

THE WEBSTER MINE

adjoins the Wetmore on the west. The Webster lies west of the brook which runs between the two mines. The Webster has been idle for several years, until recently, owing to the condition of the ore market, and the embarrassed condition of the company's financial affairs.

The mine is now controlled by Messrs. Watson and Palmer, of Marquette, and the ore is mined on contract by Mr. Fred Dishno, at 80 cents per ton. This sum covers all the mining expense for the ore, delivered in the cars. The mining is all open cut work. There are two pits; the main one is about 60 feet deep and 200 feet long and the other of slightly lesser dimensions.

The ore body is fully 100 feet in width, and the ore is of the same quality as the Wetmore, about 60% in iron and .25% in phosphorus; 9,260 tons were mined during the year 1886, and there are now about 12,000 tons in stock, which occupies all the dock room, so that work has been suspended until after the opening of navigation. It is expected the season's product will be about 40,000 tons.

The force employed is about 40 men. The ore is not entirely clean; it has to be picked.

Year.	Tons.	Year.	Tons.
1882.....	4,413	1885.....	---
1883.....	---	1886.....	9,246
1884.....	930		
Total.....			5,589

Watson and Palmer, Managers, etc., Marquette, Mich.

In 1881 and in the summer of 1882 some exploring work was done at several points west of the Webster, at each of which a good showing of ore was made, but no work has been subsequently done at these points, except at the well known mines, the Beaufort and the Titan.

Between the Webster and the Beaufort, in the same section, to-wit: the S. E. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Sec. 22, T. 48, R. 31, is an exploration designated as

THE PORTLAND,

where a line of test pits dug across the formation indicated the existence of a body of ore 80 feet in width. But then the extent of the ore can only be a matter of conjecture with the limited data. It is only probable that there is ore enough for a mine of greater or less dimensions. Some controversy regard-

ing the lease of the land, together with the depressed state of the ore market, have prevented further work until now it is proposed to open a mine, and a few men are already at work on the location—April 15, 1887. Mr. J. C. Fowle, Superintendent of the Michigamme Co., has charge of the work. The same gentleman is also superintending the opening work on the adjoining property in section 26, to-wit: the N. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$, T. 48, R. 31. The explorations made here in 1881 and '82 gave equally favorable results as were obtained in section 22. It is also proposed to mine and ship ore from this land the coming season.

THE BEAUFORT IRON MINING COMPANY.

The Beaufort mine, in the N. $\frac{1}{2}$ N. W. $\frac{1}{4}$ of Sec. 22, T. 48, R. 31, continues to look first rate. I visited the mine in April last, and found all the indications, etc., very favorable.

The mine is now wholly under ground, and has a length of about 600 feet east and west. The ore is continuous, and averages, at right angles to the wall, 20 feet in width. The dip is to the south, lying very flat, the angle being about 28° with the horizon.

The mine is dry, the ore hard brown and yellow hematite, that stands well in the pillars and stopes, as does also the hanging wall, so that the ore can be mined out in large rooms, leaving pillars of ore between. These rooms are from 15 to 30 feet wide, and the pillars are about 20 feet. The ore is easy to mine, as it breaks out in large blocks, and is reasonably clean. The company work about thirty men, and has about 5,000 tons of ore in stock. If the mining work were pushed a large product could be got out. There has been for a few years past so little demand for this quality of ore that but a small product has been mined. There are two shafts. No. 1 goes down in the east end of the open pit, and is 160 feet in length. No. 2 is sinking vertically from the surface, about 300 feet east from No. 1, and is about 60 feet deep, 30 feet through sand and gravel, and is 30 feet in ore. The shafts are connected by drift through the ore. The machinery consists of two boilers, two drums—Akron, Ohio, make—4 $\frac{1}{2}$ feet diameter, and Burleigh compressor.

Hon. S. S. Curry, President, Ishpeming, Michigan; M. E. Williams, Superintendent, Beaufort, Michigan.

THE TITAN IRON MINING COMPANY'S

mine joins the Beaufort on the west. The mines are only separated by a bar of ground. In essential features the two are nearly identical. The Beaufort, however, seems to have a greater length of ore than has been developed in the Titan, and possibly the ore in the latter is more mixed with rock, and requires

more picking. The mine is also wholly underground, and about 500 feet of length of opening. The west end of the mine is poor, the rock cuts out the ore. The company works about 30 men, and there are two shafts, two hoisting drums, compressor, Camp, Lane & Webster, each $4\frac{1}{2}$ feet in diameter, and in the last year there has been added an Ingersoll compressor, having the capacity of operating seven drills. There are three only used in the mine. Like the Beaufort the Titan could furnish a larger product. The ore deposit is fully 20 feet wide, and the roof and pillars stand well. There is about the same amount of ore in stock as there is at the Beaufort, and the mine is controlled by the same officers, M. E. Williams, Superintendent; S. S. Curry, President, etc.

THE CHAMPION IRON CO.

is undoubtedly one of the best conducted mining corporations in the State. The management has always been liberal with its employés and progressive in its methods of work.

The mine is noted far and wide for the uniform excellence of its ore and for the magnitude of the product. The ore is the best specular slate and magnetic; there is none better found in the State. It commands the highest price and is the most eagerly sought for by the furnace men for the manufacture of Bessemer pig. Two-thirds of the product is first-class ore, that averages about 68% in metallic iron, .040% phosphorus and 1.50% in silica. All the ore taken from the mine is Bessemer; the grading is made on the percentage of iron contained.

The Champion mine location is one of the pleasantest and healthiest in the iron region, situated upon the level plateau overlooking the valley and hills to the north and the waters of the beautiful Lake Michigamme to the west. The buildings, miners' houses, etc., are substantial, commodious and neat, every house has a garden, for which the soil is well adapted. Besides the dwellings, there are other provisions made for the comfort and well being of the men and families not usually found at mines, at least not usually of such excellence and furnished at the expense of the company as they are here. Among these are bath rooms connected with the change house; there are 14 of these rooms, all provided with good zinc lined bath tubs with hot and cold water, which is pumped from Michigamme Lake, and hence pure and sweet. The change house proper is also supplied with every requisite for convenience and comfort. A large fine building has been erected by the company, centrally and pleasantly located, containing a commodious hall suitable for public meetings, entertainments, etc., also having apartments for library and reading room.

The latter is furnished with leading daily and weekly papers, magazines, etc.,

and is open day and evening, kept warmed and lighted, and is accessible and free to all.

There is a large, handsome school building erected a few years ago, in which a well-regulated graded school is maintained. Several fine church edifices adorn the location, affording the conveniences for varied religious worship. Good sidewalks, streets, shade trees, etc., prevail, and a pleasant grove of maples situated in the village has been preserved and rendered clean and pleasant for the use of the people. On public holidays, such as the 4th of July, in the summer, it has been the custom of the company to furnish a band of music, and the use of its steamer and boats, for free excursions on the lake. Every pains has been taken at such times to make the occasions happy and enjoyable.

In the matter of wages, the Champion has always been esteemed among the most fair and liberal. It pays as good prices for its work as any of our companies. At my recent visit to the mine, April 10, I saw the labor cash sheet for the preceding month of March. No class of miners were having less than \$2.25 per day.

The average daily earnings for drill men were.....	\$2 57
The average daily earnings for miners, sinking and drifting.....	3 11
The average daily earnings for trammers.....	2 19
The average of all miners underground daily wages.....	2 70
The average of all miners on contract, daily wages.....	2 52

The mine is a good one to work in; as safe as any and dry and with good air. Two fatal accidents occurred in 1886; one man and one boy were killed. The former, a new man, fell into a shaft. The force employed averages 500 men. I have been particular in referring to the above matters owing to the strike by the men a few weeks ago, the only one that has occurred at any of our mines, recently. I wished to ascertain how just cause for complaint the men might have against the company. By all I could learn, in talking with the men, and with officers of the company, the trouble was caused largely by agitation and misrepresentation emanating from irresponsible persons who had for good cause been discharged from the company's employ.

In repairs and improvements on miners' houses, the company has expended in the past year \$13,000. Among the important improvements made in 1886 is in the method of hauling the wood from the lake up to the mine. The wood for the boilers and the use of the location is obtained from lands surrounding Michigamme lake, and is taken to the lake from the woods in cars, on tracks laid for the purpose. The cars hold two cords of wood each, and run onto the flat boats, which are towed to the landing by a steam tug owned by the com-

pany, whence they are hauled up the incline 4,800 feet long, 180 feet rise, by stationary engine and wire rope. The arrangements are admirable for expeditious working. They can remove from the scows, so stated, 24 cars in 15 minutes' time. This number can be hauled up the incline to the boiler house. The cars are provided with a simple automatic brake, consisting of a shoe and chain that stops the car immediately if anything gives way. The machinery for operating this track consists of an engine 18"x24"—drum 8' diameter, 8½ feet face. Here, as elsewhere in the mine, the electric bell is used to signal.

One of the most promising things at the Champion is a "new find," just east of the East Champion mine. Here they have removed the dirt and exposed the top of a lense of ore 26 feet wide and 75 feet east and west. The lense pitches to the west and dips to the north at a sharp angle. The ore is slate and magnetic, of seemingly good quality. It is expected that this will add greatly to the product the coming year.

In the mine the lenses of ore are somewhat contracted in dimensions in the bottom as compared to the magnitude which they hold in the upper levels. Formerly the Champion mine had a few immense stopes that furnished the product; now there are more stopes than heretofore, none of them so large, but generally looking fairly well, and in the aggregate suffice to keep up the product.

The general features of the mine at the present time may be sketched as follows: No. 1 shaft, the most easterly one, is not worked. No. 2 is down to the fifth level in the north deposit; below that point the ore, owing to the westerly pitch, went to No. 3 shaft. South of No. 2, in the south deposit, is an old shaft, designated as B, in which they are now working at a depth of 125 feet. The ore is west of the shaft 100 feet, and 15 feet wide, good, second class magnetic. Work in this ten men and one drill. They stope out as fast as they sink, *i. e.*, sink a level and stope the ore, and by the time it is exhausted have another ready to begin on.

No. 3, above the eleventh level, had both the north and the south deposits; at the eleventh they come together, but further down in the twelfth, thirteenth and fourteenth levels they have the two deposits again, somewhat less regular, however, and smaller than they were above.

The levels have uniformly shortened on the east, now they are lengthening in that direction. This has occurred in the eleventh, twelfth and thirteenth. The latter is 100 feet east of the shaft, and the ore is 10 feet wide and continues to become wider. West of the shaft in the twelfth, thirteenth and fourteenth levels all the ore is standing, 30 feet wide. From the surface to the fourteenth level is 840 feet.

No. 5 shaft has encouraging features. In the eighth level the ore extended

156 feet west; in the ninth level the length west reached 171 feet, and in the tenth they are already 50 feet west of the line, which should limit the ore if a uniformity in the cut-off occurred, and still they find no rock to bar their progress. The ore is the best of slate and black ore side by side. They are also working west in No. 5 in the third level and have a stope of ore.

No. 6 shaft is 160 feet deep and at the bottom they have drifted east towards No. 5, 125 feet. West of No. 5 the ground is all unexplored; it is possible that other lenses of ore will be found between Nos. 5 and 6 shafts. It is also the supposition, based on the experience with the other shafts, that as the ore pitches west, No. 6 will cut the main ore lenses when the proper depth is attained.

No. 7 is 300 feet deep. They are sinking and stoping. The ore body gives a stoping length of 100 feet, with a width of eight to ten feet. The shaft is in rock. They drift to the ore.

