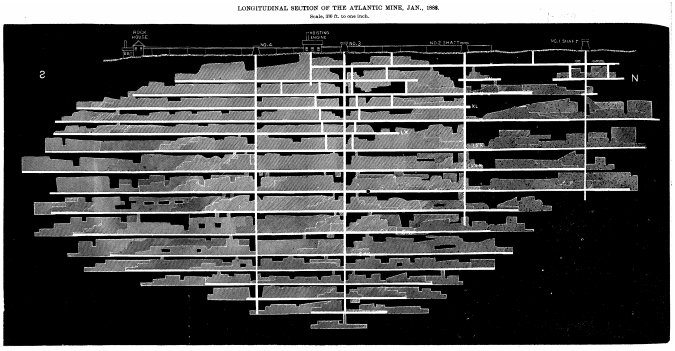
THE NONESUCH MINE

has been entirely abandoned and the machinery removed.

There are many miles of the copper range between the Evergreen Bluff and Portage Lake yet to be more thoroughly explored in the future. It is probable that important mines may be found; but there are none that have been worked for many years, and none that ever received much attention throughout this portion of the range. The first active mine north of Ontonagon is

THE ATLANTIC,

which is one of the most remarkable mines in the state. Remarkable for the uniformity of the deposit, the economy of the management and the fact that notwithstanding the excessive leanness of the lode the company continues to prosper. Through a series of years it annually not only makes ends meet, financially, but unfailingly accumulates a surplus for distribution among its stockholders. In previous reports I have dwelt quite largely on this interesting mine, and have visited it recently and finding nothing new to chronicle, I do not deem it necessary to recapitulate what has so lately been written. I have marked the map up to date and that, with Capt. Tonkin's report, will give the important new facts about the mine.



ATLANTIC MINE REPORT, FOR THE YEAR 1887.

The directors present the following report of operations during the year 1887:

The production of mineral was 5,074,361 pounds, which yielded 71.77 per cent., or 3,641,865 pounds of refined copper. The shipments to market amounted to 4,021,726 pounds

(including 379,861 pounds of the product of 1886), which realized an average price of 12.12 cents per pound.

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

Production.

3,641,865 lbs. copper, at about 12.34c		$449,504 38
Add balance of interest account		2,774 57
		$452,278 95

Costs.

Working expenses at mine as per clerk's tables		$302,660 59	
Freight	$13,483 45		
Smelting	35,284 12		
Expenses	6,354 91		
Brokerage	2,013 48		
Insurance	1,486 49		
Storage	384 95		
		59,007 43	
			361,668 02
Showing a mining profit in 1887 of			$90,610 93
There has been expended for additions to plant, as per detailed statement hereafter		$7,232 89	
And we charge off amount due by Thomas J. Pope & Bro., bankrupts, for copper sold and delivered, part of which will probably be realized hereafter		2,512 00	
			9,744 89
Leaving a net gain for the year of			$80,866 04
The surplus from 1886, after payment of dividend, was			264,100 09
Making the net surplus, Dec. 31, 1887 as shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of one dollar and fifty cents per share ($60,000) was paid February 1, 1888.			$344,966 13

In order to take advantage of the improved copper market, the copper produced after the close of navigation was brought to market by rail and disposed of at satisfactory prices. We are thus enabled to close the copper account for the year, the net result being better than was estimated at the time of declaring the dividend. The surplus carried over will enable us to make some additions to the machinery that will be needed in order to maintain, without interruption, the present scale of production, which should give us about 4,000,000 pounds of ingot during the current year.

For details of the work performed, and its cost, we refer to the subjoined tables and summary of results. The usual financial statements and report of agent at the mine are also submitted.

JOSEPH E. GAY,
JOHN STANTON,
EDWIN H. MEAD,
ISAAC B. CRANE,
JOHN R. STANTON,
Directors

NEW YORK, March 8, 1888.

ASSETS AND LIABILITIES, ATLANTIC MINING COMPANY, DECEMBER 31, 1887.