The Champion will probably furnish an output the coming season of 160,000 tons, worth in the lake ports \$7.50 per ton. It is probable that the product of the Champion may not again equal its out-put of 1884, but it may be relied on for a large annual product still.

Products of Champion mine in previous years:

Year.	Tons.	Year.	Tons.
1868.....	6,225	1878.....	73,764
1869.....	21,535	1879.....	93,203
1870.....	73,161	1880.....	112,410
1871.....	67,588	1881.....	144,025
1872.....	68,402	1882.....	157,516
1873.....	72,782	1883.....	104,960
1874.....	47,097	1884.....	208,156
1875.....	56,877	1885.....	173,914
1876.....	66,002	1886.....	137,593
1877.....	70,883		
Total.....			1,755,835

The officers are W. E. Stone, Treasurer, Boston, Mass.; A. Kidder, Agent, Marquette, Mich.; W. Fitch, Superintendent, Champion, Mich.; James Cundy, Mining Captain; Wm. Williams, Master Mechanic.

THE HUMBOLDT IRON CO.

There is nothing new or encouraging to record of the Humboldt mine. I

have fully described it in previous reports, and find nothing of interest to add. The mine has been gradually assuming each year smaller dimensions.

Mr. Maas, the agent, is exploring with the diamond drill in ground to the east where there is reason to expect success. The formation presents many features of an encouraging character. The ore is hard specular, of good quality, but non-Bessemer, which sold in 1886 at an average price of \$5.33 per ton.

J. B. Maas, Agent; Ed. Maas, Superintendent, Humboldt, Mich.

The Humboldt mine, including its predecessor, the Old Washington, has produced annually as follows:

Year.	Tons.	Year.	Tons.
1865.....	4,782	1876.....	3,333
1866.....	15,150	1877.....	16,546
1867.....	25,440	1878.....	23,921
1868.....	37,757	1879.....	18,204
1869.....	58,462	1880.....	14,727
1870.....	79,712	1881.....	26,302
1871.....	48,725	1882.....	43,436
1872.....	38,841	1883.....	31,866
1873.....	38,014	1884.....	23,763
1874.....	27,890	1885.....	11,776
1875.....	9,642	1886.....	20,207
Total.....			626,545.

THE REPUBLIC IRON CO.

In going through the Republic mine recently with Mr. Morgan, the President, and Capt. Pascoe, the former remarked that they had not yet devised how to mine out a large quantity of ore without leaving openings in the ground of corresponding magnitude, and in time making it apparent that the constant drift upon the resources of the mine has served to materially lessen the amount of ore originally held in store.

The Republic has still a great deal of ore in sight, and is certain to be a large producing mine for some years to come, but it is not likely that the annual product hereafter will equal what it has been in preceding years unless the pillars are resorted to. There is more first-class hard ore to be seen in the Republic mine still, than in any other mine in the State, but the stopes are less than formerly. There will be, probably, a considerable falling off in the product of the pits at the southwest part of the mine, particularly in the Pascoe pit, which will not yield to exceed half of the product of 1886. The

shaft is 860 feet in length. The formation is very much contorted, the lateral pressure to which it was at some period subjected, having made innumerable sharp folds that have served to place the ore across instead of with the formation. These bodies of ore are exceedingly irregular. There is no instance of greater irregularity to be seen in any of our mines than appears in the Pascoe pit. The ore is mainly back of the shaft, east of it, in the jasper foot wall, and has been found in every direction and in every form of body. Just now, however, there is comparatively little ore to be seen in the bottom; a drift into the hanging wall has revealed a deposit of slate ore that may prove to be of suitable magnitude; it has not been developed yet—April 20, 1887. In the levels above are some good stopes. The Morgan pit—situated west of the Pascoe—is also poor in the bottom; it is the same depth and has similar characteristics. The ore is in narrow stopes across the formation and very irregular in form and in manner of occurrence. Further up in the pit, from the eleventh level up to the ninth, there is a good body of ore, which makes around the jasper that stands near the shaft, in the foot wall.

The Ely pit is also 860 feet in depth, and while it is equally as puzzling as the others, it shows far more ore than is to be seen in them. In fact the Ely will furnish about its usual product. These pits are down to the fourteenth level, and the Ely and Pascoe are connected in the eleventh level by a drift. The ore in the Ely is mainly specular slate, and averages 12 to 14 feet wide and 100 feet in length. It is all Bessemer. None of the pits in the Republic mine contain much water. The next, the fifth pit to the north, is the Gibson, and, at the time of my visit, it was not working. So far as they have been able to discover, there is little ore left. The pit will be worked again as soon as they have air enough for the machinery, the supply being short just at present.

No. 1 is the deepest pit in the mine, being about 900 feet deep. It seems to be looking first rate, *i. e.*, there is a good deal of ore in sight. A year ago the ore from this pit went up the crooked skip road described in the last report, to No. 5. This meandering skip road has now been done away with. All the ore that goes up No. 5 now, is taken from ore pillars. The ore in No. 1 lies behind the shaft in the foot wall. Though irregular in form there is enough of it to give a large product, and at a moderate cost. No. 5 large cage goes down to the eighth level, 500 feet from the surface. The cage is used for the men who are taken down on it to the eighth level, and use the ladders for the rest of the distance. The plan is, the present season, to mine away such of the ore pillars as can be spared in No. 5, and this will, in part at least, make up for the shortage to ensue in the Morgan and Pascoe pits. No. 6 double skip way, in the same shaft with No. 5, goes to the twelfth level, where they

have a run of 60 feet through jasper, where the ore comes in again. They have sunk an incline skip road, an underground shaft, down to mine this ore on the north. The ore is brought up from the bottom in the skip, dumped into a car, and is run to the main shaft.

In the bottom they are driving north in the ore to meet a similar drift going south. The ends are 45 feet apart now.

In No. 7 the run of ore is north and south. They have opened it 300 feet in length. The ore is fifty feet wide at south end and 20 feet at the north. Running with the magnetic, and underlying it, and in contact with it is a body of specular slate. No. 7 shaft is 760 feet deep. They open a drift along on the top of the ore, and at suitable distances winzes connect this drift with the level above. The pitch of the ore is northwest, and in a few years No. 8 will have the black ore, No. 6 both black and slate ore. The latter deposit is 60 to 70 feet long, and about 30 feet wide, while the black ore deposit overlaying it in No. 6 is very thick, and has a length of 300 feet. Together these two pits, 6 and 7, will give their usual product. No. 6 will give a little less than common, and No. 7 a little more. By taking out pillars in No. 5, the product of 1887 will probably about equal that of 1886. The mine is safe, but one man was killed in 1886, out of a force of 500 to 600 men. They are now—April—mining 60 tons a day from the pillars. The underground skip road goes from the twelfth to the thirteenth level, and they are sinking to the fourteenth. It is a substitute for the winding shaft formerly used.

The several pits at the Republic produced in 1886, as follows:

Pascoe.....	21,598 tons
Ely.....	21,952 "
Morgan.....	43,053 "
Gibson.....	5,969 "
Nos. 1, 5 and 6.....	73,827 "
No. 7.....	45,081 "
No. 8.....	19,146 "
No. 9.....	5,233 "
No. 1.....	94 "

237,158 tons.

Vessel rates from Marquette to Cleveland for 1887 will start at \$1.60. In 1886 the rates at start were \$1.25, and became \$2.10 at the end of the season. Republic Company ships most of its ore in its own vessels.

The officers remain as heretofore: David Morgan, President, Republic, Michigan; Peter Pascoe, Superintendent, Republic, Michigan; Geo. Wilson, Clerk.

The product for each year has been as follows:

Year.	Tons.	Year.	Tons.
1872.....	11,625	1880.....	235,385
1873.....	105,435	1871.....	233,651
1874.....	122,639	1882.....	235,108
1875.....	114,726	1883.....	152,565
1876.....	120,045	1884.....	277,739
1877.....	165,836	1885.....	249,070
1878.....	176,221	1886.....	241,161
1879.....	135,131		
Total.....			2,540,827

THE WEST REPUBLIC MINING CO.

The West Republic mine is in the west end of the ox bow shaped trend of the ore formation, which bends around the south end of Smith Bay, making the westerly continuation of the great Republic mine. The latter lies in the high jasper bluff that extends around the south and east sides of the bay, while the West Republic is situated to the west of the bay and extends under the Michigamme river to the west side of it.

Just now there is not much stoping ground in the mine—April, 1887—and the outlook for adding greatly to the product of 1887 is not bright. The ore in the drift across the river is in too small quantity to pay to mine and tram the long distance necessary to the shaft. The shaft—No. 2—is 450 feet deep, and they are preparing to abandon the use of it by sinking another 50 feet northeast of the former, down through the old workings and to give it the inclination necessary to reach the ore that is east of the river but pitches to the northwest. They are pushing ahead to find the hanging wall; the foot wall seems to go off very flat to the northwest. They expect to reach a stope of ore soon in this shaft.

They are also sinking a shaft about 250 feet southeast of the former, near the south line of the property—15 feet from it. The shaft is 50 feet deep and has some ore in the bottom. They discovered the ore on the Republic side of the line, and, as it dips northwest, it will of course be found on the West Republic property; whether it will prove of any commercial value remains to be seen.

Near the southeast corner of the land they have also sunk a shaft 125 feet and have a vein of pulverized slate ore mixed with sand. If it were not for this impurity it might be valuable. The deposit is about 15 feet wide and is apparently about 50% in iron and is probably Bessemer.

The company employs about 60 men.

J. O. St. Clair, Superintendent, Republic, Mich.

The mine has produced as follows:—

Year.	Tons.	Year.	Tons.
1881.....	7,378	1884.....	19,023
1882.....	27,865	1885.....	12,674
1883.....	30,734	1886.....	10,664
Total.....			109,348

Office 101 St. Clair street, Cleveland, Ohio; A. C. Saunders, Treasurer.

THE COLUMBIA MINE,

situated north of the Republic, has been idle during the past year and still remains so. The mine was opened in 1873 and worked until 1883, during which time 94,249 tons of ore were shipped.

THE FREMONT IRON CO.,

formerly the Erie, is also idle. No ore was shipped in 1886. The property and exploratory work were fully described in the last report, and there is nothing important to add.

THE PITTSBURG AND LAKE SUPERIOR IRON CO.'S

mine in the Cascade range has greatly improved of late, and in going through it a few days ago—April 20—I find it plain to observe the change for the better from what appeared a few years ago. Mr. Kirkpatrick's work with the diamond drill has had a good result, and has led to the discovery of bodies of ore through which the mine is enlarged and rendered more valuable.

The company has lately bought a controlling interest in a blast furnace at Sharon, Pa., to which place much of the ore is sent to be made into pig iron.

The ore is good quality—hard specular slate—non-Bessemer, but 64% to 66% in metallic iron.

In the old pits—Palmer mine—the ore has been followed until now the stopes are away off to the northeast at a considerable distance, horizontally, from the collar of the shaft.

The inconvenience resulting from this circumstance has led to the work of sinking a shaft which, when completed, will save the underground tramming. This shaft is vertical 6' x 16' in size and will be double cage. It is now 160

feet deep and will be in the ore at about 200 feet. The ore deposit in this pit is in two lenses separated by 20 feet of jasper; they are of good width and length and quite free of rock. Are hoisting here 60 tons per day.

At about 1,100 feet northeast of the mine the company is operating a shaft that was sunk a year ago. The shaft is 270 feet deep, is 6' x 10' in size. They use a bucket now but will furnish the shaft with skip. They are mining in this shaft 50 tons per day now. The ore is 14 feet wide and is opened for a length of 100 feet. Is clean, fine, hard specular.

The company expects to ship 60,000 tons in 1887. Contracts for shipping 48,000 tons have already been made at \$1.40 per ton from Escanaba to Cleveland. Railroad freight, 80c per ton.

Joseph Kirkpatrick, Agent, Palmer, Mich.

The company employs 130 men; none were killed in the past year.

Table of products:

Year.	Tons.	Year.	Tons.
1871.....	4,171	1879.....	24,141
1872.....	34,495	1880.....	38,595
1873.....	41,204	1881.....	34,273
1874.....	16,106	1882.....	40,590
1875.....	4,070	1883.....	19,414
1876.....	15,324	1884.....	11,747
1877.....	20,211	1885.....	5,679
1878.....	4,704	1886.....	24,034
Total.....			348,761

THE WHEAT MINE,

situated about a mile east of the Palmer, is also looking well, much better than heretofore. Some recent discoveries of ore have been made on the property that greatly enhance its value. The company ceased to work the hard ore mine several years ago and the ore shipped has been taken from the hematite deposit south of the hard ore on the opposite side of the railroad track. Here they have worked out a pit 200 feet long north and south and about 75 feet deep, with a skip road down at the north end. They are stripping off the sand west of the pit preparatory to stoping the ground in that direction. The ore is of good quality but is so mixed with rock as to require constant picking to render it merchantable ore.

On the north side of the track, at the foot of the hill that slopes to the south,

they have a new find of bluish hematite ore that is clean, and of better quality than that mined in the hill opposite to the south.

The company has been running a diamond drill northeast of the old hard ore mine and claims to have good results. The drill core indicates the finding of good ore. I understand that they bored through 32 feet of it. Altogether the outlook at the Wheat mine is much better than formerly.

The officers are Daniel McGarry, President; Thomas Prout, Superintendent, Palmer, Mich.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1879.....	850	1883.....	6,625
1880.....	3,324	1884.....	6,824
1881.....	9,040	1885.....	9,200
1882.....	9,554	1886.....	15,851
Total.....			64,489

At the old

GRIBBEN MINE,

situated in the Cascade Range, in the S. E. $\frac{1}{4}$ of Sec. 28, T. 47, R. 26, Negaunee parties are now working—doing exploring work. At the time of my visit to the location they were operating a diamond drill, boring at a steep angle across the formation at the east end of the old open pit. The hole was then, about April 15, 225 feet in length. The drill was in hard ore of fair quality. The indications are good. Capt. J. F. Foley, of Negaunee, is directing operations.

West from the Gribben are a number of old mining locations, where work was done in 1872-3. One of these,

THE HOME,

also in section 28, has been recently explored. Mr. Ed. Anthony, *et al.* of Negaunee, had an option for a lease on the property, and did some exploring, which resulted, it is claimed, in finding ore 50% in iron, .020% phosphorus, and 30% silica. The parties who held the option disposed of it, and preparations have begun to work the mine the coming season.

The Cascade Range affords abundant indications of ore. Nowhere are they more plentiful. But those which appear in the outcrops are lean flag ores that have no market value—high in silica and low in iron.

The deposits of good, hard ore that have been worked have proved generally of limited extent, that gave no profit in working them. Still, until recently, the explorations have been wanting in thoroughness, as compared to such work in some other places. The rocks are well defined, and the ore formation is a broad one. It is quite possible that future exploring work in this range may result in discoveries of great value.

THE SWANZY AND CHESHIRE MINES,

situated in the N. E. $\frac{1}{4}$ of Sec. 18, T. 45 N., R. 25 W. The first ore was shipped from here in 1872, having been discovered by the veteran explorer, Silas C. Smith, after whom the mine was named. Subsequently it became known as the Cheshire. Afterwards Mr. J. J. Pierce, the owner of the mine, organized another company, the SWANZY, to operate an adjoining 40, the S. W. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$, and the CHESHIRE was abandoned. Now again, work is to be resumed at the Cheshire and discontinued at the SWANZY. The mine is reached by a branch of the C. & N. W., and is near the bank of the Escanaba river. The ore is a soft hematite, similar to that found in the Norway mine, in the Menominee range. It averages about 60% in metallic iron, and .040% in phosphorus, and about 2.00% in silica, thus placing it within the Bessemer limit. However, it seems that the ore, so far as they have been able to determine, is about exhausted. Future exploration may result in finding other equally valuable deposits in this isolated locality.

The two mines have produced annually as follows:

Year.	Tons.	Year.	Tons.
1872.....	13,415	1880.....	13,201
1873.....	9,329	1881.....	15,011
1874.....		1882.....	31,494
1875.....	188	1883.....	13,730
1876.....	225	1884.....	3,557
1877.....	8,433	1885.....	
1878.....	16,924	1886.....	8,328
1879.....	17,831		
Total.....			152,100

J. J. Pierce, Sharpville, Pennsylvania, President, John R. Wood, Superintendent, Negaunee, Michigan.

THE FELCH MOUNTAIN MINING DISTRICT

will enjoy a moderate activity the coming year. The poor results obtained in

that section heretofore for all the exploring work done, induced its virtual abandonment so far as mining was concerned. There has nothing new been discovered; nothing to be said beyond what was mentioned in previous reports. The mines that will be worked are

THE METROPOLITAN,

the Northwestern and the Calumet. The former is situated in the N. E. $\frac{1}{4}$ Sec. 32, T. 42, R. 28 W., and the mine still contains a considerable quantity of medium grade ore. It is the property of the Metropolitan Iron & Land Co.

There has been shipped from the mine as follows:

Year.	Tons.	Year.	Tons.
1882.....	23,854	1885.....	
1883.....	36,643	1886.....	6,393
1884.....	27,527		
Total.....			94,467

S. S. Curry, President, Ishpeming, Mich.

THE NORTHWESTERN MINE,

which adjoins the Metropolitan on the west, also has considerable ore, possibly more than the Metropolitan, but it is medium grade non-Bessemer ore.

The mine shipped in—

Year.	Tons.	Year.	Tons.
1883.....	7,202	1884.....	10,004
Total.....			17,206

Wells Smith, Superintendent, Metropolitan, Mich.

THE CALUMET

is the only other mine in the Felch mountain range from which ore has been shipped. It is about three miles south from Metropolitan in the S. W. $\frac{1}{4}$ N. E. $\frac{1}{4}$ and S. E. $\frac{1}{4}$ N. W. $\frac{1}{4}$, Sec. 8, T. 41, R. 28. Here were opened in 1883 some deposits of excellent soft blue ore—running high in metallic iron and low in phosphorus—far within the Bessemer limit, but the deposits were shallow. They occurred in the limestone, which was the underlying rock, and were soon exhausted. The mine yet holds some lower grade ore, and it is said that some mining will be done here the coming season of 1887.

John R. Wood, Superintendent; A. B. Cornell, President, Youngstown, O. Shipments have been as follows:

Year.	Tons.	Year.	Tons.
1882.....	5,847	1884.....	3,627
1883.....	29,239		
Total.....			39,113

THE GOGEBIC IRON RANGE.

Nothing in the previous history of Michigan mining has awakened so great a public interest as has been manifested in the Gogebic Iron Range in the past year. There has been, and still continues to be an immense amount of exploring done, and speculation has been rife. The entire range for a length of more than 30 miles, is dotted with so-called mines. Most of them are as yet mere explorations—mere beginnings—where they have either found no ore or have it in small quantity. It generally takes time, patience and money to find ore, and where there are no exposures, and the rocks are deeply buried beneath the drift, the work of development is slow, expensive, and uncertain. But zeal for investment in this range does not seem to be dependent upon any such tedious process.

There has been a veritable craze for mining stock. Innumerable companies have been formed, and the stocks were eagerly taken as rapidly as issued. Not unfrequently there is nothing apparent but the fact that the land is “on the range,” and is crossed by the ore formation, imagination does the rest. Apparently not a few are sufficiently endowed with this faculty to see in fancy, beneath the overlying surface, magnificent deposits of ore, of which the Colby is but the counterpart. At the present writing the excitement, which has prevailed for more than a year past, has culminated, and is tending to subside. Still, there is great activity in this region, in mining work, in exploration, in investment, in railroad building, in the growth of the towns, and in business generally. The mines are greatly hampered in their shipments of ore through lack of vessels, which if continued will lessen the season's output materially.

The villages of Bessemer, Ironwood, Wakefield and others along the range are teeming with prosperity. Buildings are going up on all sides, and the towns are growing rapidly in size and population.

The Gogebic is proving to be one of the most valuable iron mining districts in the country. Perhaps no mineral discoveries of recent years are of more importance to the country than the ore deposits of Gogebic county. This estimate of their surpassing value is, primarily, based upon the superior quality of

the ores obtained, upon the fact of its uniform adaptability to the purposes of steel making.

All the ore, or substantially all of it, which is found in the Gogebic range, is within the Bessemer limit. That is, the percentage of phosphorus contained is sufficiently small to render the ore suitable for the manufacture of Bessemer pig iron. The other qualities of the ore, the metallic iron contained, the silica, etc., also are in such quantity as to commend the ore to steel makers.

When we consider to what extent the rapid cheapening of the cost of steel has caused it to be substituted for iron in the manufacture of rails and other important articles, we are quickly led to understand the superlative value of low phosphorus ores. Steel rails, as we know, are almost wholly used now in place of the iron ones formerly employed, and are infinitely preferable, while costing but a trifle more.

Steel rails are now made and sold nearly as low as the common "pot metal" article, which formerly was the only resource. The substitution of steel for iron in the manufacture not only of rails and of nails, but for other objects too numerous to mention, but all important and indispensable to our use, and all resulting from the Bessemer process, assures the certainty of the demand of the ores which are adapted to this purpose.

The supply of Bessemer ore is limited, and it is apparent that it must continue to remain so, since, with the exception of those of the Gogebic range, there has been little increase in the number of Michigan mines yielding Bessemer ore for several years, notwithstanding the vast amount of exploring that has been done, the numerous discoveries that have been made.

Many deposits of ore have been opened in the past few years in Marquette, and in Menominee counties, but all these, which are of any considerable magnitude, have proved to be non-Bessemer. So that with the exception of the Minnesota mines and the Gogebic, there has been no recent accretion, of any significance, to the number. The increase in the aggregate of the output of Bessemer ores is mainly due to the increased production of the mines already existing.

The Gogebic mines possess unusual facilities for transportation. The railroads use ore cars holding, nominally, 20 tons, but really 24 tons, and are conveying ore to market nearly as cheaply as it is done by vessels.

Thus far the only carrier has been the Milwaukee, Lake Shore & Western Railway, and the nearest lake port is Ashland, Wis., which is distant about 40 miles west from the center of the ore producing portion of the range. At Ashland are three ore docks, two belonging to the M., L. S. & W., and the other to the Wis. Central R. W. Co. The latter at this writing—June 1—has nearly completed its line to the mines and will soon be ready to compete for the ore carrying business.

Added to these the Chicago & Northwestern R. W. Co. is extending the Menominee River branch from Iron River west to the Gogebic range. This extension will be completed the present season and will then give the mines an outlet to Escanaba on Lake Michigan. Besides the Duluth, South Shore & Atlantic, which has already incorporated into its system the Marquette, Houghton & Ontonagon, and the Detroit, Marquette & Mackinac railroads, is rapidly building its line from Ashland easterly. The line is located two miles north of Bessemer and runs along north of the iron range. When this is completed the Gogebic ores will, probably, have another independent route to the ore docks at L'Anse, Marquette and St. Ignace.