Assets.

Cash		$21,907 [illegible]
Accounts receivable		25,195 [illegible]
Loans		40,000 [illegible]
Copper on hand sold		200,183 [illegible]
		$287,285 [illegible]

At Mine.

Cash	$3,197 03	
Coal	9,355 50	
Wood	14,061 90	
Supplies	26,550 59	
Merchandise in store	41,146 15	
		94,311 17
Total assets		$381,597 [illegible]

Liabilities.

Indebtedness at mine	$18,753 43	
Agents drafts outstanding	5,903 38	
Accounts payable	11,974 11	
		36,630 [illegible]
Balance of assets		$344,966 13
(Less dividend payable February 1st, 1888, $60,000).		

SUMMARY OF RECEIPTS AND EXPENDITURES OF ATLANTIC MINING COMPANY, FROM DATE OF ORGANIZATION TO DECEMBER 31, 1887.

Receipts.

Capital stock paid by consolidation	$700,000 00	
Capital stock paid by assessments	280,000 00	
		$980,000 00
Sales of copper		5,669,094 82
Other sources		853 15
		$6,649,947 97

Expenditures.

Real estate ("South Pewabic" and "Adams" mines, buildings, railroad, stamps, etc., as valued at consolidation)	$659,642 11	
Real estate (lands since purchased)	23,464 41	
	$683,106 52	
Net expenditure for additional equipment, mining operations, smelting and marketing copper, taxes and incidentals	5,261,875 32	$5,944,981 84
Balance of receipts, being net profit to date		$704,966 13
Deduct dividends paid		360,000 00
Net surplus December 31, 1887		$344,966 13

(As shown in detail in the preceding statement).

STATEMENT OF WORKING EXPENSES AT THE ATLANTIC MINE FOR THE YEAR ENDING DECEMBER 31, 1887.

Underground Expenses.

Sinking 92.7 feet, average $24.19 net		$2,242 50	
Drifting 4,138.9 feet, average $4.54 net		18,788 31	
Stoping 14,941.133 fathoms, average $4.39 net		65,590 18	
Timbering, tramming and labor		59,300 03	
Timber, materials and supplies		7,501 47	
Pumping and operating air compressors:			
Labor	$5,004 00		
Fuel	13,728 00		
Supplies and materials	3,789 51		
		22,521 51	
			$175,944 00

Surface Expenses.

Superintendence, and labor of all kinds, less sundry credit items	$25,666 89	
Supplies and materials	5,836 63	
Fuel	12,990 60	
Feed for teams, etc.	1,021 66	
Fire insurance	380 00	
Taxes	4,378 17	
Canal tolls on copper	369 94	
Expenses and sundry repairs	747 32	
	$51,391 21	
Less amount received for rents	4,235 00	
		47,156 21

Railroad Expenses.

Labor	$5,999 01	
Fuel	1,420 47	
Supplies	2,289 12	
		9,703 60

Stamp Mill Expenses.

Labor	$26,501 50	
Fuel	29,635 56	
Supplies	11,536 74	

Fire insurance	$862 50	
Taxes	743 36	
Teaming, mineral, etc	572 12	
Total running expenses		$302,[illegible]
Construction Account—At Mine.		
Materials used in building and equipping trestle from No. 1 to No. 2 shaft, also additional trestle from No. 3 to No. 4, addition to No. 1 shaft house, enhouse and hoisting machinery	$4,066 49	
Labor on same	2,746 68	
Log dwelling	200 00	
At Mill.		
Log dwelling, etc	219 72	
Total expenditure		$300,[illegible]
Summary of Results.		
Ground broken in openings and stopes	15,552.5 cubic fathoms	
Rock stamped	255,750 tons.	
Product of mineral	5,074,361 lbs.	
Product of refined copper	3,641,865 lbs.	
Yield of refined copper per cubic fathom of ground broken	234 lbs.	
Yield of rock treated, 14.24 lbs. copper per ton, or	0.712 per cent.	
Gross value of product, per ton of rock treated		$1.[illegible]
Cost per ton of mining, selecting and breaking, and all surface expenses, including taxes		.[illegible]
Cost per ton of transportation to mill		.[illegible]
Cost per ton of stamping and separating		.[illegible]
Cost per ton of running expenses at mine		1.[illegible]
Cost per ton of freight, smelting and marketing product, including New York office expenses		.[illegible]
Cost per ton of working expenses		1.[illegible]
Total expenditure per ton of rock treated		1.[illegible]
Net profit per ton of rock treated (exclusive of interest earned)		.[illegible]

AGENT'S REPORT.

ATLANTIC MINE, L. S., MICH., January 1, 1888.

John Stanton, Esq., Treasurer Atlantic Mining Co., New York:

DEAR SIR:—I herewith present the following report of operations at the Atlantic mine for the year 1887:

No. 1 shaft has been opened and put into working condition to the 5th level. On the 16th of August we begin hoisting rock. Very fair rock has been taken from the 2d and 5th levels north and south of this shaft.

No. 2 shaft is down to the 11th level. We have drifted and stoped a considerable amount of rock from the following levels north of the shaft, viz.: 3d, 7th, 9th, 10th and 11th levels.

No. 3 shaft has been sunk from the 16th to the 17th level. The 14th, 15th, 16th and 17th levels have been extended north, and the 15th, 16th and 17th levels have been driven south of this shaft. Stoping has been done in all of these levels.

No. 4 shaft has been extended from the 14th to the 15th level. Drifting and stoping have been carried on in the 10th, 11th, 12th, 13th, 14th to the 15th levels south of this shaft. A large quantity of timber has been used to keep the mine in working condition, but notwithstanding this we have had some caves between the shafts and have had to "spill" through some of the fallen rock, and with timbers form our levels sufficiently large to run the cars through the drifts and stopes beyond.

The drainage at the 16th level has made it necessary to use a small pump. A Gordon and Maxwell duplex pump has been located in this level at No. 3 shaft, and is operated by compressed air. It lifts the water to the 11th level, and the main pump takes it from this point to the surface.

The mine has never looked better than at present, and everything is in good working condition.

SURFACE.

A considerable amount of new work—necessitated by the opening of No. 1 shaft—has been done. A trestle road, 800 feet long, averaging 23 feet high, has been erected from No. 1 to No. 2 shafts and laid with 30-lb T rails. An additional trestle road has been constructed from No. 3 to No. 4 shaft, about 600 feet long and 35 feet high. This road has also been laid with 30-lb rails.

No. 1 shaft house was built in 1873. Some years thereafter the dump and sheaves were removed, and the building fitted for use as a merchandise warehouse. A great deal of work was therefore necessary to refit it for hoisting. The dumps and sheaves were rebuilt and replaced, and the building put in good working order.

An 18x24 "Bird" engine, with boiler, formerly used to operate the saw-mill, was repaired and refitted with drums and counterweight, and located for hoisting purposes at No. 1 shaft. It is enclosed in a building 30x40 feet. The hoist operates very economically, as the counterweight balances the skip, and the force is expended only in hoisting rock.

We have on hand a 16x24 "Bird" engine, with boiler, having ample power to operate the saw-mill, and will soon put it in place.

Many dwellings have received considerable repairs, several new roofs laid and six additions built. A warehouse, 80 by 35 feet and two stories high, has been erected for storage purposes.

The rock-breaking machinery, hoisting plants, pumping and compressing machinery are all in fair condition.

RAILROAD.

The road is in very good condition. A quantity of new 60-lb. steel rails have been laid, and a large number of new ties.

The rolling stock is in very fair condition.

STAMPING.

About the only changes at the mill during the year were replacing two 16-inch cylinders by two 18-inch ones, and a new duplex Worthington condenser. The larger cylinders have increased the capacity of the mill and enabled it to handle the increased quantity of the rock that has been sent to mill in the past three months.