The first ore shipped from the Gogebic range was in the fall of 1885—barely one and a half years ago—and already it has some of the largest producing mines in the country. It is probable that the Colby will send out more ore the current year than any other mine in the State. In fact its product will doubtless exceed that of any mine in any previous year. There are other mines in this range from which, though not so large an amount of ore can be gotten out immediately, are, perhaps, equally as valuable and seem likely to prove so in the long run.

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

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

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

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

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

The first of these mines is the

ASHLAND,

and it is also one of the largest, being second in magnitude only to the Colby. The Ashland mine has improved greatly within the past few months, until now it has developed one of the finest deposits of ore in the State. The estate comprises the S. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ of Sec. 22, and the N. $\frac{1}{2}$ N. W. $\frac{1}{4}$ Sec. 27, T. 47, R. 47 W. The land in section 22 belongs to the Ayers estate, and that in 27 to the L. S. S. Canal Company. Adjoining the mine on the north is the flourishing village of Ironwood, and west of it on the opposite side of the river, is the village of Hurley.

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

From No. 1 to No. 2 is 285 feet, and a surface rise of 40 feet. The shaft—

No. 2—is only 100 feet deep. It is connected with No. 3 by a drift in the first level through ore 40 to 150 feet in width.

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

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

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

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

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

From No. 4, east to No. 6, is a long stretch of ground, 820 feet. This ground, however, has not been wholly explored; a number of test pits have been bottomed in ore. Even No. 6 and No. 7 shafts are new work, sunk within a

few months past and are even now getting in readiness for hoisting. As they are in low ground they were flooded with water when the snow melted in April. Heavy ditching to the south, to the river, will be required to secure immunity from this danger. These shafts are 300 feet apart, each is 129 feet deep, and No. 7 is 465 feet west of the east boundary.

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

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

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

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

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

The mine shipped in

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

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

Adjoining the Ashland on the east is

THE NORRIE MINE,

which is the property of the Metropolitan Iron and Land Co. The mine is in the S. $\frac{1}{2}$ S. E. $\frac{1}{4}$, Sec. 22, T. 47, R. 47, the fee of which is owned by the estate of J. C. Ayer, from whom the mining company holds a lease with the usual royalty for the ore. The ore formation runs the long way of the 80—one half mile, and as this company also holds the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$, Sec. 23, which adjoins on the east, it really has a length of ore formation of three-fourths of a mile—N. 80° E. The Norrie is one of the four chief mines of the range and is, perhaps, thus far, the most systematically worked of any.

There are seven shafts in all but the best ones—those affording the larger portion of the ore are at the west part of the mine. No. 1 shaft is a new one, at which they are just now erecting a plant of machinery to operate it. It is 180 feet east from the west line, and is 100 feet deep, and they have drifted each way to east and to west at the bottom, 25 feet, and have cross-cutted to north 20 feet, in the west side of the shaft. These drifts are all in ore, so there is no doubt of having a good lense of ore in this shaft. The Norrie ranks second only to the Colby in the matter of shipments. The mine is wholly underground and systematically arranged in "rooms" and pillars, and timbered in good shape after the Nevada system.

The maximum length of the main pit is about 850 feet, and the width at the east end in the bottom is more than 110 feet. They have a cross-cut 110 feet, all in ore with no rock yet. The maximum width of ore in the second level, 175 feet down, was 160 feet. The west shaft in the main working pit is No. 3, which is about 700 feet east of No. 1, and is 250 feet deep. It was started in ore on the foot wall at the surface, but at the second level the foot wall "makes" north 20 feet from the shaft; and at the third level it is 50 feet north. East of the shaft it is 100 feet, as is shown by a winze that starts in the second

level 100 feet north of the foot, but in sinking it vertically the foot is struck in the third level, showing that in this distance down the foot wall has flattened and gone north 100 feet. However, further on east, at No. 5, the foot wall is back to the south, the excessive flattening being confined to the west end.

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

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

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

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

No. 5 is opened pretty well in the third level, and is looking finely. The drift from the shaft east is 150 feet, and still in good ore. Possibly the ore will continue to No. 6 shaft 300 feet from No. 5. Certainly it has lengthened east, since in the second level it only extended east 140 feet. The shaft is in the foot wall, and they cross-cut north to the ore. A cross-cut in the ore is in 110 feet, but not yet through it as I have previously stated. The ore is clean and first-class.

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

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

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

The mine produced in

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

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

THE EAST NORRIE,

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

D. E. Southerland, Mining Captain.

THE AURORA,

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

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

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

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

The Aurora, unlike its neighbors, was first worked open cut at the west end,

and they are preparing to "strip" the ore at the east end, preparatory to proceeding here on the same method.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

THE NORTH AURORA MINING CO.

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

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

Directly east from this is

THE PABST MINE,

in the S. $\frac{1}{2}$ N. E. $\frac{1}{4}$, Sec. 23. It is one of the best equipped mines in the range. The drums, new ones, are six feet diameter, besides four, not used, three and a half feet diameter; two cupola boilers 125 horse power each, and two locomotive boilers, National Compressor, with capacity of 12 drills, of

which number eight are used; Rand's three skip, two tons capacity each, and two of one-half tons each; seven tram cars, good ones, each one and a half tons capacity and full equipment of pumps.

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

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

But the ore deposits, so far as shown, are by no means as large as are found at the other mines in this vicinity, that is, at the Aurora and at the Iron King.

The Pabst has four working shafts. No 1 is 45 feet west and 360 feet north of the southeast corner of the property. It is sunk vertically, 124 feet deep, and is 8' x 18' outside measurement, divided into three compartments. They are now sinking in it for another level. The ore body is 15 to 20 feet wide and 75 feet long; there has been taken of it from the shaft 7,500 tons. They are also exploring north with a drift, are in mixed ore and rock. The drift is in 12 feet only.

No. 2 shaft is 330 feet west from No. 1, and 100 feet deep, inclining to the north at an angle of 60°. It is sunk in the foot wall. They have drifted west 80 feet and east 70 feet, and have ore 30 feet wide; but it is not first-class, that is, there is more or less rock in it. There is only one level, the ore body extends down from 25 feet below the surface.

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

In the bottom level in this shaft they have gone east 17 feet—to the rock—and west 70 feet. The ore is about 40 feet wide. They are still stoping west. In this breast stope there is some sand mixed with the ore, and on the foot wall side are concretions—iron nodules, etc., in the ore. The pit is pretty wet—“droppy.” In the level above the length of ore west was 117 feet. The shaft is 127 feet north of the south line of the land.

No. 4 shaft is 232 feet west of No. 3. It is sunk in the hanging wall and is vertical, 145 feet deep, 7' x 9' inside of the timbers. The plan is to sink 40 feet more and then open another stope. The shaft has cost \$30 per foot,

including the timbers. The ore is harder than in some of the mines here, and in sinking the shafts considerable rock is penetrated, so that the power drills are quite an advantage in pushing the work.

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

Southeast from the mine, on the S. W. $\frac{1}{4}$ of Sec. 24, a village has been platted—Jessyville—where is already a postoffice and half a dozen saloons, etc.

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

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

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

The mine produced in

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

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

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

NORTH PABST MINING COMPANY

is the title of an organization engaged in exploring in the land north of the Pabst, to wit: the N. $\frac{1}{2}$ N. E. $\frac{1}{4}$, Sec. 23. So far the work done is sinking test pits, etc.

THE IRON KING MINING COMPANY

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

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

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

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

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

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

No. 5 is the third of this line of shafts. It is 800 feet east of No. 2, and at this date—May 18—is 85 feet deep. The shaft passes through 75 feet of earth and rock capping, and then comes into fine ore. The ore body at No. 5 has been tested by means of a test pit, which is north of the line of the shafts, and which they sunk 65 feet when ore was reached, in which they cross-cutted south, 62 feet in ore. They are now sinking in this ore to test its depth. They have drifted west in it 30 feet in ore.

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

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

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

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

In the second level they have drifted west 90 feet and east 30 feet, both in ore, and ore in the breasts of the drifts. The ore has been crossed with a drift to the north, a distance of 55 feet, and still not to the hanging. Thus pretty well demonstrating the fact that there is a great body of ore to be opened in this shaft. The shaft is about 1,000 feet east from the west line. Altogether it is pretty certain that the Iron King is to be a great producer of first-class ore. It is an important feature that none of the other mines show, except the Colby, that at the Iron King are two series of ore deposits running with the formation, two veins they are called, which if they are found to continue across the property will give the mine great value. They are making surface preparations to render the machinery and other requirements adequate to the needs of a

large output. An ore pocket is building at No. 4, and the railroad is extending to it. The ore pocket is to be a large one having a capacity of 1,000 tons of ore. It will have sufficient length to enable them to load half a dozen cars at one time. A similar pocket will be built at No. 1 and at No. 2 shafts. The railroad branches are connected with M., L. S. & Western main line. There are at the mine, it is stated, 780,000 feet of logs, 300,000 feet of square timber, and 100,000 feet of plank, all to be used in the mine and in surface work. There are a number of dwellings, a large boarding house for men, and other necessary buildings, among which is a good engine house containing a plant of hoisting machinery of W. C. & Lane manufacture—drums 6' diameter. The force employed averages now 160 men. They expect to ship, the present season, 75,000 tons of ore.

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

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

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

THE BONNIE IRON MINING COMPANY

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

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

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

No. 4 is 200 feet west of No. 3, and is 100 feet deep. It is idle. The shaft holds a small vein of manganese ore, or very high in manganese. One analysis of this ore gave 27.50% manganese and 37% iron, .027% phosphorus. The deposit is two to four feet wide, and is not continuous. It gives way to rock. Cross-cuts in this shaft did not develop anything of value. The "ground" is hard and unpromising.

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

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

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

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

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

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

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

THE FIRST NATIONAL IRON MINING COMPANY

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

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

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

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

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

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

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

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

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

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

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

I merely call attention to this to show the extravagant estimate that is made of these properties, many of the mines, so-called, in this range. The Ashland, for instance, is quoted at \$40 per share, 40,000 shares, \$1,660,000. A large sum, certainly, but even then the stock is cheaper than the major portion of the stocks of the mines in the Gogebic Range would be at one-hundredth of that figure. There has been a great deal of money made in manipulating the stocks of the Gogebic Range, and some of the stocks will prove a good investment. But on the other hand, there has been, no doubt, a good deal of misrepresentation and fraud, and some of the financial gains represent equal losses. Money acquired by the sale of stocks that are valueless, is to the same amount a loss to the unfortunate purchasers, who had, perhaps, in good faith, acquired the stock. The Gogebic stocks have been scattered over the country, and many purchasers will suffer severely from their ultimate great depreciation in value. These remarks are not introduced here to apply to the First National, but with reference to their application to the over estimate of the value of the stocks of the most of the mines in this range.

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

THE BLUE JACKET IRON CO.

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

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

in stock. The engine house is furnished with two drums for hoisting, 4½' diameter each, Bullock's pattern; one for No. 1, and the other for No. 4 shaft.

The other explorations on the property have not developed ore.

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

THE NEWBERRY

is the title given to an exploration in progress, consisting of a shaft just north of the wagon road, that runs along the range. It is just north of the Bonnie in the S. E. ¼ of Sec. 13, 47, 47. The shaft is 75 feet deep, the time I saw it—May 19—and in a quartzitic flag.

THE NORTH IRON KING

is another exploration just begun in similar location as the above; but north of the Iron King mine, in the S. W. ¼ of Sec. 13. Wm. Hockin has charge of the work and some Minneapolis men furnish the money.

THE PURITAN MINING COMPANY

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

The description of the property is the S. W. ¼ Sec. 17, T. 47, R. 46, and the mine is all in the east half of the property, adjacent to the quartzite foot wall. To the north and west of the mine the ground has been a good deal explored with test pits, most of which were sunk to the ledge, and show in the debris about them a mixed ore and jasper. West of the mine, a few hundred feet, is a railroad cut about four feet deep, in the ledge, and 100 feet long, diagonally across from the quartzite foot wall, northwesterly. It cuts through a very rich jasper, that is, through ore which is too high in silica to be merchantable, but it affords excellent indications for finding ore, possibly at greater depth. Not unfrequently in this range, lean or mixed ore is succeeded in depth by that which is clean and marketable.

In the Puritan there is a full half mile of the ore formation—of the quartz-

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

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

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

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

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

No. 4 shaft is the next most important one. It is 1,290 feet west from the east line, and is 115 feet deep, inclining 65° north on the foot wall. The first

level is 65 feet down from the top. About the shaft it is mixed ore and rock, and so continues west 60 feet, where good ore is reached, 20 feet in width. The ore holds for 70 feet, and is followed up to the surface dirt on an incline of rock, which separates this ore from a body of equal length west of it. The partition wall is about ten feet thick, and dips east at about 45°. The westerly lense has a width of upwards of thirty feet, all in ore. East of the shaft the ore is mixed with rock, and requires picking. At about 50 feet east is a drift to south 10 feet, to the quartzite, and at 60 feet in is a cross-cut north 40 feet. Both these are in the same formation that is found in the main drift. Above the first level, about 20 feet, clean ore is found 10 feet in width, which has been drifted and stoped in 60 feet west and 70 feet east. I judge that it extends up to the surface dirt, and that it continues yet further both east and west. The end of each drift is ore.

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

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

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

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

A new engine house has been built, and they are now placing in it a fine plant of machinery, consisting of steel boiler 60' x 16' besides heater, two winding drums, each 5' diameter; Ingersoll Air Compressor, to operate seven Rand drills. Engine house 48' x 25' with L 24' x 35'—iron roof.

The machinery was made at the Iron Bay Foundry, Marquette. Besides are change house 36' x 18', with wash room, etc., attached, large boarding house, fine residence for superintendent, and about 20 good miners' houses, etc.

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

The yield in 1886 was 16,388 tons.

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

THE IRONTON IRON MINING CO.

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

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

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

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

South of the line of the shafts, and about midway east and west, they have just completed a new engine house, which is supplied with four 5-foot drums, two engines, two boilers, each 48" x 16'.

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

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

At 225 feet east of the main shaft is No. 2, and they have just started

another one. It is close to the Wis. Central R. R. track, and will be No. 3—480 feet from No. 1.

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

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

The company shipped last season, 16,307 tons, which sold at an average price of \$5.00 per ton.

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

THE TONTINE MINE

joins the Ironton on the east. The main shaft is about 100 feet from the boundary, and is 130 feet deep. It is sinking to find the ore of which a small deposit was discovered in a shaft close to the line. The main shaft now sinking is vertical, and at bottom is 60 feet from the foot wall. They have just found the ore, but had not developed it as yet. They have a small engine house, with a limited plant of machinery, and several dwelling houses; also an ore dock convenient for stacking and shipping ore. The estate consists of 80 acres of land, being the E. $\frac{1}{2}$ of the S. E. $\frac{1}{4}$ of section 17.

The work is in charge of Capt. C. W. Hale.

THE VALLEY IRON MINING COMPANY

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

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

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

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

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

THE COLBY MINE

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

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

The mine is opened in two separate deposits of ore, situated north and south of each other, and running east and west. They are commonly spoken of as the north and the south veins. The south deposit is against the foot wall, the regular quartzite belt that underlies the ore in this portion of the range. The deposit has been opened for a length of 1,000 feet, and has a width of clean ore of 40 to 130 feet. The ore was first attacked at the west end, where the lenses outcropped just beneath the dirt, in the upper face of the bluff, where it descends somewhat abruptly to the west. The formation dips north at an angle of 65°, and the ore inclines also to the east at an angle of about 30°. As the work advanced eastward, the inclination of the ore has carried it under the rock capping, which, for a considerable distance, has been removed, but now this work of "stripping" the ore will cease, and the mining will be wholly underground, as it already mainly is.

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

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

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

The method of mining contemplates taking out all the ore. The main drifts are east and west along the walls and at suitable distances through the deposit. Thence the ore is blocked out—rooms and pillars—each 40 feet. The rooms are timbered, using the usual sets, which are lagged up against the pillars. To remove the pillars the rooms are filled up with rock; that is, the surface material is run down and made to occupy the opened space; after which the pillars are mined away by taking successive stopes on top of them, under the dirt. This final work of exhausting the levels will proceed from one to the other working down, and thus the same filling material will serve from one to the other; as each is worked out the refuse dirt will be let down into the next below, and so on in succession. This plan of extracting the ore is a great advance on the method of endeavoring to hold the mine up with timbers. It is economical, expeditious and safe. Of course it requires mining experience, skill and great care; but it is undoubtedly the cheapest way to mine this ore.

The ore is very dry; it is a dry mine, and thus the pillars stand well. The

ore is easily mined, requires but little blasting. There is no more pleasant, comfortable mine to work in in the country than the Colby.

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

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

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

The dike on the north side really makes the foot wall in this deposit. It lies pretty flat and they work from it, allowing the overlying burden to fall on it. Standing on the north side of the open pit and looking south we see this south wall constantly crushing down. As the ore is removed it is made to settle down on the dike. The underground opening made in the north deposit is 400 feet long and 80 feet wide. It is reached by two shafts, one on the north side inclining downward to the south, following down on the face of the dike, and the other away over to the south, near the office, in what was thought, when it was sunk, to be the foot wall of the ore. But now the bottom of this shaft is near the dike, and the ore is away south of it. It is an easy mine to work; not much timbering is required; they worked south and let the roof crush in the dike.

All the surface appointments are simple. The machinery is such as is adequate to this work, but nothing superfluous. The mine is held on a limited lease, from the owners, by Pickands, Mather & Co., Cleveland, and the entire direction of the work is under Mr. Jos. Sellwood, of Ishpeming, who has a full

corps of competent assistants, prominent among whom is Capt. Harry Roberts, who is full of enthusiasm for the Colby. The company's lease runs until Nov., 1888.

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

At a quarter of a mile further east the company has sunk a shaft, recently, 100 feet deep on the quartzite foot wall and have a deposit of clean ore in the bottom 70 feet wide, and they have drifted east and west in it 150 feet.

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

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

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

THE PALMS IRON MINING COMPANY

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

A new railroad track has just been laid along the foot wall side of the shafts, convenient for the pockets for receiving and transferring the ore directly from the skips. Away down the slope of the hill to the north is the track earlier located, where is an ore dock 300 feet long, and ore pockets, the latter 40 feet high. A tram track 700 feet long extends from the east part of the mine to this ore dock; but now that the railroad company (M. L. S. & W.) has built along close to the shafts, it is not likely that the one down under the hill to the north will be greatly used.

The shafts are well distributed, but thus far they do not seem to have penetrated any large body of ore. They are mainly in a mixed ore formation. More or less rock is found in connection with the ore. This is true of all the shafts, but none of them is very deep yet, and judging from the experience

recently acquired at the Anvil, which is the next mine on the east, better results are likely to be obtained at a greater depth.

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

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

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

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

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

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

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

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

THE ANVIL IRON MINING CO.

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

The Anvil is a new mine; as to that matter all the mines in the Gogebic may be called new, but the Anvil is a newer development than some others. It has

come into prominence quite recently through the discovery that the main ore-body is of very large proportions, a matter that has just been ascertained. So that now it is quite certain that the Anvil, for a time at least, is to be a large producer.

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

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

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

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

No. 1 is 360 feet east of the west line, and 50 feet south from the east and west $\frac{1}{2}$ line and 175 feet deep. It opens into the ore, which gives the mine its chief value. It is in this shaft that the main attraction lies, the basis of the great good fortune that has come to the hands of the owners.

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

To particularize in regard to No. 1 shaft, when the ore was first found, it was but four feet in width, and at 75 feet in depth it proved to be 13 feet wide, but when the shaft had reached a depth of 175 feet, a cross-cut to the north was again started and pursued for a length of 180 feet, 161 feet of which distance is in ore. I examined this drift, somewhat hastily, and did not discover anything but ore. Some of it is clean fine ore, especially in the part adjacent to the foot wall, but there are other portions, towards the north, in the north half or the drift, where the ore is mixed with sand. Still, the whole drift for the length of 161 feet seems to be all ore; assuredly a wide body of it. The rock is at the north end of the drift, 19 feet of mixed rock and ore.

Samples of the ore for an average of the first 45 feet from the shaft, gave an analysis 64.80% metallic iron. The succeeding 35 feet of length gave 62.20%. The following portion of drift for 45 feet, 61.80%. Average for 130 feet of

the drift was 61.80% in iron, .028 in phosphorus. The final 33 feet of the ore averaged 56% in iron, .031% phosphorus. These figures were given me by Mr. Scott.

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

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

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

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

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

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

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

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

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

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

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

THE EAST ANVIL.

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

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

THE GOGEBIC MINE

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

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

NORTH ANVIL,

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

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

THE WELLS AND MINER OPTION,

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

I noticed chiefly 3 shafts; one about 20 rods from the $\frac{1}{2}$ line on the north side: it is 60 feet deep and is not worked in now.

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

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

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

Frank D. Koob has charge of the work, and is assisted by about 30 men. They have been at work for 12 months, but have met with results scarcely equal to their efforts and hopes.

Joining this property on the east is

THE RHINELANDER,

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

I believe the company is incorporated.

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

The next mine east of the latter is

THE MIKADO,

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

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

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

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

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

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

Joining the Mikado on the east is the

ATWOOD OPTION,

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

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

THE PILGRIM

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

THE SPEEDWELL

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

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

THE STAR,

where they are also exploring with a diamond drill.

THE FLORENCE

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

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

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

THE SUNDAY LAKE RANGE

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

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

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

THE IRON CHIEF,

operated by Moore, Benjamin & Co. The description is the E. $\frac{1}{2}$ S. W. Sec. 10, T. 47, R. 45, being $\frac{3}{4}$ of a mile east of Sunday Lake. The company reported having mined and shipped in 1886 9,500 tons of ore which sold at an average price of \$5.50 per ton, which facts indicate favorably for a new development.

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

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

SUNDAY LAKE MINE

lies upon the side hill northeast from Sunday lake, being the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$, Sec. 10, and is one of the early and well known mines of the range. The mine has two working shafts, the west one of which is but 80 feet east of the west line of the land of the company. It is 150 feet deep and has been, since reaching the ledge, all the way in ore. At the bottom the ore east is about 10

feet wide, and so continues west of the shaft for a distance of 30 feet, thence west for 50 feet, to the line, it is 40 feet in width; but it is not clean ore, very much of it, especially on the north side of the deposit, is rock or ore in which there is so great a proportion of sand rock boulders as to render the ore of not much practical value. East, the shafts are connected 187 feet apart, and they were making at the bottom when I was last down in the mine a secure timber drift between the shafts.

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

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

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

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

THE BROTHERTON MINING CO.

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

No. 2 is, as above stated, in low ground 500 feet west of No. 3, and is 100 feet in depth. It is sunk in rock, in what is supposed to be a separation be-

tween the two branches into which the ore body at No. 1 divides in going east.

Work in this shaft, as well as in No. 1, was seriously impeded in the spring when the snow melted, by reason of the pits being flooded with water.