The results per ton of rock are not so favorable as last year, the increased cost being largely due to the increase of 65 cents per ton in the cost of coal.

Allow me to refer you to the tables made by Mr. Van Tassel, which show the cost in every department, and also the map exhibiting the work done during the past year.

I would recommend to your favor the officers who have all worked faithfully for the best interests of the company.

Yours truly,

WM. TONKIN, Agent.

The following table gives the product each year:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1866	6	1,475	1887	1,027	
1867		1,760	1878	1,132	
1868	764	258	1879	1,152	
1869	823	857	1880	1,170	
1870	186	617	1881	1,264	
1871			1882	1,315	
1872			1883	1,341	
1873	431	1,336	1884	1,586	
1874	686	403	1885	1,791	
1875	783	1,036	1886	1,751	
1876	917	1,041	1887	1,820	
Total				19,951	

It will be seen that the product of 1887 was the largest in the history of the mine. The mine is no richer, only more rock was stamped. As a postscript to the foregoing, I may state that a few men are employed on Sec. 16 exploring by test pits. They encounter considerable depth of drift covering the ledge.

The company is preparing to make No. 1 a double skip shaft, that is to put a second skip track; it is now to the 7th level; work at the 2d level in this shaft develops considerable "barrel work." At No. 2 shaft they have put in a balance car to the skip and have removed the hoisting engine at No. 2 to the foot wall side.

No. 3 shaft is sunk to the 18th level, and they are preparing to extend the skip track from the 17th down.

In No. 4 shaft the skip road has been carried down to the 16th level, from which point they are now hoisting—July, 1888.

The following table gives the important results of the Atlantic mine's operations for the past 13 years:

	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Number of tons of rock stamped	80,000	96,696	105,780	121,709	113,668	169,825	176,555	189,800	195,669	209,510	241,010	247,035	255,750
Yield of ingot per ton, in pounds	19.58	18.99	19.42	18.50	19.00	14.37	14.36	13.866	13.708	15.1	14.86	14.18	14.34
Number of fathoms broken in mine	5,628	6,550	7,091	8,299	8,665	9,929	9,240	10,170	11,161	12,210	13,403	14,724	15,552
Yield of ingot per fathom, pounds	278	280	290	243	266	244	2,735	259	240	259	267	238	234
Cost in cents per ton for stamping and washing	67.96	67.09	57.79	48.85	42.44	38.13	42.54	37.07	35.25	30.95	30.36	26.53	27.31
Total cost per ton of rock mined, etc	3.90	3.58	3.08	2.78	2.33	2.25	1.96	1.9082	1.7789	1.71	1.436	1.2801	1.4622
Total average cost per pound, ingot	$0.2212	$0.1895	$0.1637	$0.1683	$0.1220	$0.1584	$0.1368	$0.1376	$0.1256	$0.1087	$0.936	$0.908	$0.1020
Average price per pound received for copper	.2247	.2135	.1854	.1615	.1630	.1997	.1712	.1756	.1500	.1181	.1116	.1092	.1212
Dividends paid				20,000	30,000	40,000	80,000	80,000	40,000	20,000	40,000	40,000	60,000
Net profit per ton of rock		.44	.51	1.01	.87	.5000	.4711	.4958	.2483	.0919	.2205	.1529	.2706
Per cent. of copper in rock	.976	.949	.971	.925	.95	.713	.718	.693	.685	.755	.743	.709	.712

THE HURON COPPER MINING CO.,

since its re-organization in 1880, has made a good record. The undertaking was bad enough to begin with, but added to the original difficulties, which were understood and could be provided for, there have been unforeseen troubles, serious accidents, which have increased the burden. Each year has brought with it some misfortune at the mine—dam giving way, explosion of boilers, and finally the destruction of the stamp mill by fire. Still the company, through persevering effort and most excellent management, has successfully breasted its era of troubles, and having kept its craft afloat through a period of adversity may now reasonably hope that the silver lining to the clouds which have obscured its horizon indicate the dawn of better days, and that under calmer skies and upon smoother seas the ship freighted with the Huron's fortunes is destined, perchance, to enter upon a prosperous voyage.

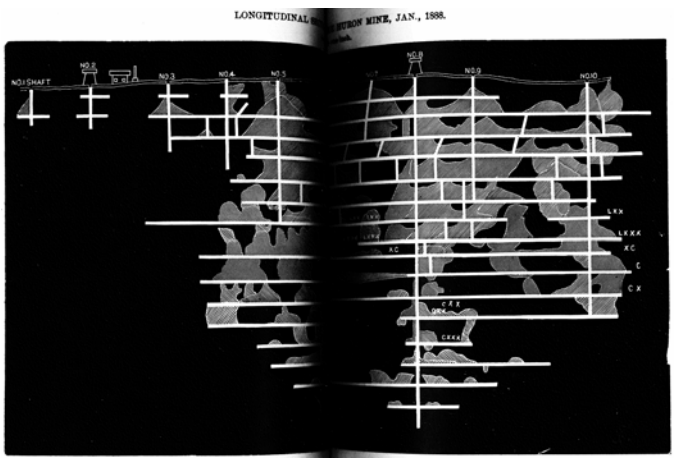
The stamp mill is better than before the fire, since there are several new boilers and the arrangement of the necessary buildings has been much improved. There are, as before the fire, two head of stamps, which work up 375 tons of rock per day. The stamp mill is first-class and is doing good work. The facilities for pumping the water have been increased and modified, and altogether the water supply rendered more abundant and secure. Capt. Vivian declares that the mine is better at greater depth, becoming more purely amygdaloid. The mine furnishes some excellent rock, and if extensively opened, a good deal of good rock can be had.

Capt. Vivian has been experimenting with the Jewel filter to purify the mine water for the boilers.

He states that filtering of the water is of great advantage to the boilers. I may add that they are using the Jewell filter—one of a capacity of 125,000 gallons per day—at the Hecla mine, and are so well pleased with the results as to have ordered one also for the Calumet mine. It is declared to effect a saving of fuel and to preserve the boilers. I have marked up the map to the close of the year.

Table of product of Huron mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	3		1872	276	1,684
1856	12		1873	237	1,883
1857	35		1874	125	1,005
1858	24		1875	31	1,289
1859	22	1,387	1876	31	1,857
1860	4	1,000	1877	41	161
1861	49		1878	32	1,100
1862	69	1,305	1879	14	1,760
1863	69	206	1880	35	285
1864	50	1,745	1881	127	515
1865	238	11	1882	182	579
1866			1883	360	213
1867	683	1,164	1884	963	1,660
1868	740	80	1885	1,135	1,163
1869	841	863	1886	996	995
1870	42	183	1887	742	103
1871	134	1,453			
Total				8,354	1,659



D. L. Demmon, Secretary and Treasurer, 19 Congress street, Boston, Mass.; Johnson Vivian, Superintendent, Hancock, Mich.; T. Whittle, Mining Captain; Alex. Loranger, Clerk.

The Huron is the most southerly of a group of mines situated south of Portage Lake in the village of Houghton and opened in the Isle Royal lode. Its experience is of value to the companies north of it, between it and the lake.

I witnessed at the Huron in December an interesting trial of the Gates rock crusher. It works very rapidly and effectively; 12 tons of rock were run through the machine in 14 minutes. Three men worked incessantly to supply the machine, and two others to keep it clear, which they were so far unable to do that a stoppage of two minutes was required. The test thus indicated that the machine would crush one ton per minute. The larger No. 6 machine, would probably do much more than this. There is no question of the effectiveness of these machines. They will do more work and do it better than any other breaker I have ever seen tried. The trouble is, if any, they do too much; rock can not be had to supply them. A ton per minute is too much rock for one mine to supply. It occurred to me that the rock was put into better shape for the stamp than it is done by the ordinary breaker.