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

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

The ore obtained at the Brotherton has been mined, chiefly, in No. 1 shaft, 500 feet west of No. 2, with which it is connected by drift in the first level. The workings also reach west, 300 feet from the shaft, making the total length underground in the first level 800 feet. The ore was of variable width, reaching a maximum of 40 feet. The shaft is sunk to the second level. I did not go underground in No. 1 shaft, but inferred from what was told me that the mine did not have a hopeful look in the bottom of this shaft. There were about 14,000 tons of excellent ore in stock, and it was stated that the product for the season would reach 50,000 tons.

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

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

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

THE CROWN POINT MINING CO.

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

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

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

THE CHICAGO MINING CO.

is exploring on the E. $\frac{1}{2}$ S. E. $\frac{1}{4}$, Sec. 8; joining the Crown Point on the west.

Considerable work has been done. The company has a shaft 300 ft. from the line 87 ft. deep, vertical, and has a small deposit of good ore. There are about 20 tons in stock, merchantable ore. There are other shafts and pits, but none showing ore. Joseph Lee, Supt. Work 12 men, have suitable plant of machinery.

THE HOUGHTON,

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

THE ALPHA MINING CO.

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

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

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

Frank V. Holston, Prest., Ashland.

THE IRONSIDES.

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

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

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

THE NORWAY MINING CO.

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

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

THE IRON PRINCE,

which is one of the most prominent locations in this portion of the Sunday Lake range. But with this, as with the others, the ore in quantity sufficient to

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

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

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

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

Among those which I visited are

THE HOLYOKE,

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

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

THE IRON AGE MINING CO.

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

THE DICKIE,

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

THE CHICAGO,

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

AT CHANNINGS,

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

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

By far the best explorations are north of Marinesco, in the vicinity of the east branch of the Presque Isle river. These are the JOLIET, LA RUE,

PRESQUE ISLE, ARTHUR, LOGAN, HOLLAND and LINCOLN. The locality is known as the

TOBIN RANGE,

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

THE JOLIET

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

LA RUE

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

THE PRESQUE ISLE

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

THE HOLLAND,

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

THE ARTHUR

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

THE LOGAN

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

THE APPLETON

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

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

THE REPUBLIC REDUCTION COMPANY

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

They have a suitable building and steam power. They are experimenting now with a Starrevant mill, No. 12, 1,200 revolutions per minute. They are using No. 12 wire mash, and finishing on No. 30. They run through 38 tons of rock in 7 hours, and get 55% of ore from the rock; that is, they waste 45%. There is practically an inexhaustible supply of the rock. No doubt the concern will ultimately be successful. The ore is Bessemer, and is, when reduced, in proper condition for a "fix."

PIG IRON.

DESCRIPTION OF BLAST FURNACES.

SPRING LAKE IRON CO.

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

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

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

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

Record of Fruitport Furnace.	1885.	1886.
Bushels of charcoal used.....	1,444,675	1,610,850
Gross tons of ore used.....	28,684	29,551
Gross tons of limestone used.....	386	431
Number of tons of pig-iron made.....	17,217	17,776
PARTICULARS.		
Number of charges run.....	57,787	64,434
Number of bushels per ton of iron made.....	84	90½
Per cent of yield of ore in the furnace.....	60½	60
Number of pounds of limestone used per ton of iron.....	50	54½
Number of days run.....	321	324
Average daily product.....	53.63	54.85

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

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

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

THE ELK RAPIDS IRON COMPANY.

It would be difficult to locate a furnace more favorably with respect to obtaining wood for charcoal, and for shipping by water. The height of the stack is 47 feet, and diameter of bosh $11\frac{1}{2}$ feet. In 1885 the furnace made, on the average for the year, 304 days, 53 tons of iron per day, using 93 bushels of charcoal per ton. The following table shows the results for the year 1886, just closed:

Total No. of tons of pig iron made.....	17,434 $\frac{900}{240}$.
Total No. of tons of ore used.....	29,801 $\frac{900}{240}$.
Per cent of yield of ore in the furnace, <i>i. e.</i> , No. of lbs. of iron to each 100 lbs of ore used	58.70
Total No. of tons of limestone used.....	925 $\frac{610}{240}$.
Total No. of bushels of charcoal used.....	1,715,905
Average No. of bushels of charcoal to ton of iron made	98.42
Total No. of days that the furnace was in blast	309
Average number of tons of pig iron made per day run.....	56 $\frac{945}{240}$.
Market value of pig iron made.....	\$338,728.67

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

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

MARTEL FURNACE COMPANY.

The Martel furnace is situated at St. Ignace, in the Upper Peninsula, on the Straits of Mackinac. It was built in 1881, on the completion of the railroad from St. Ignace to Marquette, but after being in blast for a brief time, it was closed down, and has since been idle, until the past year, when it was put into blast, and has been run 139 days. Height of stack, 53 feet; diameter of bosh, $10\frac{1}{2}$ feet.

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

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

W. B. Vance, Secretary.

THE PIONEER FURNACE

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

Alex. Maitland, General Manager, Negaunee, Michigan.

THE GAYLORD IRON CO.

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

Diameter of bosh is $9\frac{1}{2}$ ft.

The furnace made in 1885 4,803 tons of iron, using 99 $\frac{3}{4}$ bushels of charcoal to the ton of iron. Charcoal weighs 20 lbs to the bushel. In 1886 the furnace made 8,903 tons of pig iron.

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

No. of bushels charcoal used, 753,000.

No. tons of iron ore smelted, 13,225.

No. of bushels charcoal used per ton of iron made, $8\frac{1}{2}$.

All Lake Superior ores, yield of ore in the furnace, *i. e.*, No. lbs. of iron made from each 100 lbs. of ore, 61%.

N. Woods, clerk, etc., Gaylord Iron Co., Detroit.

THE JACKSON IRON CO.

has operated one stack at Fayette, Delta Co., L. S., Mich., in which were made during the year 1886 10,581 $\frac{1}{2}$ tons of pig iron.

No. bushels of charcoal used, 1,122,840.

No. bushels of charcoal used per ton of iron made, $115\frac{1}{2}$.

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

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

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

Height of stack 59 ft., diameter of bosh $9\frac{1}{2}$ ft. Ore used was Jackson mine ore, hard and soft. The wood for charcoal was 50% soft wood.

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

EUREKA IRON AND STEEL WORKS

manufacture at Wyandotte, Mich.

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

The Co. made during 1886, of pig iron, 11,668 $\frac{1}{2}$ gross tons.

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

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

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

Average yield of ore in furnace, 60%.

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

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

J. G. Van Alstyne, Agt.

DETROIT IRON FURNACE CO.

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

No. of days run in 1886, 181.

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

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

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

Seven tuyeres each 3 in diameter.

Top at charging line 7 ft. diameter.

Closed top, Lee Burt's patent charging apparatus.

Hearth water jacketed.

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

THE ANTRIM IRON CO.

has a furnace located at Mancelona, Mich., being near the northern end of the lower peninsula, in a fine hardwood region. The furnace was operated during the past year—1886—198 days.

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

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

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

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

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

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

E. Fitzgerald, manager.

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

RECORD OF THE ANTRIM IRON FURNACE.

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

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

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

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

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

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

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

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

These figures and statistics were taken direct from the books of the company. Since the company took possession of the property, March 15th, 1886, the machinery has all been thoroughly overhauled, the stack relined, the oven

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

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

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

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

BANGOR FURNACE COMPANY.

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

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

They used a mixture, $\frac{1}{3}$ specular and $\frac{2}{3}$ hematite. Ores, L. S. mine specular and L. S. hematite, Winthrop, Chapin, Great Western ores. The charcoal cost on the average six cents per bushel. Height of furnace stack, 51 feet, use bell and hopper, diameter of bosh, 10 $\frac{1}{2}$ feet.

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

PINE LAKE IRON COMPANY

operates a furnace at Ironton, in Charlevoix county, which has been in blast

but a portion of the past year. It is now idle, and has been for two months preceding the close of the year. Total number of tons of iron made, 5,070.

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

THE PENINSULAR IRON COMPANY

operates a furnace in Detroit. Height of stack, 42 feet; diameter of bosh, 9 $\frac{1}{2}$ feet.

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

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

Solon Burt, Secretary.

THE DEER LAKE IRON COMPANY'S

furnace is located about two miles northwest of Ishpeming, in the Upper Peninsula. It produced the last year 10,898 $\frac{1}{2}$ tons of pig iron.

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

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

VULCAN FURNACE CO.

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

The Vulcan furnace is at Newbury, in Luce county, in the upper peninsula, and is one of the most substantial and best appointed furnaces in the State. The local superintendent is Royal A. Jenney, Newbury, Mich.

Height of furnace stack is 53 ft.

Diameter of bosh, 10', 6".

Seven tuyeres each 3" in diameter.

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

Hearth is water jacketed.

Charged with Lee Burt's patent charging apparatus.

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

Average yield of ore in the furnace 58%.

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

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

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

COAL.

COAL MINES.

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

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

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

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

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

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

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

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

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

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

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

	Years previous to 1877.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Williamston.....							10,454	884			1,000
Jackson mine.....		67,147	61,785	65,000							
Corunna Coal Co.....			22,537	16,215	12,252	7,060	8,624	9,000	8,000	10,000	15,975
Other mines.....		1,500	1,000	800							1,000
R. H. Emerson & Co.....					66,780	61,666	60,103	40,412	13,712	15,553	21,363
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
Stanford Coal Co.....										15,000	4,743
Total.....	350,000									45,174	49,902

SALT.

SALT.

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

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

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

The law requires that the report shall contain :

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

THE SALT DISTRICTS.

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

District No. 1, Saginaw County—

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

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

District No. 2, Bay County—

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

District No. 3, Huron County—

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

District No. 4, St. Clair County—

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

District No. 5, Iosco County—

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

District No. 6, Midland County—

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

District No. 7, Manistee County—

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

District No. 8, Mason County—

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

District No. 9, Gratiot County—

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

RECAPITULATION.

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

DISTRICT NO. 1—SAGINAW COUNTY.

For whom Inspected.	Barrels.
Nason, Allan & Co.....	19,120
Green, Ring & Co.....	56,062
Cameron & Merrill.....	39,313
Saginaw Manufacturing Co.....	13,974
N. & A. Barnard.....	45,686
D. Hardin.....	12,211
D. Hardin & Co.....	7,400
Williams Bros.....	24,634
Brand & Hardin.....	12,536
Wright Lumber Co.....	47,878
Wylie Bros.....	20,621
J. H. Pearson & Son.....	17,238
C. K. Eddy & Son.....	34,372
Redmond & Nolan.....	3,351
J. H. Freaney.....	9,393
E. R. Phinney.....	7,968
W. A. O'Donnell.....	12,245
Frank Bischkee.....	1,924
Wiggins, Cooper & Co.....	30,359
Eaton, Potter & Co.....	11,334
Rust Brothers & Co.....	25,738
Gebhardt & Estabrook.....	18,727
Burnham & Still.....	1,902

For whom Inspected.	Barrels.
D. S. Chapin.....	2,899
W. B. Stillman & Co.....	4,976
Sample & Camp.....	18,261
Nelson Holland.....	33,077
Warner & Eastman.....	21,536
C. & E. TenEyck.....	15,224
J. G. Owen.....	27,094
J. J. Winsor.....	8,650
W. L. Webber (trustee).....	34,731
Tyler & Son.....	20,046
Saginaw Lumber & Salt Co.....	33,684
C. Merrill & Co.....	44,149
G. E. Anthony.....	15,897
Whittier & Co.....	11,097
Backus & Binder.....	5,070
W. B. Mershon.....	20,057
E. F. Gould.....	23,487
T. Jerome & Co.....	24,821
A. T. Bliss (upper mill).....	47,132
Stevens & La Due.....	38,226
Sanborn & Hill.....	29,958
C. L. Grant & Co.....	12,120
A. T. Bliss & Bro (lower mill).....	43,175
E. C. Chapman.....	13,693
Rust, Eaton & Co.....	29,948
Hamilton, McClure & Co.....	60,947
Whitney & Batchelor.....	71,831
Melchers & Nerreter.....	10,232
LaDue, Stevens & Co.....	11,971

TOTALS.

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

DISTRICT NO. 2—BAY COUNTY.

Dolsen, Chapin & Co.....	35,722
Pitts & Cranage.....	53,511
Birdsall & Barker.....	12,068
N. B. Bradley & Sons.....	43,812
McLean, Son & Co.....	43,820
Wm. Peter.....	29,549
Eddy, Avery & Eddy.....	33,952
F. E. Bradley & Co.....	34,392
L. L. Hotchkiss & Co.....	57,860
Laderach Bros.....	15,749
Malone & Co.....	42,654
H. W. Sage & Co.....	73,160
Keystone S. & L. Co.....	461
C. B. Curtis (agent).....	34,357
C. E. Lewis.....	9,251
mith Bros & Co.....	23,012

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

TOTALS.

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

DISTRICT NO. 3—HURON COUNTY.

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

TOTALS.

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

DISTRICT NO. 4—ST. CLAIR COUNTY.

R. B. Baird.....	19,676
Thompson Bros.....	71,500
Marine City Stave Co.....	100,363
J. A. Wanzey & Sons.....	8,373
Lester & Roberts.....	2,812

For whom Inspected.	Barrels.
Germania Salt Co.....	6,228
Johnson & Henry.....	50
Excelsior Salt Works.....	2,007
Marine City Salt Works.....	15,523
Marine City Salt and Brick Works.....	6,525
Algonac Salt Co.....	8,113
Toledo Salt Co.....	9,431

TOTALS.

Fine bulk.....	3,450
Fine.....	229,079
Coarse.....	816
Packers'.....	3,223
Second quality.....	13,929
Total bbls.....	250,602

DISTRICT NO. 5—IOSCO COUNTY.

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

TOTALS.

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

DISTRICT NO. 6—MIDLAND COUNTY.

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

TOTALS.

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

DISTRICT NO. 7—MANISTEE COUNTY.

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

TOTALS.

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

DISTRICT NO. 8—MASON COUNTY.

For whom Inspected,¹	Barrels.
Pere Marquette Lumber Company.....	70,309
Thos. R. Lyon (agent).....	8,912

TOTALS.

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

DISTRICT NO. 9—GRATIOT COUNTY.

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

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

RECAPITULATION.

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

TOTALS.

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

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

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

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

Table showing increased and decreased inspection per district:

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

COMPARATIVE TABLE.

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

Year.	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	19,267	33,544	32,615		1,855,884
1879.....	1,997,350	15,641	18,020	29,927		2,058,040
1880.....	2,569,037	16,691	22,237	48,623		2,676,588
1881.....	2,673,910	13,885	9,633	52,821		2,750,299
1882.....	2,923,542	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	31,423		3,297,403
1886.....	3,548,731	22,221	31,177	71,235	3,893	3,677,257
Total.....						34,100,469
Salt manufactured prior to 1869.....						3,282,117
Total amount of salt produced in Michigan to date, barrels.....						37,382,586

GYPSUM.

GYPSUM.

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

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

Years.	Land Plaster, Tons.	Stucco—Barrels, 300 lbs. each
For years previous to 1866.....	*100,000	80,000
1866.....	14,604	-----
1867.....	17,439	-----
1868.....	28,637	34,996
1869.....	29,996	41,187
1870.....	31,437	46,179
1871.....	41,126	48,685
1872.....	43,536	59,767
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
Total product.....	820,142	1,686,469

* Partly estimated.

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

Name of Company.	Number of Tons of Land Plaster produced by Michigan Companies.										Number Barrels of Stucco produced by Michigan Companies.									
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.				
Godfrey & Bro.....	9,117	9,000	6,422	6,080	5,682	4,593	4,467	4,560	-----	23,000	27,500	30,274	37,000	30,453	30,942	28,273				
Grand Rapids Plaster Co.	8,970	12,000	6,375	7,512	5,013	3,044	4,143	3,632	-----	23,500	20,400	32,854	40,000	24,390	26,498	28,627				
Wyoming Mills.....	7,000	10,000	6,098	6,801	4,400	3,052	4,059	3,714	-----	-----	-----	-----	12,000	13,108	11,193	11,327				
Union Mills.....	4,500	7,500	6,716	8,298	5,500	3,185	3,663	3,687	-----	35,000	34,913	23,074	30,000	23,176	15,654	18,027				
D. Noble & Co.....	10,585	9,570	6,572	6,037	4,000	3,202	3,900	1,947	-----	24,504	30,000	27,893	38,000	30,288	26,344	28,760				
Smith, Bullard & Co.....	1,586	1,500	1,000	2,993	4,600	4,122	4,346	6,030	-----	-----	-----	11,817	30,961	23,961	20,797	27,113				
Alabastine Co.....	-----	-----	-----	-----	4,032	6,680	3,606	5,608	-----	-----	-----	-----	13,172	11,321	10,147	11,147				
Geo. H. White & Co.....	1,900	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----				
Totals.....	43,658	49,570	33,178	37,821	33,225	27,888	28,181	29,398	-----	106,104	112,813	135,655	201,133	156,677	141,575	153,274				

COPPER MINES.

THE COPPER MINES.

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

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

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

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

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

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

I have endeavored to go over this ground so fully in previous reports and to explain the methods by which this reduction of cost has been effected and to show how skillfully and economically all the work in our copper mines is per-

formed, that I deem it unnecessary to dwell upon the subject further at this time. One thing is apparent: the days of operating small copper mines have passed. It is only by the vast increase in the magnitude of the work that the relative cost has been so greatly cheapened. Energy, economy, the greatest mining skill, the use of every mechanical appliance, all have their place, all are brought into requisition, and the result is the marvellous success attained at the Franklin, Atlantic, Osceola, Quincy and other of our great copper mines.

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

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

THE CONGLOMERATE,

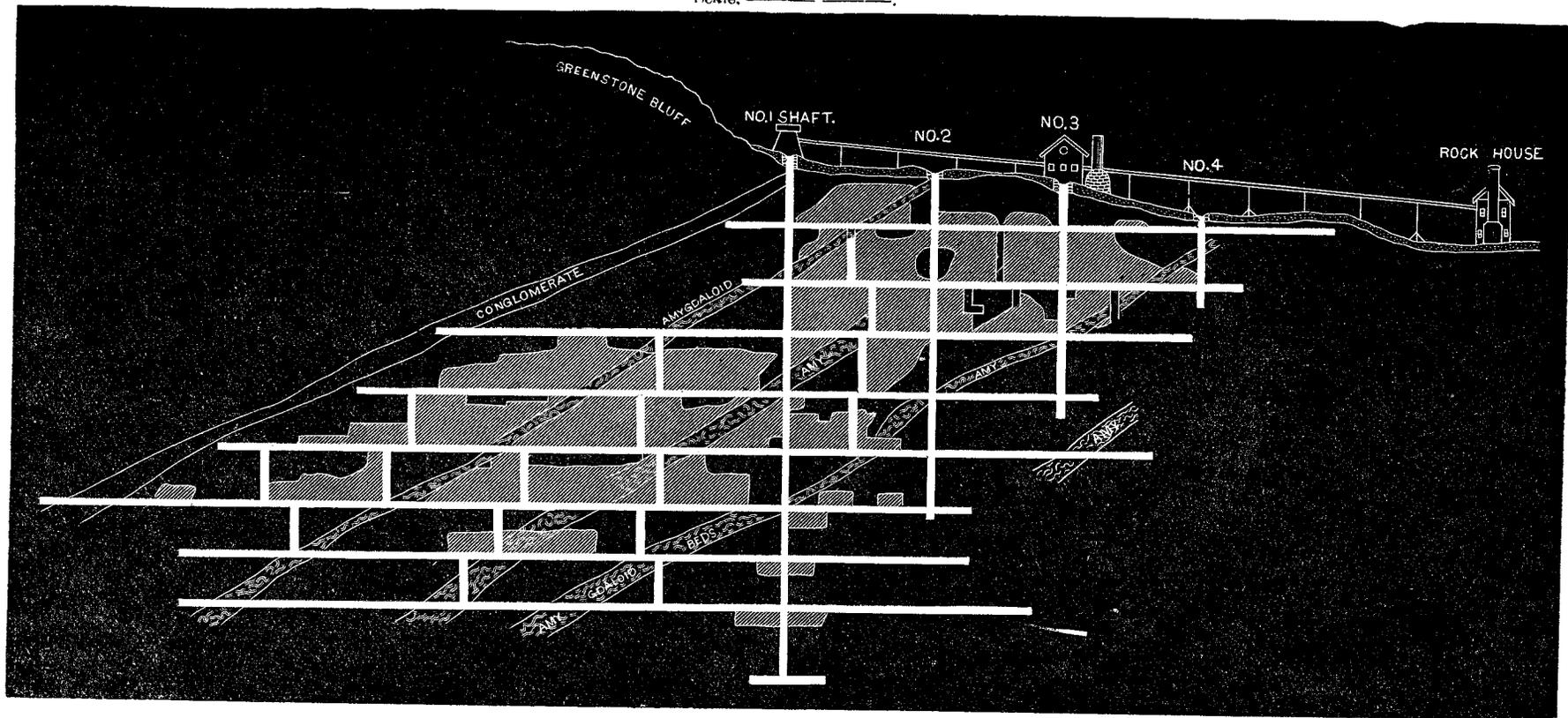
is the most northerly of the mines that have produced any copper in the past year. I find little to add to what was given in my previous report. A few tributaries extracted 22 tons and 505 lbs. of refined copper, all barrel work and small masses obtained in the old Northwest vein and in the upper levels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

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

These companies were known as the Northwest Copper Mining Association, which was formed in 1847, and owning 4,320 acres of land in T. 58 N., R. 30 W.—the mine which had been prospected. In 1849 the capital stock was increased and the company re-organized under the title of The Northwest Mining Co. In the succeeding ten years the company expended \$939,000 and thus exhausted its capital stock. In 1861 a re-organization was effected, taking the name of the Pennsylvania Mining Company. The estate comprised 2,880 acres of land, to which were soon added by purchase 6,000 acres of timbered land.

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

Scale. _____.



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

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

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

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

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

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

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

General office of company 308 Walnut street, Philadelphia.

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

The following table shows the copper production at this mine:

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

THE CENTRAL MINING COMPANY

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

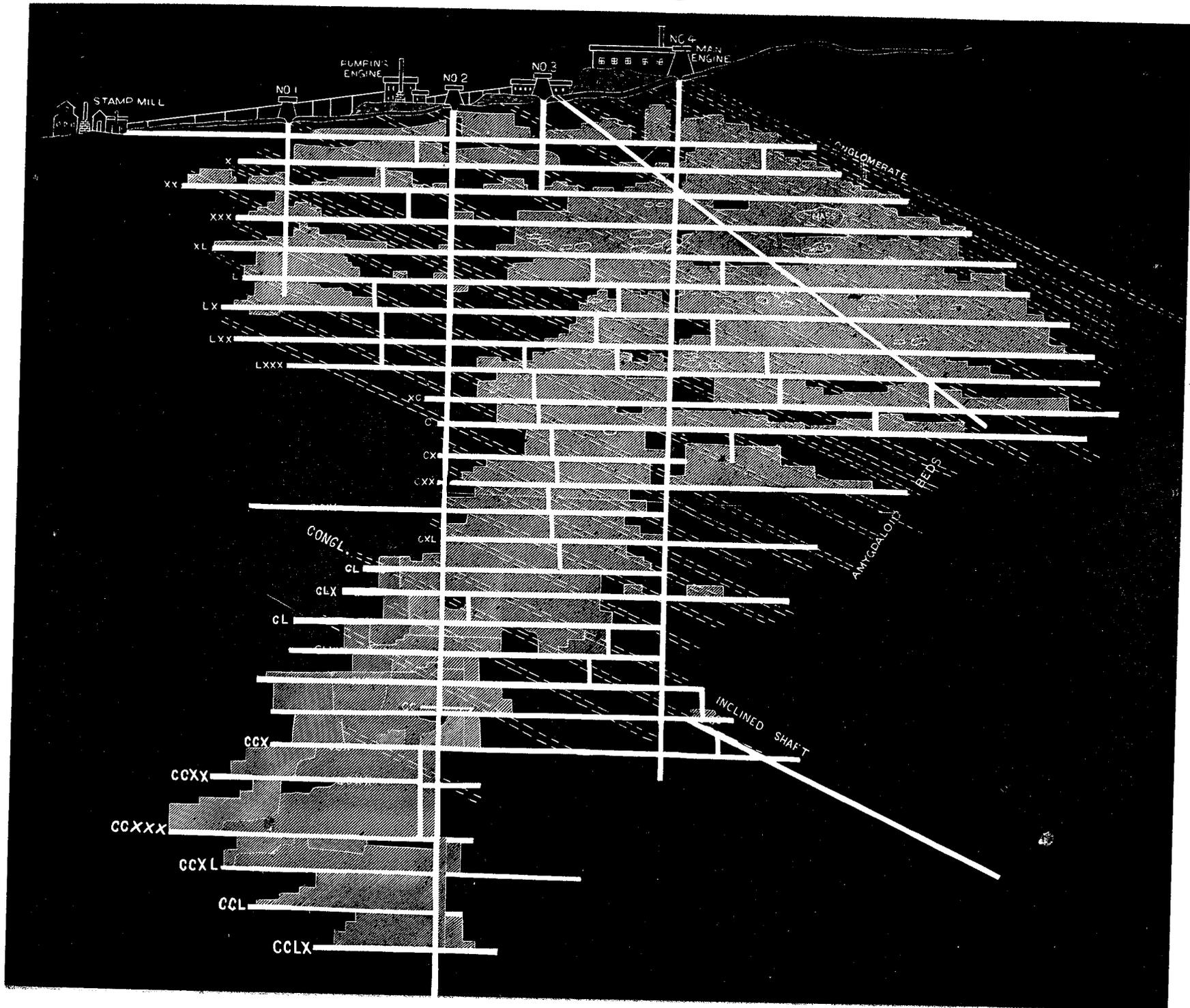
It is a very interesting mine, and the affairs of the company are exceedingly well managed.

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

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

LONGITUDINAL SECTION OF THE CENTRAL MINE, JAN., 1887.

Scale, 360 ft. to one inch.



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

The conical drum for the counter weight is 6 feet and $13\frac{1}{2}$ feet diameter, respectively, at the ends, and 14 feet long. The two engines to operate them are each 30"x60", built by Frazier & Chalmers, Chicago.

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

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

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

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

The directors present the following statement of the operations during the year 1886: The production of mineral was 1,600 755-2000 tons, and the quantity smelted was 1,590 815-2000 tons, which yielded about 79 per cent., or 2,512,886 pounds of refined copper.

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

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

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

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

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

GEORGE A. HOYT,
ROBERT PORTERFIELD,
JOHN J. CRANE,
ALBERT J. HATCH,
WM. C. STURGES,
JOHN STANTON.

Directors.

ASSETS AND LIABILITIES, CENTRAL MINING COMPANY, DECEMBER 31ST, 1886. EXCLUSIVE OF REAL ESTATE AND MINE PLANT.

Assets.		
Cash.....		\$22,663 37
Loans.....		92,040 00
Silver on hand.....		432 70
Copper on hand, sold.....		39,308 62
Copper on hand, unsold, 478,964 pounds.....		50,291 22
Accounts receivable.....		6,032 40
		<u>\$210,768 31</u>
At Mine.		
174 1865-2000 tons mineral, at \$125.....	\$21,866 56	
Cash.....	3,115 97	
Merchandise in store.....	23,360 00	
Supplies.....	32,970 24	
	<u>81,312 77</u>	
		<u>\$292,081 08</u>
Liabilities.		
Agent's drafts.....	\$9,739 07	
Indebtedness at mine.....	18,005 30	
Accounts payable.....	8,232 40	
	<u>35,976 77</u>	
Balance of assets.....		<u>\$256,104 31</u>
(Less dividend, February 1st, 1887, of \$40,000.)		

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

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

AGENT'S REPORT.

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

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

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

ANNUAL REPORT OF THE

GROUND BROKEN.

Sinking in shafts and winzes 188 feet, average cost.....	\$20 26
Drifting on vein, 979 2-12 feet, average cost.....	9 02
Stoping on vein, 1,781 3-36 superficial fathom, cost.....	13 74
Stoping on vein, 22 cubic fathom, cost.....	18 00
The total amount of ground broken in openings and stopes is 3,000 cubic fathoms.	

PRODUCTION.

1,172 bbls. stamp copper, weighing.....	1,679,135 lbs.
214 hhds barrel copper, weighing.....	689,125 "
324 masses copper, weighing.....	832,495 "
Total.....	3,200,755 "
Or 1,609 755-2000 tons.	
Average yield of mineral per fathom of ground broken.....	1,066 lbs.
Average yield of ingot per fathom of ground broken.....	842 "

EXPENDITURE AT MINE.

The total expenditure for the year is as follows :

Mining and surface expenses.....	\$140,448 07
Stamp mill expenses.....	14,032 06
Taxes.....	3,658 70
Construction account.....	21,540 05
	<u>\$178,678 88</u>
Less rents received.....	4,667 07
Total expenses.....	<u>\$175,011 81</u>

SINKING.

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

DRIFTING.

The 23d level south has been driven 22 feet.

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

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

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

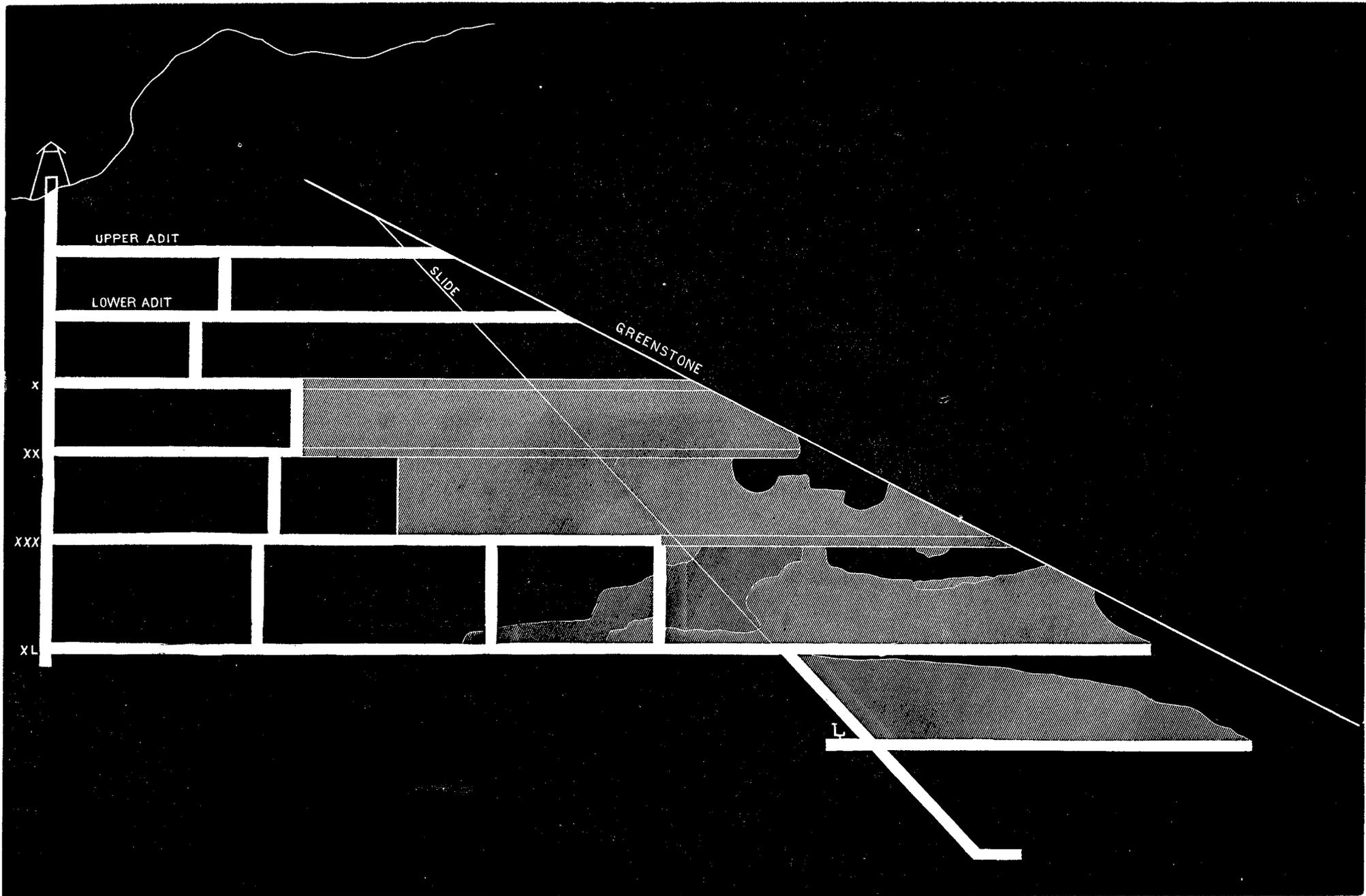
At the 27th level we have drifted 70 feet north and 31 feet south of No 2 shaft. The north drift has exposed a good vein about 2½ feet in thickness, but the south drift is poor.

STOPING.

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

LONGITUDINAL SECTION OF THE ST. CLAIR MINE, 1887.

Scale, 120 ft. to one inch.



CONSTRUCTION.

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

Table showing product of Central Mine—refined copper:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
1856.....	32	403	1872.....	623	56
1857.....			1873.....	751	1,117
1858.....	71	1,011	1874.....	870	900
1859.....	84	312	1875.....	733	952
1860.....	125	1,370	1876.....	1,080	1,400
1861.....	70	139	1877.....	997	1,640
1862.....	133	1,972	1878.....	945	1,013
1863.....	278	1,548	1879.....	899	1,495
1864.....	381	1,855	1880.....	1,013	73
1865.....	346	1,200	1881.....	709	465
1866.....	574	1,842	1882.....	676	1,595
1867.....	637	745	1883.....	634	556
1868.....	1,353	1,827	1884.....	723	747
1869.....	903	1,801	1885.....	1,078	1,408
1870.....	663	1,156	1886.....	1,256	886
1871.....	716	662			
Total.....				19,447	1,173

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

THE ST. CLAIR COPPER COMPANY

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

THE COPPER FALLS MINE

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

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

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

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

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

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