THE ISLE ROYAL MINE

joins the Huron on the north. The mine has not been worked for many years. All of the south side mines were failures, including the Atlantic, when formerly worked by a prior company under the name of the South Pewabic, and it would be a failure to-day if it were worked as it then was. Low grade copper bearing belts can not be worked at a profit on a small scale. There must be vigorous, intelligent management, and all the modern appliances of mining, to make mines in such a deposit as the Isle Royal profitable.

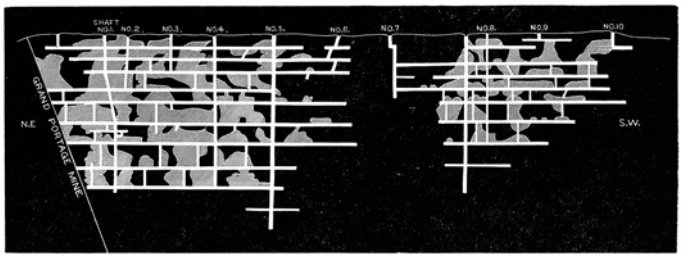
A large quantity of rock must be mined and manipulated, and with the use of compressed air drills, high explosives, large hoisting skips and winding drums, powerful engines, the improved Ball stamps and Collum washers, etc., etc., this has become an easy matter.

Two of the old mines in the Isle Royal lode, one on either side of the mine of that name, have been re-opened and worked since the former abandonment. The Huron on the south, and the Grande Portage on the north, and both afford evidence that the belt is a paying one to work if worked rightly.

No fact is better established by the experience of copper mining on Lake Superior than this, that all things being equal, the greater the output, the better the chances for a favorable result. Like all amygdaloids the Isle Royal lode is bunchy, wide and narrow, rich and poor in places, it must be so opened and worked as to leave the poor ground standing and take out the good rock. There is an effort making to combine

under one corporation, and I certainly esteem the project a good one. Equipped and worked as the Osceola and Atlantic are equipped and operated, and it would be as profitable. The properties combined could be economically worked. They are favorably situated. A long adit from near the lake, driven south in the lode, would prove the mine and give several hundred feet of "back" through a long distance, upwards of a mile to the Huron line. The old shafts would afford ventilation. The adit would secure drainage and would constitute an avenue for sending out the rock from the mine. There are two, possibly more, well defined copper bearing belts on these properties. Both have been mined in and have shown to be about equally rich. The maps herewith given show that the good and poor ground are about the same in each of the Portage mines. The dark portions represent the standing ground. The vein makes mass and barrel copper, and some fine stamp copper rock of which the prevailing mineral is epidote. The hanging walls are good, being firm trap rock.

LONGITUDINAL SECTION OF THE ISLE ROYAL MINE, 1888.
Scale, 30 ft. to one inch.



The Isle Royal and Huron were both early mines. Comparing their products from 1855 to 1882, it seems that the former produced the most copper, 422 tons more than the Huron in that period. It was no more extensively worked than the Huron, was no better fitted out with machinery, so that it is safe to conclude that the Isle Royal has equally as rich a portion of the lode as the Huron.

Provide machinery and work them largely, and I see no reason why they should not pan out as well as the Franklin and Atlantic.

The Isle Royal mine has produced in toto, 4,602 tons, 71 lbs. refined copper. The estate consists of 480 acres, lying in the village of Houghton.

Graham Pope, Agt., Houghton, Mich.

THE GRANDE PORTAGE MINE,

lying contiguous with the Isle Royal, has been fully described in former reports, particularly in that of 1882. Also what I have herewith said of the Isle Royal mainly, also includes the Grande Portage. If the two mines are combined and operated as one by a single company; and better still, if the combination includes the Sheldon-Columbian, it will certainly, in a mining sense, be a wise move.

The Grande Portage has been idle for four years past.

The mine has produced in all 1,613 tons, 434 lbs. of refined copper.

Peter Ruppe, Sec. and Treas., Hancock, Mich.

THE SHELDON-COLUMBIAN MINE

lies between the Grande Portage, and the margin of Portage Lake. It has not been operated for many years, and if again opened up as a mine it will be, probably, as one of the combination previously alluded to in describing the Grande Portage, etc. The mine produced during the years that it worked 708 tons, 548 lbs.

Graham Pope, Agt., Houghton, Mich.

THE QUINCY MINING COMPANY.

The Quincy mine that has heretofore stood second in the rank of copper producers in this State, is now relegated to the third place, not through any falling off in its own. product, for the mine is as rich and productive as ever, but through the fact that the Tamarack has superseded it; has become a larger producer.

The Quincy, however, heads the list of amygdaloid mines; and there is no likelihood of its losing this place. The Quincy has very rich ground; not all of it, perhaps, but the greater portion of the amygdaloid is well mineralized. It is a wide belt, and some of the best ground is found in the "pockets," or branches lying east and west from the main lode.

The ground plan of the levels looks like the projections of an iron mine, so irregular. The Quincy has been uniformly good for many years. The company has been relieved from anxiety as to its product. The mine has been so uniform in quantity and quality of rock, one year and another that, without change of plant or increase of force or effort, the product each year varies but little. This is shown by the percentage of copper obtained, as given in the following table:

Year.	Per Cent.	Year.	Per Cent.	Year.	Per Cent.
1861	2.55	1870	2.61	1879	
1862	2.03	1871	2.29	1880	
1863	2.75	1872	2.17	1881	
1864	2.96	1873	2.60	1882	
1865	2.60	1874	2.61	1883	
1866	2.63	1875	2.44	1884	
1867	2.74	1876	2.38	1885	
1868	2.25	1877	2.11	1886	
1869	2.48	1878	1.76	1887	

This table shows that there is no deterioration in the quality of the rock. It gave a larger percentage last year than ever.

The burning of the rock house at the mine was no loss to the company in the long run. It has a much better one now and in a much better situation than the one destroyed. In fact the new rock house is admirable, and the situation is such as to meet future requirements of the mine. The man-engine machinery has been altered to great advantage, too. There are not many changes about the Quincy; it is an old mine and was equipped years ago. Some things are old-fashioned and would be better if more modern, perhaps.

I notice judicious modifications from time to time, as I frequently visit the mine. Capt. Harris is alive to improvements and is constantly making them to advantage.

The mine has reached a depth of 2,800 feet, to the 37th level, and is thus one of the deepest mines on the lake. A fuller description of the mine would necessarily involve a repetition of what has been said in previous reports. I have discussed in previous reports, particularly in that of 1881, the Quincy stamp mill. There is no doubt but the company has needed a more modern mill for years. It has cost too much to manipulate the rock. Comparative results with the Osceola, Atlantic mills, etc., tell the story. The company has decided to construct an entirely new mill on Torch lake, where it owns a mile in length of land bordering the lake, in Sec. 23, 55, 33. The mill will be in lot 3, about a mile south of the Osceola and Tamarack stamp works. The company owns on both sides of the lake, which is here about half a mile wide.

The average depth of the water at this point is said to be 61 feet. The company will build a railroad from the mine to the mill. The organization for this purpose is called the Quincy and Torch, Lake Railroad Co.

The commerce of Portage lake, and particularly of that portion of it between Hancock and Houghton, is of so much importance that the vast amount of sand run into the lake by the stamp mills located there is a serious matter, and the U. S. Government officers have from time to time intimated to the copper companies that such disposal of their refuse must finally cease. The filling up of the south end of Torch lake is matter of minor importance.

The survey for the railroad has been made and the distance found to be six miles, with a maximum grade of 80 feet.

The following report by the officers of the company gives the main facts of the year's work.

QUINCY MINE REPORT.

ANNUAL REPORT OF THE DIRECTORS OF THE QUINCY MINE FOR THE YEAR 1887.

AGENT'S 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: