

on the vein, across it 75 feet, all in ore. The foot wall is a black slate, and the hanging a quartzite, though the hanging wall has not been reached in the test pits. A shaft, 50 feet in depth, has been sunk, all in ore, below the stripping. Two large pits are started, east and west of each other, about 300 feet apart. In these the earth has been removed to the ledge, to a width of 125 feet, and a length west and south of 150 feet. Shafts will be sunk in the center of each of these pits, and a level stoped away, and the ground between the pits also stripped to the ledge, and are stoped to the first level, thus making a pit 500 feet long and the full width of the vein, whatever that may prove to be—75 feet and upwards.

A railroad line is being surveyed to the location, and will be speedily followed by the construction of the road. Some buildings have been erected and machinery secured, which will be got ready to work as soon as may be.

The ore is a yellow, ocherous, and a hard, brown hematite, very similar, if not identical, with that of the Dalliba. The company's land is well covered with a fine growth of timber, and the mine is opening in high, dry ground, giving excellent drainage. It is certainly a very promising mine.

On the N. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of Sec. 26, T. 48, R. 31, some explorations have been made by means of test pits, which, as in the locations previously described, have thus far resulted very favorably. The pits are bottomed in ore, and have been dug across the vein, showing it to have a great width. This property is held by Mr. Wetmore and Dr. Northrop on a lease.

PORTLAND.

Still west, in the S. E. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Sec. 22, T. 48, R. 31, they have a line of pits extending from foot wall to hanging, 80 feet. Of course, as the work has been done some time ago, the pits are, partially, now filled with water, so that it is impossible to see the ledge, and one can only judge from the materials thrown out and the statements that are made. These all show very nearly the same character of ore, an ocherous, yellow, or hard, light and dark brown hematite, very free from rock quartz or other rock. This find is called the Portland.

THE BEAUFORT.

The Beaufort, so called, comprises the N. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of the same section 22, T. 48, R. 31. Here about the same amount of exploration has been made, with about the same result as the preceding.

THE TITAN.

The same may be said of the Titan, which comprises Lot 1 in Sec. 21, T. 48, R. 31, which has also been explored with the same encouraging indications.

THE CASCADE RANGE—(JUNE, 1882).

The occurrence of iron ore in this locality was one of the earliest known in the region. The United States Surveyor, in 1845, observed and commented upon the remarkable outcrop of lean iron ore, upon the top of which is the corner of Secs. 29, 30, 31, 32, and which, forming a high, exposed ledge of lean flag ore and jasper, extends for a considerable distance east and west.

In this rocky bluff considerable mining has been done. Owners of lands and lessees have organized companies and prosecuted work, but the so called ore which they have mined and shipped has generally proved to be suitable for other purposes than iron making.

After the panic in 1873, the mines on this range, with the exception of what was known as the West End Mine, became idle. Subsequently the Palmer Iron Company was organized, and the Palmer Mine. The West End has been continuously operated by that company, and has become so favorably known that it has, to a great extent, redeemed the bad reputation which the ores of this range had previously acquired.

THE PITTSBURG AND LAKE SUPERIOR IRON COMPANY.

The Palmer Iron Company was merged into the Pittsburg and Lake Superior Iron Company, with Ralph Bagley, of Pittsburg, President; Jeffrey Lippincott, Secretary and Treasurer; Joseph Kirkpatrick, Agent, Palmer, Michigan.

The estate consists of 26,444 acres of land, on which are a number of old mining locations, so that Palmer is quite a village, having a good many houses, generally well built, stores, etc.

At the mine the ore deposit extends nearly north and south and dips at an angle of about 55° to the east. Further to the east the formation bends, taking an east and west direction. The mine was at first worked openly, and now shows a series of pits, 640 feet in depth, down the west walls of which the skip roads descend, extending below the bottom into the underground workings. The foot wall is a diorite schist; the hanging, a hard jasper.

Commencing with No. 1 the skip road is down 340 feet; the bottom of the pit is about 85 feet long, separated into two lenses, between which about 25 feet of jasper intervenes. The bottom vein averages 20 feet wide, and the upper one 16 feet. They are wide in the middle and narrow at the ends. The stopes are the full height of the lift, 40 or 50 feet. At both ends are headings of jasper. The skip road goes down on the foot wall vein, and they mine the upper one by milling the rock through a winze into the lower drift. The yield of the pit is 60 tons daily. The several pits are in lenses of ore which underlie each other in succession as we go south.

No. 2 underlies No. 1 to the west 70 feet. The intervening rock is a hard jasper. The skip road goes down from the top 300 feet. The lens is small,

only about 6 feet wide and 60 feet long; the ore is good and the lens just about holds its own as they go down.

No. 3 is in still another lens underlying No. 2 to the west. The shaft is 300 feet from No. 2 and the soap rock, separating the lenses, is about 24 feet thick. The lens of ore is about $6\frac{1}{2}$ feet wide. They have recently sunk the last level, and are now drifting from the shaft; have opened 30 feet in this level. The pit in the levels above is about 70 feet long.

No. 4 shaft is down 260 feet to the bottom level, which is opened 100 feet. The vein varies in width from 3 feet to 9 feet, and still underlies to the west No. 3, with an intervening wall of jasper of 10 or 12 feet. The whole length of the openings is about 700 feet, north and south, and the daily product is, on the average, at present, about 100 tons. The company has done some exploring with a Bullock diamond drill within the past year. In all five borings have been made.

No. 1 hole was bored at an angle of $60\frac{1}{2}^\circ$ with the horizon, and after going through 115 feet of diorite, was stopped.

No. 2 was bored 50 feet in quartzite, 20 feet in lean ore, 6 feet No. 2 ore, and 20 feet banded jasper. These holes are east from the mine to Sec. 31.

No. 3 passed through 50 feet quartzite, 17 feet No. 1 ore, 28 feet jasper, and stopped; the hole is in Sec. 29, not far from the mine.

No. 4 hole was in quartzite 32 feet; No. 1 ore, 4 feet; barren jasper, 31 feet; vertical hole.

No. 5 is in 505 feet quartzite, bored vertically, and will be continued until they strike the ore. This hole is further to the east, near the location, or the old Cascade Mine. A new pit has been started in No. 5 to the south; have taken off 20 feet of stripping, and have just come to No. 1 ore, 6 feet wide. They are obliged to hoist a good deal of rock. Taking the average of all the pits 50 % of the rock hoisted is thrown away; but from No. 1 very little waste rock, comparatively, is hoisted; from the others it is nearly two-thirds waste, coming mainly from the hanging wall. The company employs about 175 men.

Below the mine and the village the company has in active operation a saw mill and a good stock of logs, and are cutting ore and selling a considerable amount of lumber.

Among the most notable of the improvements which have been made in the past year, is the construction of a fine brick residence for the agent, Mr. Kirkpatrick. It is one of the most substantial, commodious dwellings in the region.

Capt. W. H. Whiteside, upon whom devolves the care of the mining work, etc., has held his position for nine years, and is a competent, estimable man, who has the confidence of the company and of the employes.

The product in 1881 was 39,276 gross tons, and the total output to date is 214,216 gross tons.

Some exploring is being done in one or two of the old mines between the Pittsburg and Lake Superior, and the Wheat Mine, the East End Mine, but nothing of importance has yet transpired.

THE WHEAT.

The Wheat is the first active mine to the east. The estate is the S. E. $\frac{1}{4}$ of Sec. 29, T. 47, R. 26, and joins the Pittsburg and Lake Superior Company's land on the east. It is owned by Dr. Wick, of Cleveland, Ohio, and is held

on a lease by The Wheat Iron Mining Company. While the mine has been worked to a slight extent for some years, the main part of the work has been done in the last year; the openings are not very expensive. The lenses of ore in this range seem, so far, to be small or lean.

At present not much is doing in the mine. They are working in the north end at the bottom of the east open pit, pushing a drift to the north; the drift is in 15 feet in ore; the width is 15 feet to 25 feet, apparently, the lens pitching down to the northwest. The same lens has been followed from the surface, the working of it out thus far making an open pit 100 feet long, 60 feet wide, and 50 feet deep. At the lower end it had been seemingly cut off, but it proves to be only a lens of rock, and the ore is making fully as large beyond and below. The work in the other pits, just now, is only scrambling. The machinery consists of hoisting engine, four drums, pumps, etc. About 25 men are at work under Captain Thomas Trout, and are putting out a weekly product of 100 tons. The company shipped last year 90,000 tons, and has made a total output of 16,444 gross tons.

At the hematite deposit, which is claimed as good ore, nothing has been done.

The officers are: Daniel McGarry, President, Cleveland, Ohio; Thomas Axworthy, Secretary and Treasurer; F. W. Judd, General Agent.

THE WICK MINE.

The same parties operating the Wheat own also the Wick Mine, which lies to the south of the Wheat a short distance, being 40 acres in Sec. 32. The officers are the same as those of the Wheat Mine.

The mine is a soft hematite of fair quality, into which a shaft has been sunk 16 feet in ore. Some test pitting has been done, and the shaft is located in the best showing. The work here is in charge of Capt. John Brown.

THE CLANCY MINE.

Joining the Wheat on the east is the Clancy Mine, comprising 40 acres of land in Sec. 28. There is nothing to show but some test pits, giving indications of soft hematite ore.

The officers are: John Clancy, President; M. W. Bates, Secretary; I. N. Watson, Treasurer, all of Grand Rapids, Mich.

THE GRAND RAPIDS MINE.

Still further to the east is the Grand Rapids Mine, comprising 40 acres, being the S. W. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Sec. 28, T. 47, R. 26.

This property was formerly included in what was known as the Gribbon Mine. Some mining work was done last year, and a small stock pile of ore, about 2,000 tons, got out, but the quality of ore is hardly up to a standard that will give it much market value. The pit from which this ore was obtained is not now working.

The work has been transferred to the low ground south of the hillside into which the former pit was made. In this low ground they are sinking in a deposit of tolerably hard hematite, which may turn out to be of some value, but they are hindered in the work by the water. There are a half dozen good log houses on the location.

The officers are: I. J. Whitefield, President; Marcus W. Bates, Secretary; Isaac Phelps, Treasurer; office, Grand Rapids, Mich.

The property is held on an option from H. M. Atchinson, of Negaunee, Mich. The work is in charge of Frank Koop.

THE LAXEY MINE.

Joining the Grand Rapids Mine on the east is the Laxeey Mine, worked by a company of the same name, recently organized. The land is held on a lease from H. M. Atchinson, and the officers are well-known Negaunee gentlemen.

J. Q. Adams, President; P. B. Kirkwood, Secretary and Treasurer; H. M. Atchinson, General Manager.

A shaft has been sunk 60 feet in depth, 37 feet of which is claimed to be in ore. They have drifted 30 feet in the direction supposed to be across the deposit; but they have 8 or 10 feet in width of clean ore, and a known length of 40 or 50 feet, and a greater width of mixed ore. They are now sinking to ascertain the depth, and are still in ore. The product is a good quality of hematite. The company has had analyses made, which if the samples were a fair average, make an excellent showing—64.70 % metallic iron; .023 % phosphorus. If the outlook is sufficient to warrant, the branch railroad will be extended to these mines. The hanging wall is a quartzite—the foot a soft schist. About 20 men are at work on the location. A hoisting engine and drum are in operation.

THE MEXICAN MINING COMPANY.

The Mexican Mining Company is an organization which has been lately made to further explore and possibly to purchase the Carr mine, situated further up the hill south of the Grand Rapids mine. The description is the N. W. $\frac{1}{4}$ of Sec. 33, T. 47, R. 26. In 1873 the mine was worked and a few thousand tons of lean ore gotten out and shipped, since which time it has been idle. I visited the location, but did not see anything very promising in the way of mineral. Further exploration, it is said, will be made. At present nothing is doing.

The Superintendent is Geo. Berringer; Secretary and Treasurer, Geo. W. Hayden, Ishpeming, Mich.; President, W. F. Swift, Ishpeming.

THE NEGAUNEE MINES—(JUNE, 1882).

Within the limits of the city of Negaunee, and situated a short distance south from the business portion of the town, are a number of mines commonly known as the "Negaunee hematites." The most westerly of these, on the south side, are the South Jackson and the Inn Cliff's Section 12 mine, mention of which has heretofore been made in describing the mines of those companies.

MCCOMBER MINE.

Adjoining these on the east is the McComber mine, comprising the N. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Sec. 7, and the S. W. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Sec. 6, T. 47, R. 26. The mine has been quite fully described in previous reports, and still continues to be one of the leading hematite mines of this range, both as regards the quantity and the quality of its ore, though the quality is now hardly up to its earlier standard. Its output in 1881 was 23,051 gross tons, and its total shipments to date amounts to 252,345 tons.

In the report of 1881 it was mentioned that a very promising pit had just been opened near the southeast corner of the engine house. This pocket has since been worked out and did not prove to be of much magnitude, but a leader trending to the northeast, past the southwest corner of the engine house, is now being opened, and may lead into a similar or larger deposit. Seventy-five feet further to the southeast they have sunk a shaft which is in good ore, the deposit apparently making parallel with the ore at the engine house.

Within the year they have begun to work underground in the easterly pits. North of the engine house 150 feet, in line with its west end, is a "down-right" shaft of 169 feet deep, and at about 223 feet to the west of this is another vertical shaft a 109 feet deep. Both these are connected to the depth of the latter, and the ore in the upper levels, except pillars, has been removed. In the bottom from the east shaft, they have drifted north 25 feet, coming in that distance to a soft rock, which was followed out 60 feet, the last 30 feet being in ore, which still continues and is likely to do so beyond the west shaft, since such was the case in the levels above. To the south a drift 35 feet was run all the way in rock—jasper—after which ore was reached, into which they have pushed 30 feet, and now have at the end of the drift a breast of ore 14 feet high and about the same in width. The jasper appears to be coming down on the northeast side, but the opposite side is still unaltered. In this east shaft, also, a drift has been opened a 100 feet in the direction of old No. 2 pit to the east. The drift is a mixed hematite rock. Also a drift 25 feet to the west, which was in ore but terminates in rock. The bottom drift to the west is 40 feet below the west shaft and to the most of it 25 feet when opposite the shaft they will drift south to it, and rise up to the bottom of the shaft. A drift has been extended west to the boundary, 50 feet west of the west shaft. This shaft is called No. 8, and the last one No. 3.

The most productive parts of the mine at present are Nos. 2, 3, and 5 pits, No. 3 being the main pit. In this pit, in the 143 feet level, are three good stopes—to the west, southeast, and to the northwest. Each of these stopes is about 14 feet high and of an equal width. Above the level in this pit they are only scrambling.

No. 5 is now the last working pit of the mine. Its direction is northwest and southeast, having a length of about 300 feet and a depth of 100 feet, and 50 feet wide in the middle, narrowing at the ends, giving it an oval shape. From this they are now taking 60 to 70 tons of ore per day. They are stopping at the west end and sinking in the bottom. The dip of the ore lines is about 45° to the south, and it varies in width from 12 feet to 60 feet, with a length of perhaps 300 feet. There is considerable ore in the north wall. It is mixed with rock, but looks as if it might pay to take it down and sort out the ore. The hoisting in this pit is done with buckets and two derricks, worked from the engine house. The surface has been stripped beyond the east end of the pit above the ore, which a thin wall of rock separates from the main pit. This rock will be taken down and the pit continued east. The ore all goes into the ore pockets, of which there are four, placed above the railroad track, and the cars are filled from under these pockets.

Up on the hillside, 600 feet to the south, some men have just uncovered a body of apparently good ore. No sinking or other test has been made in it. As exposed it is 12 feet wide.

The mine was opened in 1870, and has since been continuously worked. The ore is of an excellent quality, and sells readily in the market, being suitable for Bessemer iron.

The Local Agent is Henry Merry, Jr.; Mining Captain, Charles Cook.

THE PENDILL MINE.

The Pendill Mine is situated but a few rods south of the Union Depot in the city of Negaunee. The stock pile and ore pocket are close to the main track. The mine is also north of the McComber, the estate being the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ of Sec. 6, owned by the Hon. J. P. Pendill, of Marquette, but held on a lease by the Union Iron Company.

The mine was opened by Wm. C. McComber in 1877, who mined that year 4,000 tons of ore. During the succeeding time, until 1879, the mine remained idle, when it was worked for one year, until April, 1880, by the McComber Iron Company. In 1880 the company now working the mine became possessor of the lease, and has since held it.

The mine was never worked in an open pit. A shaft was sunk from the surface and is now 195 feet deep, on an inclination of 80° to the west. It has been worked in levels of about 25 feet apart. The bottom is now called the 6th level, and is looking poor. They have drifted east from the shaft about 80 feet, and are now drifting north in the 5th level, 175 feet down; to find the Jackson vein have gone 60 feet. No ore is now being hoisted. There are no stopes to mine, and no ore in sight to sink or to drift into; however, the mine is a very small, underground affair, and has before looked as unfavorably as it does now, and afterwards recovered. The ore is a good quality of hematite.

The officers are: John Burt, President, Detroit, Mich.; Hiram Burt, Secretary, Marquette, Mich.; Richard Bryant, Superintendent, Negaunee, Mich. The product for 1881 was 13,586 tons, and the total to date is 34,094 tons.

THE NEW YORK HEMATITE.

The New York Hematite is another name for what was formerly called the Grand Central Mine. It is southwest from the Pendill, or northwest of the McComber, on the adjoining land. The company have worked an open pit a short distance east from the old Grand Central Mine. This pit has a direction of northeast and southwest, 80 feet in length on its bottom, and 20 feet wide; the depth is about 60 feet. The bottom is partly in ore, and a drift to the south 25 feet is in ore; also one of same length to the southeast showed very well in ore.

These drifts are in the bottom level. In the bottom they are now sinking for a stope, and are also removing the dirt which has fallen down from the sides in considerable quantity through the action of frosts and spring rains. Two skip tracks go down into the pit from the east side, operated with wire rope from the engine house, standing 150 feet to the east. This mine is in the S. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Sec. 7. Another similar pit to the east is temporarily idle, through failure of machinery, partly, and partly through the unsatisfactory condition of the deposit.

The company, or J. Q. Adams and James Foley, the holders of the lease, are exploring on the next "forty" to the east with such success that the claim is made that they found the eastern continuation of the Jackson hard ore vein. They have put down three drill holes, with the Akron churn drill, to the ledge, and think that they have the vein 75 feet wide, and have also gone east and west on it 190 feet. The ledge is covered with 16 to 18 feet of drift. The drill hole cleanings certainly showed very fine, hard ore. A shaft has been begun and is down on the ledge, showing mixed ore on top. If it proves to be really a fine, hard ore deposit it will be an important fact. Much search has from time to time been made for the Jackson ore to the east of that mine, but has never been found unless, indeed, this discovery proves to be it. The further outcome excites some interest at Negaunee.

THE MANGANESE MINING COMPANY.

The Manganese Mining Company holds three forty-acre lots in Sec. 7, lying east from the McComber, and between the Milwaukee, the Rolling Mill, on the south, and the New York Hematite on the north. Mr. J. W. Schadt, of Negaunee, who controls the lease of the land, has given "options" in the east and the middle forties.

Some men are at work under Capt. Roberts opening a pit and sinking a shaft on the west forty, but, as yet, have not enough ore in sight to assure them of having a mine.

The middle forty, joining the Rolling Mill Mine, is being explored by Mr. Foley for Mr. James H. Dalliba, of Cleveland, O., who has an option for the lease of the land, the consideration being, it is said, \$25,000. A shaft 25 feet in depth has been sunk to the ledge, and 40 feet of drift made across it; 28 feet of the drift is declared to be in ore.

THE CHICAGO MINE.

The Chicago Mine is the southeast forty of Sec. 7. The mine has been opened but little over a year, and shipped last season 5,531 tons of ore, and now has about 2,000 tons in stock pile. The workings have extended under-

ground, but were so filled with water at the time of my visit to the mine, (June 3), that I was unable to go down into the mine. It was represented by the men in charge to be looking well, and that mining work would be resumed as soon as the pumps were repaired and the mine freed of water. The mine is provided with a hoisting engine, and drums, etc., and has a large ore pocket standing above the railroad track.

THE ROLLING MILL MINE.

The Rolling Mill Mine is now idle. It was one of the best hematite deposits that has been discovered on this range; but the old mine worked out, and the pits were allowed to fill with water. An effort was made last season to pump it out, but the machinery proved inadequate and the attempt was abandoned. Some exploring is now being done to try and find a new deposit. The mine is owned by Mr. Luther Beecher, of Detroit.

THE STAR MINE.

The Star Mine lies east of the Chicago and the Rolling Mill Mines, in Sec. 8. It is in the Cedar Swamp, between the bluffs.

It is a new enterprise undertaken by Mr. J. B. Maas, of Negaunee, in the summer of 1881. Several shafts have been sunk, one to the depth of 60 feet, and considerable drifting has been done; enough to determine the existence of a body of hematite of some magnitude. It is but a short distance to the mineral branch of the Chicago & Northwestern Railroad.

A force of 22 men, under Capt. John Bartle, are now at work to open a mine, no easy task in this low ground. Shafts will be sunk and underground mining resorted to from the outset.

The Agent is Ed. Maas, Negaunee, Mich. The property consists of the W. $\frac{1}{2}$ of the S. E. $\frac{1}{4}$ Sec. 8, T. 47, R. 26.

THE BAY STATE MINE.

The Bay State Mine is the name under which is known what was formerly called the Green Bay, and latterly, the Indiana Mine. The property is the W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Sec. 8, and is controlled by Messrs. Allen & Blake, of Negaunee.

Considerable mining has been done on this location, but not much good ore obtained. The ore that was shipped in 1872, 1873, etc., was of a very low grade; a jasper hematite that could not now be sold at any price.

The new company, the Bay State, was organized, some 10,000 shares of the stock were sold, and work was begun May 1 last, and they are now employing 18 men engaged in sinking a shaft, near the east line, in some of the earlier workings. This pit is down about 20 feet, in mixed ore; they have a small engine hoisting. To the northwest, on the other side of the high knob that intervenes, they are making a long cut to reach a body of ore into which a shaft has been sunk a distance of 16 feet. This deposit they have crossed, showing a width of 30 feet, and have tested its length for about 100 feet.

This land was leased in 1879 by Wm. J. Allen, and himself and Mr. Blake have since worked it, calling it first the Indiana; but learning there was already a company having that name, changed it, recently, to the one above

given. Mr. Allen directs the work; he is an old worker in this vicinity, and has done a good deal of unavailing exploring about Negaunee, but is now confident of success. In 1872-73 he operated what was called the Allen Mine.

THE ALLEN MINE.

This old mine, lying next east from Green Bay, Thomas Tracy, with some others, is exploring. They have chosen a place where formerly some work has been done, and are preparing to sink a shaft in a ledge of mixed ore. As they have been but a few days at work, there is of course but little to show.

THE MILWAUKEE MINE.

It is still a matter of regret among not a few of the explorers and investors at Negaunee, who for so many years have, with industry and persistence, pick and shovel in hand, worked Sec. 7, testing its outcrops and perforating its out pits; or with equal faith and temerity have invested their limited surplus in "promising funds" that in the end, perchance, brought only loss and disappointment; that they had not the discernment to know that way up on top of the hill, surrounded on every side by the greenstone, was, perhaps, the richest deposit of them all. In the center of the section, on the "forty" on which they had neglected to secure an option, from esteeming it valueless, was discovered one of the largest deposits yet opened on this range, and which indeed proved a bonanza to its fortunate holders, and has, apparently, been a no less valuable possession to its subsequent owners. The discovery of the ore, analysis of its properties, and a description of the mine were fully given in the last annual report; and it is safe to say that the mine has thus far realized all that was reasonably predicted regarding it, and that its outlook for the future is equally good. The mine is in the center of the "forty," west of the Rolling Mill Mine, and southeast of the McComber, and high above them both.

The railroad to reach it starts from the east and traverses a long, high trestle on an ascending grade, reaching a depression on the hillside, at a considerable elevation, at the now idle workings of the Manganese Mine, thence by a wye it winds around the east and south sides of the hill at a steep grade, until it attains to the mine. And yet, when the mine is reached, it appears to be in a sort of a basin in the top of the hill. There are walls of greenstone to be seen in nearly all points of the compass.

Like others of the Negaunee hematite mines, the Milwaukee is a succession of open pits of a magnitude corresponding to the extent of the deposit, which has been or is working. Those from which the product is now obtained are Nos. 2, 3, 6, and 7 pits. The others are either wholly idle or occupied by scammers. A small amount of ore is obtained from No. 1 pit and is trammed through into No. 2, which is now the most westerly pit. It is about 100 feet long, 40 feet in width, and 100 feet deep.

The shaft goes down from the southeast side on the foot-wall. The skips discharge into the tram cars at the top, which are run to the pockets. From the bottom of the open pit the shaft is sunk 40 feet, and they are going to push the work underground.

In the open pit the ore was capped over and worked out in the winter and the surface, etc., above allowed to fall in. The shaft is in the foot-wall 5 feet from the ore; they have cut through and around the ore 10 feet, and come to

soap rock; the drift will be pushed through this, as it is doubtless only a partition in the ore, since in the levels above the same thing occurred, the ore appearing south of the schist and widening. On the surface the ore was narrow, now it is 10 feet.

From the bottom of the shaft in this pit they have drifted west 115 feet, in ore all the way, and come to soap rock. Also a drift a little to the northwest 150 feet, was all in greenstone when they cross-cutted 35 feet, but found no ore. This drift and cross cut will be extended when they have the facilities of getting out the water which now interferes with the work.

No. 3 is a long, ragged pit, 600 feet north of No. 2, with a south wall of mixed ore. Little holes or pockets are now being mined out in it. The open pit is 50 feet deep and the shaft is 90 feet below the bottom. The skip road goes down from the northeast side and extends to the bottom. Underground the vein is 75 feet long and 20 feet wide, but is a little mixed. They are working the level and have a stope the full length and width of the vein and 40 feet high. The bottom is in ore; they have sunk 20 feet below the level and find it the same.

The pit now furnishes 15 to 20 tons per day. A track runs from the top of the skip road to the ore pockets over the railroad.

The ore from the mine is sold to a considerable extent to local furnaces. Twenty-five cars per week are sent to the Martel furnace, St. Ignace, and as many more to the Excelsior and Carp furnaces. The mine makes barely enough water to keep the pumps going.

No. 6 is a small pit, the open part being about 70 feet across and 50 feet deep, in the center of which, below the bottom, the shaft goes down to the southwest. To the southeast is a run of ore 8 or 10 feet wide, which they are stripping from the pit to mine. It appears to be widening out; where it starts from the pit it is small, but as uncovered, it now shows a width as above indicated. Below the bottom the shaft goes down 75 feet, and they have an underground pit with a deposit of ore of the same length and 20 feet wide, while they are taking all out except the pillars. The vein is much cleaner than in No. 3. The ore requires but little sorting in this pit.

No. 7, about 300 feet east from No. 6, is the most northeasterly pit in the location. It is really divided into two open pits, the west one of which is idle, temporarily, but is not worked out as the bottom is ore. The east pit is about 100 feet long by 75 feet wide and 40 feet deep. The ore has a width of 30 feet at right angles to the walls, and is very clean, free from rock, etc. When a bunch of jasper does occur, it is isolated and easily separated from the ore. The underlay is a jaspery hematite, and the ore makes into it.

The ore appears to extend south of this pit, beyond the rock that they are now following down as the foot wall. At the west end the deposit makes an elbow, cutting across the formation to the south, and has been followed 50 feet. Another branch of the ore appears to be making towards No. 6, but has not been followed.

The hoisting from No. 7 is done with a small engine and drum situated to the south. The ore, as in the others, is trammed in the cars, into which it is dumped, to the main pockets. This pit is yielding a daily product of about 75 tons of ore, the total weekly product being about 800 tons.

To the west a few men are at work on a small deposit from which they have got out about 150 tons, and are working to see what may develop.

In No. 5 pit, lying south of Nos. 6 and 7, they have in the east end a vein

of ore 10 feet wide, which they are stripping; it seems to be making toward No. 7. In that same pit, No. 5, there are two long cuts to the south, which afforded very fine ore. There are three double, equal to six single ore pockets, having a total capacity of 120 tons. These are connected by rail track with each of the shafts, and stand above the railroad, so that the cars are filled from the pockets.

The ore from all the pits is mixed together and sold as a 58 % ore; it is not found to be, on the whole, suitable for Bessemer steel, though all the ore, except that from No. 2 pit, would probably answer for this purpose. Some complaint was made last year by the purchasers of the ore; it was sold for a too high grade ore, so that it is thought best to place it at a standard that will be sure to give entire satisfaction. The product last year was 31,365 gross tons, and will be fully equaled by the output of 1882. The aggregate yield of the mine during the two years that it has been worked is 45,448 tons.

The General Agent of the company is Mr. A. Kidder, of Marquette; local Superintendent is Capt. James Foley, Negaunee; Mining Captain, Gilbert Carmichael, Negaunee.

THE WEST REPUBLIC MINE.—(JUNE, 1882.)

This mine is in a small peninsula made by Smith Bay on the east and the Michigamme River on the north and west. The mine, as opened, is near the river, on the west end of the peninsula, and the underground workings already reach the east margin of the river.

The M. H. & O. Railroad Co. has built a track into the mine, starting from the Columbia and Kingston branch, and making a circuitous route on the west bank, it crosses the river to the east side a few hundred feet to the north of the mine. Two large ore pockets are building by the side of the track, and strong framed stretchers over the mouths of the shafts for the skip dumps, etc.

No. 1 shaft was sunk off the vein or ore. It is 125 feet deep and will not be sunk further, as the ore pitches away from it, and can be better reached from the other shaft. For some time it will answer for taking down timber, etc., and ventilation.

No. 2 shaft is also vertical; it is 135 feet deep below the surface, and about 100 feet from the east bank of the river. The main lens of ore in which they are now working is pitching rapidly under the stream. The ore is 30 feet wide from foot to hanging, and 90 feet in length. They have two stopes working in this lens, in two levels. It has been widening rapidly, and if it continues to do so at the same rate it will be in another level or two attain a width of 50 feet. They have commenced to sink for the vein on the west side of the river.

A good engine house has been built, and a hoisting engine, 2x5 feet drums, etc., erected in it. A large number of good houses have been constructed. The location is a very pleasant one, to the beauty of which very much is contributed by the large bay and river.

It is but a short distance from the westerly pits of the Republic Mine. The ore is a fine specular slate, identical with that of the Republic.

The mine is in Lot 4, in Sec. 7, T. 46, R. 29, though the company holds Lots 4, 6, Sec. 7, and Lots 2, 8, Sec. 18, T. 46, R. 29. The officers of the company are: E. G. St. Clair, President, Ishpeming, Mich.; Mark Hanna, Secretary and Treasurer, Cleveland, Ohio; J. O. St. Clair, Superintendent.

The product in 1881 was 7,354 tons, though the company did not ship until about August. The probable yield for 1882 will be 20,000 or 25,000 tons.

COLUMBIA IRON MINING COMPANY.—(JUNE, 1882).

In a quiet way, under the new management, this mine is gaining in public estimation and in value. It is so near the Republic Mine that it is, of necessity, far overshadowed by it, and its deposits of ore, naturally, appear small and contracted when compared with those of its neighbor; nevertheless the Columbia is holding its own and gaining ground. The output for 1881 was nearly double that of the preceding year, and some results obtained from the explorations with the diamond drill are greatly encouraging, and add a prospective value, enhancing that given by the promise that is based upon what may be seen.

The Columbia adjoins the Republic on the north, the property being held by the present company on a lease from the owners. The mine openings extend along the vein, or ore deposit, a distance of about 1,000 feet, and comprise six pits, numbered from 1 to 6, commencing at the south. The south pit, No. 1, is about 150 feet distant, north, from the Kingston pit, the most northerly of the Republic Company's workings. The ore is of the same character, being slightly mixed with visible specks, or with small seams of quartz or jasper. It is all an excellent second-class ore, and some of it, by sorting, makes a first-class ore. No. 1 pit is now down to a depth of 145 or 150 feet. The pit is upwards of a 100 feet in length. The width of the ore is from 8 feet to 12 feet, being widest in the middle and narrowing towards the ends, though at the north end it about holds its own in width. The vein has a vertical dip and bears northwesterly. The walls are very firm. A diamond drill hole started at 140 feet southwest from this pit at an angle of 60° dip pierced the vein at 112 feet below the bottom, passing, it is claimed, 20 feet of No. 1 ore.

The Kingston pit, to the southwest, is improving both in the width of the deposit and in the quality of the ore, and it is inferred that the Columbia No. 1 will do so likewise, when the same depth is reached. The results from this drill hole, and the experience in the pit itself, indicate that such will be the case.

No. 3 pit is 140 feet north of No. 2, or 187 feet north from No. 1. It was apparently exhausted, but a new lens was found by crossing into the hanging, affording a working deposit 100 feet and upwards in length, and 8 feet or 10 feet in width of No. 1 foundry ore.

No. 6 is the extreme northwesterly pit. The vein at the bottom is about 8 feet wide and extends under the lake, as is shown by a drift made in the deposit in that direction a distance of 75 feet. The ore in this pit is of better quality, being sold for first-class, by some sorting. They are sinking and stopping in this pit, the lens, evidently, as do all of them, pitching to the northwest.

No. 3 is about midway between No. 1 and No. 6. The mine is provided with a suitable plant for present purposes, to which has just been added a compressor for working air drills. There are about thirty good houses on the location. The diamond drill is kept constantly at work. The product for 1881 was 11,158 gross tons, and the aggregate to date is 82,033 tons.

The officers are: P. B. Shumway, President, Chicago, Ill.; B. H. Jones, Secretary and Treasurer, Chicago, Ill.; C. M. Wicker, General Manager, Republic, Mich.

THE ERIE MINE.

This mine lies northwest from the Republic, on the same range with the Columbia, and distant about five miles. The mine is in the southeast part of the N. E. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Sec. 28, T. 47, R. 30. Some work has been done here for several years back, and a few hundred tons of ore gotten out and hauled to the railroad in sleighs and shipped.

The present company was organized and began work about one year ago, and have taken out and have in stock 2,000 or 3,000 tons of good second-class ore, similar to that from the Kingston pit, but of not quite as good a quality. Two downright shafts have been sunk. No. 1, the northerly one, is 125 feet deep. In this shaft, in the 74-foot level, a chamber 30 feet square and of about the same height has been mined out, and the ore vein, 12 feet to 16 feet wide followed to the southeast 35 feet. Running northerly from the shaft is a short drift, 15 feet long, cutting a narrow vein of ore. The shaft is sunk 50 feet to the second level.

No. 2 shaft, 60 feet distant from No. 1, to the southeast, is sunk 61 feet. In the shaft is a narrow vein, which runs in the cross-cut to the east, but has been but slightly followed. A boring has been made from the north dipping to the south, under the mine, at an angle of 60°, which at a distance below the surface of 200 feet, it is claimed cut 30 feet of No. 1 ore. They are anxious for the M. H. & O. Railroad Co. to build a track into the mine, which work is contemplated.

E. H. Wright, Agent, Republic, Mich.

THE REPUBLIC IRON COMPANY.—(JUNE, 1882).

The Republic Mine has for years been esteemed one of the richest possessions in the iron region. In the estimation of nearly every one it has been placed in the front rank of the iron mines in this country. Its ores have been the standard for first quality in the market. Republic ore is the synonym for the best that can be produced. Its management is cited as of the best; its stocks command the highest price; its revenues are larger, and its aggregate profits greater than those of any other iron company. To hold stock in the Republic is to possess a coveted treasure, and an assured income.

The situation of the mine is by nature one of the most pleasing and romantic spots to be found. The Michigamme River, a stream of considerable size, has here a very rapid current, foaming over and among the rocks which obstruct its flow; but above the rapids, in full view from the location, the river spreads out into a broad, magnificent stream, which disappears to the north, between the rugged hills that come down to its margin and finally obscure it from view. Here, too, are several beautiful bays, formed by depressions in the surface adjoining the river, and high up in the northerly and westerly slope of the bold, rocky bluff which, at a few hundred feet distance, surrounds on two sides the largest and clearest of these placid sheets of dark blue water, are the shafts of the Republic Mine. The openings are along the hillside, at an elevation of about 100 feet above the bay, and 50 feet below the top of the perpendicular wall, which rises abruptly to the rear. The trend of the bluff is in the form of a hook with the long branch north and south, and the bend coming around from the south end to the west; but in this general base are several minor loops or upright folds in the formation.

The shafts or openings extend for a distance along the interior face of the

bluff, of upwards of half a mile, and are sixteen in number. Commencing at the westerly extremity, with the Perkins, they are named in order of occurrence, proceeding to the east and north: Morgan, Pascoe, Ely, Gibson; thence by numbers from 1 to 11. And further to the west, on the opposite side of the river, about a half of a mile away, is the Kingston pit.

Commencing with the Perkins, at the other end of the line: this is not a large pit. Its product is shipped under the brand, red ore. It is a hard, specular ore of good quality, but distinct, having when struck or rubbed a slight reddish cast. The pit is 175 feet deep from the surface, about 35 feet long, the width of ore about 12 feet. It has been idle for eight months until recently, when work was resumed in it. It is worked with bucket and derrick. The Perkins is separated from the Morgan pit by a crossing of jasper. This latter is 200 feet to the east, and 132 feet further is the shaft of the Pascoe pit. The two pits are connected and are similar. Near them is an engine house furnished with hoisting engine, four of Merritt's internal friction gear drums, five feet diameter.

The Pascoe pit is furnished with a double skip road, the Morgan with single skip and pump shaft.

Going to the Pascoe and descending in the skip to the fourth level we find, northeast from the shaft, a stope of ore 100 feet long and 12 feet wide. A conglomerate generally underlies the quartzite, between it and the ore. A short cross cut, 20 feet, through jasper brings us again into a large body of ore, opened for stoping. Upon each side of the shaft are pillars of ore, left to protect the shaft. The same course is pursued in the other levels. The peculiar feature of the Pascoe pit is in the lay of the lenses of ore. They occur on either side of the shaft, extending east, west, and south, the long axis across the formation. The shaft goes down between these main lenses—they cut through the jasper. Going down to the fifth level, which corresponds to the seventh of the Morgan pit, we came into a small chamber with a drift off to the east, 50 feet, partly in jasper, to the east line. To the west a short drift in jasper brings us into the ore, a narrow lens across the formation. These lenses appear to have originally conformed with the formation, but in the disturbances that subsequently occurred, the formation at this point has been squeezed together, folding one portion into the other and setting some portions, in which these lenses are included, on end, they have been turned up on edge and thrown around the long way across the formation. A drift to the west, in this level, through the jasper connects with the Morgan pit. The 6th level has been sunk, but the skip road has not been carried down below the 5th. The method of sinking the shaft is by first sinking a winze by the side of it, between the shaft and the pillar, using one of the little hoisting engines described in the Michigamme Mine, "puffers," Capt. Pascoe designates them. The sink is thus made by hoisting to the skip, and when all is completed ready to stope in the level below, the shaft is lined up, the skip road completed to the bottom, and the connection made.

Passing west through the drift we come into the 7th level of the Morgan pit. Here is a large chamber from which the ore is taken out, to the north, 40 feet in the hanging rock wall, and they are drifting to the west around a huge pillar of ore that will be left. West of this pillar is another large chamber worked out, the south side of which is a jasper wall, but in the west end is a fine stope of clean, rich, black ore 40 feet high and 25 feet wide. On each side of the shaft are pillars of ore.

In this, as in the other pits, when the deposits are of sufficient magnitude to admit of it, the general plan of working is to have 30-foot pillars of ore on each side of the shaft, and then mine out a chamber 30 feet wide, again leaving a 30 feet pillar; thus pillars 30 feet square are left each way, 30 feet apart. The bottom of this pit is 260 feet below the surface, or 187 feet below the surface of the water in the bay.

Ascending to the surface in an up-going skip we pass southeasterly to the Ely pit. This pit is thrown back 100 feet into the foot wall from the Pascoe and Morgan. The dip is to the northwest about 55°, and the collar of the shaft, which is 380 feet above the bottom of the mine, on the lay of the skip road, is also 87 feet above the bay. In the lower levels, in this pit, they are working a lens which is about 140 feet in length and 40 feet to 50 feet wide.

From the Ely to the Gibson pit, 400 feet distant, occurs another sharp loop or ox-bow. The formation is folded back upon itself, so that the direction of the workings are the long way north and south, jutting into the jasper foot wall, but the jasper is likewise folded so as to conform with the ore lens. The ore lens pitches northeasterly 40° to 50°; the direction would be across the formation, if the formation continued regular. There are really two lenses worked in this pit, both pitching the same way. The back one is about 30 feet long and 5 feet wide. The front one is 75 feet long and 7 feet wide. The shaft is 380 feet deep, thus making it nearly 300 feet below the surface of the water in the bay. The product is a fine, specular slate ore.

No. 1 and No. 2 shafts are around the corner, which the line connecting them makes with the line from the Gibson to the Ely. The distance to No. 1 is 100 feet. The direction of the pits is east and west, and they front to the north. They were both poor on the start, but have improved greatly since they were started.

The underground workings in these two pits are the most regular of any to be seen in the mine; they are more like the copper mines, to use Capt. Pascoe's expression, who by the way was a miner in the copper district before coming to the Republic. The levels are systematically laid out, occurring in regular succession, one below the other, and opened out the whole length from one end to the other. No. 2 shaft is 91 feet above the bay. The dip is northwesterly 55°, and the depth to the bottom 350 feet.

Going down in the skip to the 6th level, we find a vein 7 feet wide, and 30 feet east from the shaft a stope 70 feet high; passing to the west along the level we may go directly into No. 1 pit and beyond the shaft 70 feet or 80 feet till the bend is reached going around to the Gibson, where the ore is cut off. In this pit the vein is 20 feet wide. The lens dips to the north and to the west, so that it lengthens and widens with each successive level. They are putting into this shaft, No. 1, a large plunger pump. No steam is used anywhere in the mine; all the drills, "puffers," pumps, etc., underground, and some of the hoisting engines above are run by compressed air.

As the power to compress the air is largely supplied by water, this measure is a matter of economy, but chiefly it is a necessity in ventilating the mine; it would be impossible to use steam in these pits without interfering with the work. Both No. 1 and No. 2 shafts are sunk to the 7th level; pillars of ore are left upon either side of the shafts.

Ascending, No. 1 to the surface we pass to No. 3; from No. 2 to No. 3 the direction is north and south, but at No. 3 it bends off to the northwest again. This shaft is worked down to the 5th level, but only ore from No. 4 is hoisted

from it. It is practically worked out. The pitch of the lenses have so brought it and No. 4, under No. 5. The ore has passed to No. 5 shaft. Thus this part of the mine is making to the north. The one from Nos. 3 and 4 pits is hoisted in No. 5 shaft mainly.

From the shaft of No. 2 to Nos. 5 and 6 shafts is about 550 feet. These two pits are entered by a downright shaft fitted with a double iron cage lift. The collar of the shaft is 108 feet above the level of the bay. Stepping upon the cage we may easily and safely descend to the 6th level, 360 feet down. Here we see the Republic in all its magnitude, the deposit which has given to it its great celebrity, a hundred feet from foot to hanging of the finest ore. In these pits for a length of 400 feet we have an average width of ore of 70 feet. Each successive level is but a counterpart of the preceding one; there are no signs of exhaustion. It is unnecessary to attempt to describe it; it is only a matter of immense chambers, pillars, and vaulted arches. In each level, upon each side of the shaft, are the great supporting pillars of ore, beyond which, either way, occur in succession the chambers and pillars as the mining work is extended.

From the shaft an avenue 30 feet wide is cut through to the hanging wall, and in the same manner, at each 30 feet, in the direction of the vein, parallel channels 30 feet wide are opened across the vein, from foot wall to hanging wall, and at each 30 feet between these blocks cross cuts, 30 feet wide are made. Thus the whole level in both pits is blocked out, leaving in the pillars and arches that remain, nearly one-half of the ore. In the meantime the shaft is dropped another lift by sinking a winze by the side of it and opening out the size of the shaft, the bottom being securely covered over with timbers. When all is ready the timbers are removed and the skip can go to the bottom. The specular slate and the black ore are separated by 15 feet of soap rock. The former underlies.

The ore lenses pitch to the northwest, so that at greater depth these lenses will come into Nos. 7 and 8 shafts, etc.

From the surface back from Nos. 3 and 4 shafts some men are working two small scam pits. From the No. 4 the formation runs about north between Nos. 4 and 5; is a long, open pit 200 feet in length, 70 feet or 80 feet wide, and 150 feet deep.

To the north the several shafts are entered by adits from the west, out from which the ore is trammed with mules to the docks or pockets, after being received into the cars from the skips. No. 7 and No. 8 are the two most important of these northerly pits. The vein is here narrow and vertical, and frequent spurs of ore jut into the jasper foot wall.

These shafts, 7, 8, and 9, are worked by a compressed air engine in a building upon the top of the bluff 50 feet above. In it are two four-foot drums and one six-foot.

Pits 10 and 11 are comparatively of but little account. Kingston pit, on the opposite side of the river to the north, is a mine by itself, with its own plant, hoisting engine and compressor, and furnishes a second-class ore.

The hoisting in 3, 4, 5, 6, and partly from 7 is done from the main engine house situated near No. 5 shaft. The hoisting machinery now in use in this building will be replaced with four 12-foot drums, etc., now making at the Iron Bay Foundry Works, Marquette.

A novel feature in working the machinery at the Republic, heretofore fully described in the previous reports, is the extended use of compressed air in

working the engines, etc., the compressing power being mainly water furnished by a dam across the river about a mile below the location. The compressed air is brought to the mine in a 15-inch galvanized pipe, with which all the compressor pipes in use in the mine, large and small, are connected. It is thus a receiver. At the water works are four compressors, also a double engine to assist in driving them in the season of low water. At the mine are four small compressors, driven each by a single engine. Twenty-five air drills are worked in the mine, four of them Rand's, and the others, Ingersoll. Twenty-four Cameron pumps are used, run by compressed air.

The compressors at the mine are each 13x30 inches, and the four at the water works are each 24x60 inches. There are six double engines, five for hoisting and one at the water works; two pumping engines on the surface 18x24 inches and 22x36 inches; these work the plunger pumps. There are six small "puffer" engines, and a single engine running four drums at No. 5. Besides the twenty-four pumps in the mine there are 13 others, either in use on the surface or kept for emergencies—thirty-seven in all. There are twenty ore pockets situated at different points above the several tracks, as convenience dictates. These pockets are of course over the tracks, so that the cars run under them. The ore docks are on a level with the top of the cars, so that the ore all goes down to the cars, whether from the pockets or from the docks.

Another very important feature connected with laying out the yard has been observed. From the extreme southwest to the west end of the yard a down grade has been given to the tracks just sufficient to move them down to any point by the force of gravity alone. The locomotive, which pushes in the train of empty cars, leaves them upon the track to the west of the mine; they may then be uncoupled and allowed to run down, be switched upon any track, and thus guided to any point, as desired. No switch engine or switch team is used. When filled the break is taken off, or blocking removed and the loaded cars are run out on the way track below the mine. So handily does the system operate, and so well are the pockets and docks distributed that 404 cars have been loaded in ten hours. The daily product is now between 700 and 800 tons.

Mr. David Morgan, the General Manager, has given his personal attention to the affairs of the mine; his long experience, mechanical, and executive ability have been invaluable to the company.

The Assistant General Manager, Mr. W. D. Rees, is known as a very competent, experienced mining agent, and withal an obliging, accomplished gentleman.

Capt. Peter Pascoe, the local Superintendent, has held his present position since the first blow was struck in opening the mine, and that he has performed his varied and responsible duties with ability and fidelity is fully attested in the appearance of the mine and in the esteem in which he is held by both his superiors and subordinates.

The shipments for 1881 were 233,786 gross tons, and the aggregate is 1,425,319 tons.

THE BARON.—(JUNE, 1882).

All the operations at the Humboldt Mine have been transferred to the "new discovery," the west end mine, now called the Baron.

Here a new mine has been opened, and all the buildings and plant for its

working have been provided. The work here has continued through about two years, and though the immediate location was originally low and swampy, there are very little indications of it now; it has been filled up so that it appears as if it had been high, dry ground.

The ore vein has a strike of northeast and southwest, and dips to the northwest at an angle of about 52°. The north pit was worked as an open pit to a depth of 80 feet, but the shaft has been carried below the bottom 70 feet lower, underground; 50 feet of this is a new level recently sunk. This new ground they have for the summer's stoping in this pit. It has a length of about 50 feet, in direction of the vein, and is about 12 feet wide, and pretty free from rock. Heretofore they have hoisted from this pit with a bucket and derrick, but soon this method will give way to the skip. A skip road is nearly completed from the top of the new ore pockets, of which there are two, to the bottom of the pit, and in a few days will be in readiness to operate.

No. 2 pit is 120 feet to the southwest, and is down 150 feet, whole length of the skip road, but only 90 feet below the surface. The lower level was sunk last year. The first level to the south from the shaft 65 feet proved to be poor. The lower level has not been much tested in this direction; but the best ground is found to be between the shafts.

It averaged, in the first level, 6 feet to 8 feet wide.

The second level, now opening out, appears to be about the same,—the vein 6 feet to 8 feet wide, and the stope 50 feet high. They have used the diamond drill in the old mine, in the bottom, boring through the foot wall and hanging wall, but without any important success. No borings have been made in the new mine. They are mining about 100 tons per day, and expect when No. 3 is working to double the product. The company is working 212 men, a very large force for so small a mine, but much of the work is in the matter of construction, building new ore pockets, new skip road into No. 3, etc. Each pit will have a double ore pocket.

No. 1, still to the south, is of no value so far as known. It is 65 feet from No. 2.

No. 5, up on the bluff to the northeast, 600 feet from No. 3, is a small pit which they are working away in to see what may turn up. They have here only a small vein, 4 feet wide, into which they have sunk 60 feet. The shaft goes down near the north end of the lens, since on the north side of the shaft the ore is only 1 foot wide. They are drifting south from the shaft, but there is no variation in the width; it keeps about 4 feet. The hanging and foot walls are as in the other pits, respectively quartzite and jasper. They have a compressor, a small one, got of the Michigamme Company, and four air drills.

The machinery is from the old Washington Mine, and somewhat antiquated, but suffices well enough for the work to be done. The ore from No. 2 is a slate ore, and No. 3 produces a black ore; both are excellent, first-class ores. No rock or poor ore can be found in the stock pile.

This mine is about one mile southwest from the Humboldt Railroad station. It is on the Republic branch, and not far from the track on the south side. It is near the S. E. corner of the N. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Sec. 11, T. 47, R. 29.

The General Manager is John B. Maas, Humboldt, Mich., and the intelligent, experienced Mining Captain is John Hosking.

The company controls a large estate, which includes the old Washington

Mine. The product for 1881 was 26,302 tons, and the aggregate to date is 485,495 tons.

THE ARGYLE MINE.

East of the Humboldt, between it and the old Washington, is the Argyle Mine, formerly the Edwards. The new company began work the 15th of April, 1881, and is now working two shafts. The mine, from the time it was first opened in 1865, has been worked underground, and was the first to be exclusively worked in that way.

No. 3, the most northerly pit, is 475 feet deep on the lay of the formation; the last 50 feet were sunk last winter. They are working in this pit in the third and in the fifth levels. In the latter they have for a stope the whole height of the sink; have stoped northeast from the shaft, thus far, 20 feet. At the shaft the vein was 15 feet wide, but narrowed down to 5 feet, and is again widening out. To the southwest they have gone about 75 feet. The vein is narrow, about 3 feet wide, but seems to be widening beyond.

No. 2 shaft, to the west, is distant from No. 3 150 feet. It is down to a depth of 350 feet. The two shafts are connected in the first level; but below there is a bar of ground close to the east side of No. 2 shaft, which they have not perforated in the lower levels. In this shaft, as in No. 3, they are working the lower levels. In the bottom level, in this shaft, they are stoping down the vein to the southwest. It is opened to the southwest 125 feet. The stope in the bottom begins at 100 feet from the shaft, southwest of it; the vein varies in width from 5 feet to 10 feet. The height of the stope is 40 feet. The hanging wall is quartzite and the foot jasper; the average dip is about 50° to the north. The extent of the workings on the property from the extreme limits is 560 feet. A diamond drill has been used in the mine; one boring through the foot wall penetrated 14 feet of No. 1 ore, after going only 25 feet in the foot. To the north they are going to cross the formation, below the mine, with the drill.

The daily product is now about 75 tons. The estate comprises 440 acres, held in fee by the company.

The officers are: D. M. Dickinson, President; D. R. Shaw, Secretary; W. W. Wheaton, Agent, Detroit; Mining Captain, James Bale.

The product for 1881 was 5,584 tons, and the aggregate product to date is 224,613 tons.

THE CHAMPION IRON COMPANY.—(JUNE, 1882).

The Champion Mine is coming to the front as one of the richest and largest producing mines in the State. Its product last year was only exceeded in amount by that of the Lake Superior, Republic, and Cleveland Mines, while in quality of its ore it is second to no other.

The Champion has been improving from year to year as increased depth is attained. The intelligent enterprise which has characterized the management has brought to the light the knowledge of the existence of the immense lenses of ore upon which the great value of the mine depends. Few companies have been more fortunate in this respect. Ten years ago it was thought to be nearly exhausted, but now it is richer than ever, and its prospects for the possession of mineral wealth were never so good.

The south deposits are constantly increasing. The "Chimney," "The

Old Man's Deposit," and the southeast deposit, which in the upper levels were all mined separately, each with a separate cross cut from the main lens, have now all come together, making one magnificent deposit of ore. Formerly they radiated upward like the fingers that have now come into the body of the hand, and the body of the hand is this deposit of ore, 40 feet in width and 320 feet between the end stopes of the pit, and still lengthening.

There are other important facts of a greatly encouraging nature, developed during the year past, which may perhaps better be made known by going over the work somewhat in detail, taking each shaft in succession.

A shaft, to the west, still remains idle; no further exploration has been undertaken.

In No. 1 a small pocket was worked out, the same one that has been found in this shaft.

In No. 2 shaft, in the south deposit, they are stoping from the 5th to 6th level. The shaft has been sunk 90 feet below the fifth, being well on its way to the 7th level. The body of the ore has been proved with the diamond drill and opened into from the south deposit. It proves to be an immense body of black granular ore. It is believed to be the extension of the south deposit from No. 3, where first opened.

It must be remembered that the Champion was first opened in a vein running east and west, and dipping to the north 80°, with a quartzite hanging wall. Subsequently, by the use of the diamond drill in the mine it was discovered that what had been supposed to be the true foot wall was only a barrier, separating the main vein from other equally valuable lenses of ore laying to the south, and that the foot wall, the greenstone, lay to the south 140 feet distant. These north deposits and south deposits are connected by cross cuts in the different levels.

No. 3 shaft has been sunk to the ninth level, and 20 feet below on its way to the tenth. The ninth level has been opened out. To the east, in the eighth level, it is stoped out. To the west in this level it has been stoped out 140 feet, and the stope is equally as good as at any portion of the drift. This becomes a very important feature, since in the level above the ore continued to a distance west from the shaft of only 80 feet. Already it has lengthened in the eighth 60 feet, and appears likely to continue much further to the west. The ore in this part of the mine shows a strong westerly pitch in the deposits from the surface down as far as the mine is opened, of about 70° with the horizon. The shoot of ore has an east and west length of 500 feet.

In the south deposit in this shaft they are working from the seventh to the eighth levels. The opening has been a length of 320 feet, and at the west end is 40 feet wide, and constantly growing wider. To the east it is narrowing, and is now only of a width of 5 feet. The north deposit varies in width in this level, from 28 feet to 40 feet.

Between the eighth and the ninth levels the winzes on either side of the shaft have been sunk, and they have commenced stoping.

In the ninth level a cross cut from the north into the south deposit, opened into ore which has been penetrated 22 feet, and the foot wall has not yet been reached. This deposit was not before known. A winze has also been sunk from the ninth level 40 feet. Another cross cut 63 feet in length to the south passed through two new deposits of ore, one of them 10 feet, and the other 7 feet wide. They have commenced working the 10 foot vein, which is a fine granular ore. This ninth level is 600 feet below the surface.

In the south lens, between the seventh and the eighth levels, occurs the union into the main lens of the several separate deposits, which have continued down from the surface, and which has heretofore been referred to. This chimney is 100 feet east of No. 3 shaft—a cylinder of ore nearly circular, 30 feet in diameter, that has come down from the surface.

Heretofore this lens as well as the others had to be mined separately, each with its cross cut and winzes. Now that these are all together, no cross cut is required, and it becomes a very important part of the Champion Mine.

In No. 4 shaft they are mining in the 6th level in the old south deposit. The ore is trammed through and hoisted from No. 4. The deposit has shortened up and narrowed, so that there is little expectation of getting any ore below the first level; but an immense deposit of ore lies under this shaft to the west that has been proved with a diamond drill. On the direction of the hole the ore measured 86 feet, and is estimated to be 43 feet at right angles to the walls. They are coming into it from No. 3, and it dips under No. 4.

A little east from No. 4, in the seventh level, a cross cut was driven to the south 8 feet, coming into a new deposit 12 feet wide.

No. 4 shaft lies south, behind No. 3; it starts from the south deposit and works over into the north.

No. 5 is sunk from the surface through a succession of small lenses, in a chloritic or a talcose schist. These pockets have increased in size below the fourth level; they are now at the sixth level, and will be down to the seventh during the summer.

In No. 7 pit a body of ore 14 feet thick has been discovered, with a diamond drill. The ore is 240 feet below the surface, and 100 feet under the bottom of the shaft.

In the way of improvement in surface plant a new boiler house has been built, supplied with two new 6-foot shell boilers. These boilers are now supplied with water from Michigamme Lake, one mile distant, and 190 feet below the mine. The water is brought to the mine in 6-inch wooden pipe, laid underground, through which it is forced by a 6-inch plunger pump, placed at the lake. It is found that the use of this water has made a saving in fuel of \$200 per week; heretofore the use of the water of the mine filled the boilers with dirt to such an extent as to render it difficult to create steam.

A stone building is erecting to hold a duplex Rand compressor, 20x48 inches, sufficient to operate thirty-two air drills.

The product for 1881 was 145,427 gross tons, and the aggregate to date is 967,088 tons.

The mine is about one mile southwest from Champion station, on the M., H. & O. Railroad, and 120 feet above it. The distance to Marquette by rail is thirty-two miles. The location is the S. $\frac{1}{2}$ Sec. 31, T. 48, R. 29.

The local management continues in the hands of Mr. A. Kidder, Agent, and Capt. John Pascoe, Superintendent.

THE MICHIGAMME MINE.—(JUNE, 1882).

The village of Michigamme shows signs of increased activity. Many repairs and improvements are being made which were greatly needed; also some new stores and houses are building, showing an increase of confidence and business. This revival is doubtless due to the large amount of exploring that is doing in this vicinity to the west of Lake Michigamme, stimulated by the

important success which has been met with in the instances recently cited, to wit: the Farm, Webster, etc.

At the Michigamme Mine, too, the owners have more reason to congratulate themselves upon increased evidences of prosperity than have been observable for some years. At both ends of the mine have important facts been elicited that tend greatly to enhance the prospects of the mine.

It will be remembered by those who are familiar with the mine, that at the west end of No. 4 pit, from the surface down, was a "header." All the levels in this pit terminated at this wall; the ore was cut square off.

Lately a diamond drill has been worked at this level, in the sixth level, 425 feet down from the surface, on the lay, and five holes have been bored from the same center, starting from the west and coming around to the north, forming a quadrant, of which the holes are the radii.

The first hole was to the west 125 feet, all in quartzite. They discovered then that they were in the hanging wall, which is of course quartzite. The direction was changed a little to the north, and a second hole bored, which passed through the quartzite and came into the soapstone, that in the vein lies between the quartzite and the ore; but as the extent of the drill was only 125 feet, they were obliged to pull out and start again, this time a little more to the north. This hole proved to be 100 feet in quartzite, ending in 142 feet No. 1 ore. No. 4 hole, still further to the north, made 100 feet of quartzite and 14½ feet No. 1 ore, and ended in No. 2 ore. No. 5 hole, at right angles to No. 1 and due north, proved the same as the two preceding ones. The ore found is identical with No. 4, showing that this, the most important pit of the mine, really continues west; that it is not pinched out or cut off, but simply thrown to the north. A drift is following No. 3 hole to reach this body of ore. This drift is already nearly through the quartzite, and in a few days will reach the deposit. The ore will be mined out and trammed to No. 4 shaft; though, ultimately, if the deposit proves extensive, it will be mined from No. 5 shaft and be reached, as now from No. 4, by cross cuts.

This discovery, if it turns out to be what seems probable it may, will greatly increase the production of the mine, adding a new and important pit.

At the east end, in the Barnum shaft, the ground has been, all the way down, very much broken up; no true walls. Instead of the quartzite hanging it has been mainly jasper, foot and hanging, and jasper in the vein, so that the ore has been in irregular pockets.

The pit down has been worked out a length of 120 feet, and to a sufficient width for the shaft; but at the bottom, 200 feet down, the vein has suddenly widened out, showing a floor of ore 12 feet wide and 25 feet long. The length has not been determined; 25 feet is the extent of the opening. It has the appearance of coming into more settled ground, and of opening into a deposit like No. 4. The ore is very similar to that of No. 4. Altogether, this pit, which has heretofore been a disappointment, has now a very encouraging look.

No. 2 pit, 600 feet east from No. 4, is looking well. The shaft is 200 feet down. This pit also has been troublesome from not having the true hanging wall; it is more settled now. The green rock, chloritic schist, has come in the right place. In all the levels, thus far opened, the vein for a distance of 50 feet west from the shaft runs narrow, when suddenly it makes a recess square off into the foot wall, of 10 feet deep and 32 feet long, when it comes back again and continues on west with its former width. The pit is 250 feet long east and west and is terminated at the east end by a bar of rock; this will be

tested with a diamond drill, as has been done in the west end of No. 4. The main stope is in the west end, where it is 40 feet high and 10 or 12 feet wide. In this end they have the regular hanging wall, quartzite with intervening soap rock between it and the ore; but as heretofore the main dependence of the mine is No. 4. Two lifts have been sunk within the year, one of 50 feet and one of 40 feet, and the skip road taken down to the bottom, making the depth of the shaft, on the lay of the formation, 60° dip, 520 feet. The ore is very clean, black, magnetic, and slate, specular ore. The vein is very uniform, having a width, from foot to hanging, of about 20 feet. The stoping is at present mainly in the seventh level. It is now the aim to have one level, all the time, ahead of the stoping. The method pursued is, after leaving the pillars to support the shaft, to drift along the hanging wall half the depth of the sink, 20 feet, and half the width of the vein, 10 feet, hoisting the ore to the cars on the track in the level above, in buckets, by means of a rope wound, with a small engine. They have three of these little puffers, which are as portable as a windlass and a hundred times more effective; they can be set in the mine wherever needed, and do the work of hoisting on stopes and in winzes most admirably. They are coming into use in many of the mines, and are found to be an important adjunct in the prosecution of underground mining work, entirely supplanting the laborious and old time windlass.

Arches are left as frequently as are needed, depending on the character of the hanging, and the track above, in making this first cut, is not disturbed. After the first drift, 20 feet by 10 feet, has been carried forward a sufficient distance, the remaining 10 feet of the vein to the foot wall is removed, and the track is supported on timbers laid from pillar to pillar. Subsequently the next lower half of the level is taken out in the same manner with the exception that instead of hoisting the ore to the track above, it is dropped to the bottom of the level below, and then trammed to the skip.

This sinking for stopes is carried on at several points at once, as they can be by the use of the little engine hoisters, and those different places are finally connected. This pit has a length east, of 260 feet, and west from the shaft of 250 feet, making its length upwards of 500 feet. It yields fully two-thirds of the product of the mine.

When the new discovery to the west is opened and its product added, and if Nos. 1 and 2 continue to improve and become, what they seem likely to do, well settled, productive pits, the Michigamme will have advanced its position into line with the first-class producing mines. A hole is now boring with the diamond drill across the formation under No. 6 shaft, to the west of the mine. It is on an angle of 55°, and is down 230 feet; is in quartzite, and will be continued until the ore is reached.

The officers and the local management remain as heretofore. Hon. W. H. Barnum, President, Lime Rock, Conn.; James Rood, Secretary and Treasurer, Chicago, Ill.; J. C. Fowle, Superintendent, Michigamme, Mich.; J. P. Christopher, Mining Captain.

The product of the mine for the year 1881 was 57,272 tons, and the aggregate product to date since 1873 is 443,274 tons.

THE SPURR MINE.—(JUNE, 1882).

The Spurr Mine seems to be doomed to misfortune. No mine was ever started with better prospects, and even now no one seems to have lost faith in the mine. After some years of idleness work at the mine was resumed by a

new company composed of Detroit gentlemen. The work of pumping out the water was begun May 12, 1881, and was completed in about three weeks' time.

Some new machinery was added, which included an Ingersoll, single compressor, 14x28 inches, and six air drills; new pumping machinery, consisting of 6-inch plunger pump, and one new boiler. An enlargement to the engine house was made, 12 foot extension; also a new ore dock 100 feet by 60 feet has been built, and the houses and other buildings have been put in repair. A large sump made in the mine, 28 feet by 12 feet, and 9 feet deep. In the mine a 60-foot level was sunk below the old workings, and fitted up and put into working order.

No. 2 shaft. This shaft is now down 300 feet, and they are sinking another lift, which will make the depth 340 feet. The level which was sunk has been worked out, but it is found that the vein has gone off into the hanging wall. They cross-cutted 15 feet and found it. They have commenced above to take down the wall so as to open a chamber into this lens. This new vein to the south is about 10 feet wide, and they are drifting along the hanging wall in it to learn somewhat of its extent. In this point, in the old level and in the new lens, to the south, they are working five air drills, but are not getting much ore. The stopes are limited; the work is mainly exploratory.

No. 2 is the only shaft in condition to use; the others have not been repaired. No. 1 shaft, if in order, could be used to advantage. They have drifted from No. 2 under No. 1, and could rise up to the shaft and thus work No. 1 pit, which is not as deep as No. 2 into 100 feet.

No. 1, by the old company, was thought to be worked out, but the drift below, from No. 2, is in ore, so that No. 1, if sunk deeper, would be a productive pit.

One would think that the company would put a diamond drill to work in the bottom of the mine and bore through the hanging and the foot wall, and thus learn if they have something or nothing. There is no so economical or expeditious a way of testing an iron mine in such a formation as at the Spurr, as with the diamond drill.

The situation is a very pleasant one. There is a large number of good houses and other buildings, and the machinery and other plant is adequate to a large working mine. There are four winding drums, 5 feet diameter, only one of which is used. The Spurr Mine is worth testing, and the diamond drill is the instrument to do it with.

The general office is in Detroit, Mich. H. C. Pulling, President; W. D. Wisson, Secretary and Treasurer; W. D. Davis, Local Agent; Edwin Richards, Mining Captain.

The description of the land owned by the company is the N. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$, and the S. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of Sec. 24, T. 48, R. 30.

The product for 1881 was 2,746 tons, and the aggregate to date is 146,612 tons.

THE IRON KING.

West of the Spurr Mine, on section 23, the Stewart, it was formerly called, but now designated as the Iron King. Some exploring work is doing with a diamond drill, and, it is claimed, with encouraging results.

THE MAGNETIC MINE.

At the Magnetic Mine, section 20, T. 47, R. 30, some systematic exploration

has been undertaken with the diamond drill, and is still being prosecuted; nothing of value has yet been discovered.

EAST CHAMPION MINE.—(JUNE, 1882).

The Keystone Mine, which began to be worked in 1872, and has since been worked off and on, generally idle a portion of each year, has recently come out under a new name and a new organization. It is now known as the East Champion Mine. About a year ago Messrs. Spear and Case began to explore the mine with a diamond drill, and after several months working the results were so far satisfactory that a company, under the title of the East Champion Iron Company, was formed. The incorporators were Messrs. A. Kidder, James Pascoe, J. R. Case, F. B. Spear, and R. P. Travers.

Mining work was only begun in May, 1882. Previous to this, through the winter, the work was only exploratory with the diamond drill, boring from the bottom of the mine in No. 3 shaft, which is the main shaft of the mine. The result was not encouraging; at least no great amount of ore was found in the holes from this shaft.

No. 3 pit has been pumped free of water, and the shaft repaired and put in order for hoisting. The pit is 250 feet deep, and dips to the south with a quartzite hanging wall and a jasper foot. The vein in this pit is about 7 feet wide and has been opened to a distance, in the lower level, of 40 or 50 feet. The ore is No. 1 specular, similar, or nearly identical with that of the Champion Mine. They have one stope 25 feet high and the width of the vein, and have just begun to mine and hoist ore, and have also begun to sink another level. No. 2 pit is 300 feet east from No. 3. This pit has also been unwatered, and is working. It is about 100 feet deep, underground, and they are working in the bottom, where it has been opened a distance of 60 feet; the vein is from 5 feet to 12 feet wide, black magnetic ore; from this pit they are now hoisting about 30 tons per day, but when No. 3 is in full working condition they expect to hoist from the two pits 60 tons daily. A force of about 60 men is employed.

The description of the land is the S. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ Sec. 32, T. 48, R. 29, joining the Champion Mine on the east, but about one-half mile south of the railroad station, and 100 feet above it. The station is distant by rail from Escanaba, 77 miles, and from L'Anse 35 miles; from Marquette, 29 miles.

The officers are: Frank B. Spear, President; S. Watkins, Secretary, Marquette; J. G. Reynolds, Treasurer; C. T. Hampton, Agent.

The product for 1881 was 3,408 tons, and the aggregate to date is 64,264 tons.

THE TAYLOR IRON COMPANY.

Further to the west, seven miles east of L'Anse, is the Taylor Mine. It is the only point where a deposit of ore has been worked in this range, so far to the north. The mine is near the center of the N. E. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Sec. 9, T. 49, R. 33. The location is 950 feet above Lake Superior; is high, dry ground, with ample slope for drainage. The ore at this mine is a soft hematite, similar to that obtained from the Mitchell, etc.

Analyses of the ore show a percentage of metallic iron from 55 % to 60 %, and about 2 $\frac{1}{2}$ % in silica and 0.15 % in phosphorus. The land is owned by the M., H. & O. R. R. Co., and is leased to this mining company, which company

was organized in 1880, holding a quarter of a section of land, the N. W. $\frac{1}{4}$ of Sec. 9. Mining work has since been pursued, resulting in an aggregate shipment of ore of 10,559 tons, 9,499 of which were the product of 1881.

The mining work is now underground. It was first undertaken in an open cut, but subsequently a vertical shaft was sunk 140 feet to the west, to a depth of 128 feet. From the bottom of this shaft a large chamber has been worked out, 115 feet east and west, and 58 feet north and south, in which the roof is supported by four large pillars.

At the west end are three drifts to the west, in each of which is a stope of ore. In the south drift the stope is about 12 feet high and the same width; in the others they are 10 feet. On the north side they have a small stope rising on the foot wall. In the bottom they are sinking for another stope. To the west, 50 feet from the mine, they are sinking a vertical shaft, which is down to a depth of 140 feet. From this shaft the mine will be worked to the west.

The company had this spring, in stock pile, 5,500 tons of ore. A small plant of hoisting machinery is now being supplied; two internal friction gear drums, 30-inch diameter.

The officers are; S. G. Mather, President; Samuel Mather, Secretary and Treasurer, Cleveland, Ohio; H. E. Warner, Agent; John Skoburg, Mining Captain.

THE CHESHIRE MINE.

The Cheshire Mine, formerly the Silas C. Smith Mine, is located in the S. E. $\frac{1}{4}$ of Sec. 18, T. 45, R. 25; was opened in 1872, and has yielded an aggregate of 87,179 tons of ore. The ore is a soft specular, and a soft, bronze colored, putty like ore, yielding about 60 % in metallic iron and about .04 % in phosphorus. A branch railroad five miles in length connects the mine with the Chicago & Northwestern road.

The mine has not afforded a very promising outlook of late, and is at present being worked to a very limited extent. The same parties owning the Cheshire having found a far more productive mine on an adjacent forty, have transferred their operations to this new location, now called the Swanzey.

THE SWANZEY.

This mine is situated on the S. W. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ Sec. 18, T. 45, R. 25. This mine is about 1,500 feet distant to the northwest from the old workings. It consists of an open pit 200 feet long, about 40 feet wide, all in ore. It is worked to a depth of 70 feet. In the west end of the pit is a fine stope of clean ore, 50 feet wide, and as the bottom is ore they can of course sink for new stope at will. The direction of the ore deposit is northwest, and the dip 60° northeast. The hanging wall, a so-called slate, and the foot wall a mixed ore and jasper. The estimated product for the year is 30,000 tons. The following is an analysis of the ore.:

| | |
|----------------------|-------|
| Oxide of iron..... | 95.28 |
| Alumina..... | 1.35 |
| Lime..... | .60 |
| Magnesia..... | .35 |
| Sulphur..... | .02 |
| Phosphoric acid..... | .31 |
| Silica..... | 2.06 |
| <hr/> | |
| Metallic iron..... | 66.70 |
| Phosphorus..... | 0.135 |

Showing it to be too high in phosphorus for the making of Bessemer steel, but rich in metallic iron. The phosphorus, however, varies greatly, some analyses being as low as .040. At present the hoisting is with drum and derrick, but a new plant of machinery will soon be provided. A side track from the C. & N. W. branch comes into the mine, and on it are the ore dock, pockets, etc., for conveniently transferring the ore.

Some renewed attention is to be given to the old mine; it is now being freed of water.

The President is Mr. J. J. Pierce, Sharpville, Pa.; Agent, J. F. Stevens, Negaunee, Mich.; Superintendent, A. P. Wood.

Product 1881, 7,562 tons.

MENOMINEE IRON RANGE—(JULY, 1882).

The first shipments of ore from this range by rail were made in 1877, and so rapid has been the development that the aggregate shipments in 1881 from the mines on this range amounted to 739,108 gross tons of ore,—certainly a most extraordinary result to be accomplished within the brief period of five years.

The ores obtained in this district are all hematite and soft specular, but generally of an excellent quality; and some of the largest mines, as the Chapin, Vulcan, etc., yield a product which is nearly as valuable as the best hard specular ores of Marquette county, being high in metallic iron and sufficiently low in phosphorus for the manufacture of Bessemer steel.

Some of the mines, among the largest producers, are south of the Michigan line, and are thus in the State of Wisconsin. The largest of the mines on the Menominee Range, outside the limits of the State, are the Commonwealth and the Florence. The best ores that have thus far been found are in Michigan.

Many discoveries have been recently made, and everywhere men are searching and exploring for ore. Several new iron districts are soon to be opened in a range lying north of the one through which the present railroad extends. Branch railroads are building to these localities, and at each considerable activity prevails. They are known as the Felch Mountain, the Iron River, and the Crystal Falls districts.

The Crystal Falls, or Paint River district, is the most largely developed of any of the new mining localities in the Menominee Range. It has been recently made accessible by the northwesterly extension of the railroad from Florence seventeen miles, and the work of building branches to the several mining locations in this vicinity is actively in progress. The railroad was completed in April last (1882), at the terminus (Sec. 21, T. 43, R. 32). The village of Crystal Falls has been surveyed and platted, and the building of houses, stores, etc., is pushed with all vigor, so that the plot is promising to attain, in a brief period, to a town of considerable size. Building has been greatly facilitated through the operation of a saw mill, with planer, etc., that has furnished the lumber. The mill is driven to the limit of its capacity and is scarcely able to keep up with the demand. In the region of Crystal Falls is a fine timber country,—maple, basswood, pine, fir, etc.,—not surpassed by any portion of the State. The pine, however, is the only timber now used in building. The ore thus far found in this vicinity is all low grade, 50 % to 58 % in metallic iron, and too high in phosphorus for steel-making purposes, and containing also a pretty large percentage of lime. The deposits are also, generally, far from affording clean ore. They are mixed rock and ore, and the product of the mines, to all appearances, as thus far developed, will need to be carefully sorted to obtain merchantable ore.

THE YOUNGSTOWN IRON MINING COMPANY.

The most important of the mines in this vicinity is found in the N. $\frac{1}{2}$ of the S. E. $\frac{1}{4}$ of Sec. 19, T. 43, R. 32, worked and held in lease by the Youngstown Iron Mining Company. The ore deposit runs east and west across the company's land, and has been sunk to in pits, which extend for half a mile. The mine openings are in a cedar swamp leading to the north, and to the east and west, but south the land rises in a long slope, which extends indefinitely east and west. The company holds also the adjoining lands on the east, to wit: the W. $\frac{1}{2}$ of S. W. $\frac{1}{4}$ of Sec. 20, also the S. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Sec. 20, making in all 200 acres.

A test was made with the diamond drill across the ore in the land on Sec. 19. The boring was made to the south at an angle of 45° with the horizon, the drill passing through 105 feet of ore, having started in ore, and 38 feet of rock. The drill was then turned to the north, made to penetrate at the same angle, and passed through 7 $\frac{1}{2}$ feet of the same ore and 150 feet of soft jasper, then 19 feet of ore terminating in bluish slate. The drill was worked from the same station in boring both holes. It will thus be seen that there are two deposits of ore separated by 100 feet of rock. The north body is a dark, rather brittle ore. The south deposit a much softer, brownish ore, wholly free from siliceous rock, but contains lime. The small stock pile, obtained from the new shaft, is all ore, but apparently not high in iron. In this deposit a large double shaft is now sinking, having attained a depth of 50 feet, and is timbered and lined up in good shape; the bottom is in ore, with no mixture of rock. Two other shafts are also going down, one to the east and one west; one of them, the west one, is now in ore. North of these shafts, on the north vein, the earth is being removed over a sufficient extent for a large pit, which will be worked openly. This stripping is about 10 feet in thickness; on the south vein it is much greater, and this mine will be worked underground. The railroad from Crystal Falls village has been graded to the mine. The iron is now being laid and the track ballasted, and in a few days from this date (July 1), the road will be ready for operation. A slope of one in a hundred has been given to the track, sufficient, it is deemed, to allow the cars to run down to the east. The empty cars will be backed up to the west end of the mine and left, by the locomotive, and then run down as required to the pockets and ore docks, and thence to the yard beyond, to the east, by the force of gravity alone. Sufficient exploration has been done to establish the fact that the company has here ore enough for making a large mine, but it is questionable if it is of a quality to be salable in dull times.

Up on the hill south of the mine the company has built a large boarding house, and other dwellings have been erected, or are in process of being constructed.

There is a good deal to be done to open a mine in the wilderness and get it into successful operation, but the company is at least fortunate in having the services of Mr. F. P. Mills in this difficult undertaking; a young man, energetic, clear headed, and experienced in the business, Mr. Mills has, for his age, few equals and no superiors among mining superintendents in the district. He is making everything tell, and is sure to have matters in good shape. The organization of the company was completed June 15, 1882. The officers are: John Stambaugh, President, Briar Hill, Ohio; J. V. Butler, Vice President; Henry Todd, Treasurer; Henry Stambaugh, Secretary; J. G. Butler,

General Manager: office, Youngstown, Ohio; F. P. Mills, Superintendent, Crystal Falls, Mich.

Butler Creek, a small stream a few rods north of the mine, will afford excellent water for the boilers.

THE CRYSTAL FALLS MINE.

This mine comprises Lot 3, Sec. 20, T. 43, R. 32, being about fifty-three acres of land, and being bounded along the northeast side by the Paint River.

The Paint River Falls, or Rapids, Crystal Falls they are called, make here, in the center of Sec. 20, in a distance along the stream of 800 feet, a descent of 17 feet. At the lower end of the rapids, on the right bank of the river, looking downward, is an outcrop of lean ore, noted by the United States surveyors. In this outcrop, near the bank of the stream, a shaft has been sunk to a depth of 94 feet, and is now being timbered and put into shape for hoisting. The vein, thus far, is narrow, scarcely wider than the shaft, but it is intended to push it down and to drift, hoping that the deposit will increase in dimensions. This shaft affords some extraordinary good ore; very heavy, fine specimens are found in the stock pile, but these are far above the average. There is also considerable rock, and the stock pile, consisting of about 1,500 tons, will have to be picked over carefully before shipping. The mine is about midway between the Youngstown, Sec. 19 mine, and Crystal Falls village. At this point the river is spanned by a common highway bridge, and a few rods above it a railroad bridge is being constructed to carry the track from the main branch, by means of a "wye," over the river to the Fairbanks, Paint River, and Great Western Mines. It is very doubtful if the work on this river shaft results in anything of much value. There is but a short stretch of ground between to the center of the stream, which is the boundary line, and the ore deposit, so far as it has any inclination, is in that direction. Southwest from the shaft, 500 or 600 feet distant, a diamond drill is at work boring to the south at an angle of 60° inclination, and came into ore at a depth of 182 feet. The drill has gone through 100 feet of ore, being still in it. The core is an ochreous, reddish, yellow hematite, of probably about 50 % of iron. It has not yet been analyzed. There is evidently a large body of it, and if it proves to be sufficiently valuable a mine will be opened. In the vicinity of this boring, between it and the river shaft, a number of dwellings has been built for the occupation of miners.

This mine, Lot 3, was lately purchased by the Crystal Falls and the Youngstown Iron Companies, and it is now owned and worked in common by these two companies. The price paid is given out as \$80,000, which seems to be a large sum considering the showing of ore; but it is said that a good deal of the value was based upon the water power at the rapids. The Paint River has a large volume of water, and the power at this point may be utilized to operate a large air compressing plant, sufficient for the hoisting, pumping, and air drill purposes of all the mines worked by the two companies, in this vicinity. The railroad has been completed west beyond the mine, and a switch and side track laid to the stock pile, so that the ore on hand will soon be sent away. The work is under the superintendence of Mr. F. P. Mills, and the other general officers of the company are: W. K. Fairbanks, President; J. H. Howe, Vice President; F. H. Head, Secretary and Treasurer.

The Crystal Falls Iron Mining Company also, in addition to the mine above described, owns and operates

THE FAIRBANKS MINE,

Which is situated on the west side of the S. W. $\frac{1}{4}$ of Sec. 21, T. 43, R. 32. The section line, north and south, cuts through the mine openings, half way from the section corner south on the Paint River, and the quarter post north. At this quarter post is the railroad grade, which connects with the main branch, half a mile west, and extends east half a mile, coming back west to the mines on a "wye." The railroad is made long and expensive, to avoid heavy grade, and the Northwestern Railway Company is certainly very liberal to undertake so large an expenditure, based upon so poor a showing of ore. The mine is simply an open cut 150 feet in length east and west, 40 feet in width, and 50 feet in depth. The vein is a mixed ore and rock, but little of the vein is clean ore, so far as yet opened. The stock pile, which consists of several thousand tons, will require careful picking over to secure from it merchantable ore. In quality it is an "off" ore, about 55 % iron, and high in phosphorus. The company is sinking at the west end of the cut to take out the bottom, and is also stripping at the east. It is claimed that the test pits to the east are bottomed in ore, showing the existence of a large body of it. If the ore were cleaner and of a little better quality the prospect would be extremely good. As it is, accepting the quality as a merchantable ore, the showing, for the amount of work done, is a hopeful one to the owners, and certainly affords a basis for a reasonable expectation of paying results.

There is a substantial engine house, north of the mine, occupied by two 3-foot drums, and two small engines, etc., operating the two hoisting derricks. To the south are the boarding house and dwellings.

The Superintendent of the Fairbanks Mine is Mr. J. H. Elmore, who resides at Crystal Falls. The immediate supervision of the mining work is under the direction of Capt. Morrison.

The Crystal Falls Company, in addition to these two mines, laid out the village, and also owns and operates the saw mill, etc.

THE PAINT RIVER MINE.

Adjoining the Fairbanks Mine on the west is the Paint River Mine. The property comprises the E. $\frac{1}{2}$ of the S. E. $\frac{1}{4}$ of Sec. 20, owned by Ed. Breitung, Esq., of Negaunee, but held under a lease and operated by the Paint River Iron Company. A portion of the mine is the west end of the Fairbanks open cut. The surface is being still further stripped to the west, preparatory to continuing the open cut mining in that direction. For a considerable distance to the west test pits have been sunk, and two shafts are sinking in the line of the deposit, both of which are now in ore. The ore is identical with that found in the Fairbanks. A hoisting plant is being set up, and there is every prospect that the company will soon be making a stock pile of ore. The work is in charge of Capt. C. Y. Roberts, formerly Superintendent of the McComber Mine at Negaunee. The other officers are Max Wineman, President, Chicago, Ill.; Joseph Austrian, Secretary and Treasurer, Chicago, Ill., who, with Messrs. Ed. Breitung, John McKenna and Dr. Bond, form the Board of Directors.

ANNUAL REPORT OF THE
THE GREAT WESTERN MINE.

East from the Fairbanks and Paint River Mines is a new location known as the Great Western Mine. The mine is in Sec. 21, T. 43, R. 32, the company holding on a lease the southeast quarter.

The company is sinking two shafts, which have as yet reached but little depth. From the west one a lean mixed ore is being hoisted, which is sorted over, and a stock pile has been begun. The east shaft is also down to the ore, and the miners claim that in this shaft it is cleaner and of better quality, but not enough has been done to justify the expression of an opinion regarding the prospects for a mine. The branch railroad that runs into the Fairbanks, etc., comes also to the Great Western.

The officers are: S. C. Hall, President; J. M. Case, Vice President; S. D. Hollister, Secretary; George Runkle, General Superintendent, Crystal Falls, Mich.

THE UNION MINE.

The mine having the largest stock pile of any of the new openings in this vicinity is the Sheldon and Schafer, situated about three miles southwest from Crystal Falls. The estate of R. Sheldon and Mr. J. F. Schafer own the land, and have leased it to the Union Iron and Steel Company, of Chicago, and the mine is now known as the Union Mine. The estate comprises the N. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$ of Sec. 31, T. 43, R. 32.

Mining work has been in progress here for about a year, and ore, estimated at 10,000 tons, has been taken out and put into stock pile awaiting the completion of the railroad for shipment. This ore is mixed with rock, and will require considerable sorting when transferred to the cars. It is claimed that it is lower in phosphorus than that obtained at the other mines in this neighborhood. The open cut, from which it has been taken, is about 150 feet in length, east and west, and 40 feet in width, and 50 feet in depth. The sides are vertical, but the dip is probably to the south at a steep angle. The foot wall side is a smooth, silicious schist, and the hanging similar, but more broken up and showing more jasper, into which the ore appears to extend, as a short drift into the hanging shows seams of ore and rock mixed up pretty freely. The bottom is ore, as are also the ends of the cut, but no part of it seems to be wholly free of rock. The hoisting is done with derricks and buckets worked with a steam engine. The railroad is graded to the mine nearly ready for the iron, from Crystal Falls Village. The work is prosecuted under the supervision of Capt. Bortle, and the company's agent is Mr. W. H. Waters.

THE MANHATTAN IRON COMPANY.

The Manhattan Iron Company is organized to work the N. E. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Sec. 13, T. 42, R. 33. The company holds the land under a lease from T. B. Brooks and S. L. Smith, and explorations are in progress to find a deposit of ore of sufficient magnitude to constitute a mine, the attempt being, apparently, instigated by the favorable results obtained at the adjoining location, the Mastodon.

The officers are: Ed. Breitung, President, Negaunee, Mich.; J. H. Outhwaite, Secretary and Treasurer.

THE MASTODON MINE.

As previously stated adjoining the above described location is the Mastodon Mine, comprising the S. E. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ of Sec. 13, T. 42, R. 33, held under a lease by the Mastodon Iron Company, which organization is now prosecuting the mining work, under the superintendence of Capt. Richard Pocklington.

The officers are: Ed. Breitung, President, Negaunee; Joseph Austrian, Secretary and Treasurer, Chicago, Ill. Mining work was begun in an outcrop that protruded above the surface of the surrounding swamp, and from this opening some 1,500 tons of ore have been taken out and put into stock pile. A short distance to the west a shaft is down 50 feet, and bottomed in ore, and a second shaft, 100 feet further to the west, is also sinking. The ore is, apparently, a very good quality of hematite, free of rocky mixture, and thus affords very favorable indications to stimulate further investigation. Some diamond drill work has been done with, it is stated, a favorable result.

The development of this new mining district has been greatly accelerated through the enterprise of the

CHICAGO AND NORTHWESTERN RAILWAY COMPANY,

Which company, with extraordinary liberality, considering the limited amount of exploring work that had been done, has extended its line to this region, and is building branches to all the mining locations.

The same may be stated regarding all the mines on the Menominee Range. The Northwestern Railway Company has never hesitated to secure to every new mine, as speedily as possible, a branch railroad, thus enabling these incipient enterprises to begin the shipment of ore almost with the advent of their mining operations, and thereby, through the sale of the product, securing the funds to open the mine.

Without the aid and co-operation of this great corporation the iron mines must of necessity have been slow of development, and the Menominee Iron Range, instead of its busy, thriving villages, the wonderful activity everywhere manifest, its numerous mines, now reaching, in 1882, an aggregate yearly output of, probably, 1,000,000 tons of ore, would have yet remained an unbroken wilderness.

The discoveries of iron ore which have been made in what is called the Iron River District seem likely to become the most important of any recently made known. This region is in T. 43, R. 35, in the vicinity of Iron River, being the same distance north as the Crystal Falls district, and three townships west. The main line of the Menominee division of the Chicago & Northwestern Railway is building northwesterly to this point, from what is called the Iron River Junction, the point where the railroad turns north to Crystal Falls. The distance is about fifteen miles. The Iron River runs southerly and empties into the Brulé. Two villages have been platted in the southeast corner of the township, situated upon the east bank of the river, about two miles apart, to be called, the one Iron River, and the other Stambaugh.

IRON RIVER MINE.

Of the mines which have been opened in this vicinity the one attracting the largest share of public attention, and which shows at the present time the

greatest amount of ore, is the Iron River Mine, controlled by Mr. John Stambaugh, the President of the company, who is also President of the Youngstown Iron Company. The Iron River Mining Company holds, under a lease, the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ of Sec. 36, and the E. $\frac{1}{2}$ of the N. E. $\frac{1}{4}$ of Sec. 35. The mine openings, which are in Sec. 36, show a very large body of ore, perhaps 100 feet and upwards in width, which has been traced for upwards of a mile in length. Sufficient work has been done on the location to establish the certainty of the existence of a large body of shipping ore on the property, and it may become one of the most considerable mines in the State. The ore is said to average about 60 % in metallic iron; to be free from lime and low in silica, but as yet showing too much phosphorus for Bessemer.

The officers of the company are: John Stambaugh, President, Youngstown, Ohio; George Boyce, Vice President; R. McCurdy, Secretary and Treasurer; J. P. Jones, General Agent, Florence, Mich.; James N. Porter, Superintendent, Iron River, Mich.

The mine openings are at a considerable elevation, affording great advantage in opening the mine, and for cheaply handling the ore.

THE NANAIMO MINE.

The Nanaimo Mine is in the W. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ of Sec. 26, T. 43, R. 35, being northwest from the Iron River Mine a distance of about two miles. The work done here has discovered the ore deposit in magnitude equal to that shown at the Iron River location, and the ore is entirely similar. The mine is on the west side of the river, and in comparatively wet ground. Preparations are rapidly being made for mining and shipping a large amount of ore as soon as the railroad shall be completed to the mine. The village of Iron Mountain, in the vicinity of this mine, is rapidly growing.

The officers are: John S. McDonald, President and Treasurer; John Spencer, Secretary. The work is under the supervision of Thomas Luxmore, Superintendent. The land is owned by D. C. McKinnon.

THE CHAPIN MINE.

The Chapin Mine is one of the wonders of this remarkable country. Its history affords no parallel. For a mine not yet three years old it has probably never had an equal among iron mines, anywhere in the world. Making its first shipment in 1880, of 34,556 tons, it increased in 1881 to 134,521 tons, and in 1882 its output will reach, it is estimated, 250,000 tons. Already to July 1st 100,000 tons have been shipped, and 40,000 tons yet remain in the stock pile, and they are mining and hoisting at the present time an average of 900 tons per day, and the entire product is a single grade,—uniform, first-class ore. A curious feature in the history of this mine is the fact that the owner, Mr. Chapin, of Niles, Mich., held only one ticket in the lottery; he possessed only this land, these forty-acre lots, and it has proved to be the prize. In 1872 Mr. Chapin wrote to me for information regarding this land; of the probability of its containing iron ore, etc.; all that could be said of it then was necessarily the merest conjecture. It was in the iron range, deeply covered with drift; few persons had ever been anywhere in the vicinity, and still fewer had ever seen this particular land. A year subsequently, in 1873, a good quality of red chalk ore was discovered by Mr. Hyde, on land near the Chapin, and thenceforward this locality was thought to have a value.

The land, comprising the S. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$ and the S. W. $\frac{1}{4}$ of the S. E. $\frac{1}{2}$ of Sec. 30, T. 40, R. 30, is leased to the

MENOMINEE MINING COMPANY,

Which organization opened and operates the mine, paying a royalty to the owner, per ton, for the ore mined. The company also holds adjacent lands to the west, extending for a mile or upwards. The mine begins near the northeast corner of the Chapin land, and runs northwesterly for a distance of half a mile, or across two of the forties, and the company is now beginning to open on the west forty, a shaft having been recently begun close to the west line, adjoining the Ludington Mine.

There are ten shafts in all, numbered from the east to the west. Seven of these are working shafts, or soon will be used in hoisting ore. They extend along the northwesterly slope of the hill, the surface rise from the west to the east end of the mine being about 100 feet. These shafts are all sunk to the bottom level,—to the second level, it is called, being to the same depth below datum. The shafts descend to the north at an angle of 70° to 85°. They were intended to be sunk against the foot wall, but the ore is so deeply covered with drift that this was not always accomplished, and the shafts, in several instances, are some distance away from the foot toward the hanging. The others, the three remaining shafts, are used for taking down timber into the mine, so that no interference is allowed in the hoisting.

All the shafts are large and very substantially lined up; in this respect no better ones are to be found anywhere in the country. They are provided with skip roads. Some of them are furnished with double skip tracks. The depth of the shafts at the east end is about 300 feet below the surface, and at the west end, owing to the descent in the surface of the ground, the depth is, to the same level, 200 feet. The shafts are worked from the two engine houses, in the west one of which are six. Lane hoisting drums, 5 feet each diameter, and in the east building there are three of these drums; also three 30-inch drums for operating the timber shafts. In addition, in the west engine house, is the electric light engine, 16x36 inches. The main engine is 24x48 inches, Milwaukee manufacture. In the east building are two Corliss engines, each 16x42 inches, and the company is now putting in two 16-inch plunger pumps. The machinery for these pumps is deemed of sufficient power for a depth of 1,000 to 1,500 feet. These pumps will be placed in the new west shaft.

The ore from the shafts, when hoisted from the mine, is run out on long, elevated tracks, at the extremity of each of which are the ore pockets, beneath which are the railroad side tracks. The ore is, of course, during the season of shipping, dumped into the pockets, and thence dropped directly into the cars, otherwise, in the winter, etc., it is dumped over the side of the trestle and lies in stock until wanted for shipment.

The elevated track on which the ore from the three east shafts is run out to the pockets, is 800 feet in length and 64 feet in height, at the west end. This trestle is laid with double track and is worked with wire rope—Frue's automatic elevated railway. The run is made out and back in three minutes, the car carrying two and a half tons of ore. The other tracks are shorter and of less height, and the tramming is done by hand.

A new No. 1 shaft at the east end of the mine has just reached the ore,—July 2d—having passed through 50 feet of drift and a few feet of cap rock.

The shaft has a slight inclination to the north, 85° from the horizontal; the ore found is the best—soft, blue specular, free from mixture.

Descending No. 3 shaft to the second level, a cross cut was made to the north, 50 feet in rock, coming to ore, through which they drifted 80 feet across. This cross cut is at the bottom, second level, 200 feet below the collar of the shaft, and 100 feet west from it. West from No. 3 shaft the ore deposit becomes of great width. The vein is split into a north and a south deposit. The latter is opened through the whole length of the mine, but the north vein has in this pit a drift across the ore 100 feet, without reaching the hanging wall. The south vein is here, and for a considerable distance to the west, about 15 feet wide, but attains, in No. 8, a width of 130 feet.

The ore is taken out in chambers, 20 feet wide, leaving pillars of ore between of the same width; as the ore and slaty walls are soft and slack, and become yielding and friable on exposure to the air, the pillars and walls of the vein are lagged up with cedar poles, or slabs from the mill. The lagging is supported by the upright posts, which are set in contact with the ore pillars or rock. These posts are placed 7 feet apart, and are 7 feet in length, made with a tennon at each end and set in a mortise in a mud sill, and capped with a mortised timber that reaches from pillar to pillar, and resting on four posts.

These successive "bents," seven feet apart, running lengthwise with the vein, reach from foot to hanging wall, and are set as soon as the ore is taken out to the height of the post. When one stage is thus made the top is covered with poles, usually the bodies of small cedar or fir trees split in halves, and a floor is thus made on which the men can stand, etc., for stopping out another similar lift, the ore being allowed to pass through suitable apertures to the bottom below. Another 7-foot rise having been made, posts are set and capped, coming exactly over those below, and so on in succession, one 7-foot staging above another until the level above is reached, when the final rows of topmost posts come under the sills, and posts of the preceding level. The ore, which is broken down, is all milled down to the bottom and thence trammed to the shafts.

The chambers or openings run each way, at right angles, 20 feet wide, across and lengthwise of the vein, so that each pillar stands in the center of an opening, 20 feet wide on all sides of it. The uprights are stayed from swaying or knuckling, by the lagging, which is crowded between the outward posts and the pillars and walls. These posts and cross timbers are fitted before going into the mine, and are lowered down in the timber shafts. Heretofore these timbers have been used in the "rough," and were framed by hand, but a mill has been recently erected on the location where the logs are now all squared by the saw, and machinery has also been erected in the same mill for framing the timbers and fitting them all to the pattern required; and this important part of the work has thus been greatly cheapened and expedited the timbering in the mine. Of the 500 men employed underground in this mine, about one-third of them are engaged in the work of timbering. The mine is very roomy, airy, and apparently secure and safe. A very large proportion of the ore is left, but it is expected that in time some of the pillars will be removed, when the necessity for their presence is passed.

The shafts are sunk to the third level a depth of 100 feet below the present bottom, but the lower level has not yet been, to any considerable extent, otherwise opened; it will be attacked to furnish the next year's product, when a fourth level will be sunk.

In No. 6 shaft they have begun to drift in this lower level. The hanging wall is a dark colored schist, very similar in appearance to the ore, it being frequently difficult to distinguish the wall from the ore, by the eye; the weight and feel serve at once to designate them. After being exposed this north wall shells off and crumbles up into black dirt; it also contains some thin layers of quartz. The foot wall is similar in character to the hanging, a black slate, sometimes chloritic schist, becoming jaspery in places, but it shells off on exposure, and is lagged up to keep it in place.

No. 7 shaft was sunk off the foot wall, coming down nearer the hanging, so that the chambers are opened to the south, toward the foot; near it is a timber shaft. To the west of No. 7 the vein is 100 feet in width, widening in direction of No. 8, where it increases to 130 feet, and continues of like dimensions for 200 feet, as far as it has been proved by cross cuts, to the west.

No. 9 is a new shaft sunk vertically; it is double, and will be worked with a double cage, or one of the compartments will be used for a pump-rod and pipe. It is nearly completed, and they will soon be hoisting ore in it from the second or working level. The shaft is also to the third level, 100 feet lower down. From the top of the shaft is a new elevated track to the new ore pockets.

From the collar of No. 10 shaft to the second level is 90 feet, and an additional downward extension has been thus far made, of 50 feet. A drift extends west from it 130 feet along the foot wall. In sinking the shaft, etc., the ore is trammed along the first level, and hoisted in old No. 8. Ultimately the ore hoisted from Nos. 8, 9, and 10 will reach the pockets on the new elevated tramway. No. 10 is also a new shaft and is made double. From No. 9 shaft, west along the foot wall, are 8 or 10 feet of red ore, succeeded by the blue, soft specular. There is considerable of this rich ore in other parts of the mine, but no separation is made. While slightly inferior to the blue, it all goes together as one grade.

The bottom or third level, to which the shafts have been sunk, has not been crossed with drifts, but there is every probability that the deposit is of an equal width with what it is found to be where now worked. It is a wonderful deposit; of such an enormous width for so great length, and all of it such excellent ore, averaging 63 % in metallic iron and 5-100 % in phosphorus, admitting of the use of the entire product for Bessemer steel. The mine is all underground; no portion of it was ever worked in open pits.

It is expected that ultimately the power for operating all the machinery will be supplied by compressed air, the compressing plant to be placed at the upper Quinnesec Falls, on the Menominee River. The Menominee has a large volume of water, and at the falls a head of 40 feet may be used. The project is entirely feasible, and steps have already been taken to carry it into execution. A canal or race will be cut around the falls of sufficient depth to secure the ingress of the water, and long enough to give all the head desired. The compressed air will be brought in a 24-inch pipe, two miles, to the location.

All the important rivers in this portion of the Peninsula,—the Menominee, Sturgeon, Brulé, Paint, etc.,—afford many good water powers, which in time will be utilized in mining work, and probably in other manufacturing industries. The whole country is covered with valuable timber, pine, cedar, poplar, birdseye, lynn, birch, etc. The trees have grown to a height and size and have a thriftiness, surpassed in no portion of the State. Certainly these

forests of timber and these water powers in proximity form the basis of a variety of manufacturing industries, capable of an indefinite expansion. But I have wandered from the Chapin Mine. No matter, perhaps; it is a good thing to radiate from and to come back to. The mine is so large, and so rich and so young, that it becomes an agreeable subject to contemplate, and for the imagination to dwell upon. The pleasant village of Iron Mountain, which is the name of the station of the Northwestern Railway, and adjoins the mine, is in a very thriving condition, and gives promise of growing into a large and important town. It derives its name from the elevated outcrop of lean ore, situated to the south of the Chapin, which was known to the early explorers in this country, and became designated as Iron Mountain.

The water for the boilers at the mine is pumped from a small brook, which runs through the swamp below the bluff, across the location; a double Ringold's pump is used.

The lease of the land is owned and the mine is operated by the Menominee Iron Mining Company, whose general office is in Milwaukee. The local mine officers are: Mr. A. C. Brown, Agent; Capt. C. B. Rundle, Superintendent; Wm. M. Oliver, Mining Captain.

THE LUDINGTON MINE.

Next west from the Chapin is the Ludington Mine. The old mine further to the west became exhausted of ore, and the company has been at work for some time, making borings with the diamond drill to find the continuation of the Chapin vein on the Ludington land. These explorations were without avail until about February last, when the much coveted deposit was finally reached, somewhat to the north of the line in which the borings had been principally made and in the direction in which the deposit was supposed to continue. It is shown by these explorations that the ore deposit, in passing from the Chapin land into the Ludington, curves sharply to the north, making a hook. It curves to the north and dips to the north.

The new mine is very near the west line of the Chapin Mine. Mining work was begun in April last (1882) and the present outlook is exceedingly favorable. They are now mining in two open pits, and are sinking a shaft, which is also in ore. The ore is the soft, blue specular, identical with the Chapin.

The west pit is about 50 feet in diameter and 40 feet in depth. The south side is mainly rock, but the bottom and west side are of ore, as is also the north wall. Into the latter a cross cut has been driven to the hanging wall, and there is thus shown to be an apparent width of ore of 80 feet. In the east end of the pit a horse of rock protrudes from the foot wall north, partially separating this from the east pit, which latter is longer and narrower than the other, and shows a much less width of ore. There is, however, 15 or 20 feet of ore in the bottom.

The shaft, still east from No. 2 pit, is 100 feet in depth, and from the bottom they are drifting west to come under the pit, and are also drifting east and cross cutting.

In the No. 2 pit they have the hanging wall in the north side, or what appears to be such, and on the south side the rock interposes to separate the ore from its occurrence 10 feet further south. It appears as an island of rock in the midst of the ore, as the ore seems on the surface when the dirt has been removed, to make around it on all sides.

The overlying drift is 8 to 10 feet thick, and has been stripped away for some distance south and west. From the shaft to the west end of the mine they have opened the ore a distance of 500 feet. They are now taking from the mine and loading 60 cars in 24 hours, 7 tons to a car. The Northwestern track comes in east of the shaft.

The machinery comprises three five-foot drums, Rochester, and two boilers. These drums are operated by small engines placed on the same frame with the drum and on either side of it. The cylinders are 10x14 inches. There is also a machine and blacksmith shop, etc. The company employs 150 men.

The mine is owned by the Lumbermen's Mining Company. The property is S. $\frac{1}{2}$ of the S. E. $\frac{1}{4}$, Sec. 25, T. 40, R. 31.

It is under the local management of Geo. E. Stockbridge, Agent. Capt. Wm. Bice, Mining Captain, Iron Mountain, Mich.

The product of the old mine in 1881 was 3,374 tons, and the total shipments to close of 1881 are 12,250 tons.

THE EMMETT MINING COMPANY.

The Emmett Mining Company is boring with a diamond drill a few feet from the Ludington line to the north. They are going down with a vertical hole, which has already, July 8th, reached a depth of 500 feet. It is expected, as the ore deposit dips to the north, to reach it at a depth of 700 to 900 feet. This hole is in the S. W. corner of Sec. 30, T. 40, R. 30.

THE HEWITT MINE.

The Hewitt Mine lies south of the Chapin. It was opened close to the Chapin south line, and as the ore dips to the north the mine was soon worked out and exhausted, the ore having passed to the Chapin side of the line, *i. e.* crossing the south line of Sec. 30, the Hewitt being in the N. W. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$ of Sec. 31, T. 40, R. 30.

The mine has two shafts, 100 feet apart, but the ore is entirely worked out. A cross cut has been run to the south 200 feet, and has intercepted a vein, 18 feet wide, of fine blue ore, from which they are now mining. The ore is trammed out through the cross cut, and hoisted from the shaft, and reaches the cars from the pockets that are connected with the shafts by a long, elevated tram-way. In this new south vein they are sinking from the surface.

The agent of the company is Mr. C. H. Jones, Menominee, Mich. The mine produced in 1881 4,352 tons.

THE QUINNESEC MINE.

The Quinnesec Mine is narrowing up rapidly. The land comprises the S. E. $\frac{1}{4}$ of Sec. 34, T. 40, R. 30, and the mine is situated upon the hill, a little way from the pleasant village of Quinnesec to the northwest. The elevation is about 120 feet above the railroad at the Northwestern depot. The strike of the vein is east and west, and the dip is to the north at an angle of about 70°. The pitch of the ore is to the west. The rock comes in in the bottom, more and more from the east, greatly shortening the extent of the ore deposit in that direction with each successive level.

The mine is wholly underground and has reached to a considerable depth.

There are four shafts in all, but No. 4, the most westerly one, is 300 feet distant from No. 3 and sunk in higher ground, 70 feet above the others.

Descending No. 3 shaft to the third level, 160 feet below the surface, we find the vein worked out to the west 100 feet from the shaft, where a horse of rock comes in, through which a drift has been run 100 feet, and a rising cross cut to the north, 20 feet in length, comes again into ore, a lens lying north of the ore entered by the shaft. It is about 18 feet wide and has been opened east and west, 100 feet. They are not yet to the hanging wall. The ore is hard hematite mixed with rock, and requires a good deal of picking over. This level to the west is extended to connect with the bottom of No. 4 shaft. In this direction, west from No. 3, the formation has been thrown to the north 50 feet. A cross cut connects the two portions of the vein. The opening recently made to the west from the rising cross cut is in this same throw. A cross cut 40 feet into the hanging wall comes to hard, fine-grained limestone.

Descending to the 4th level we find it to be nearly all mined out. Nothing is left but the pillars, which are also being removed and replaced by timbers and loose rock.

In the 5th level they are stoping west from the shaft (No. 3) and have a winze sunk to the 6th level. They have drifted west in the vein 50 feet, and to the east, between No. 2 and No. 3, they have also a stope in this level, 20 feet wide if we include a jaspery portion along the hanging.

In the 6th level, 50 feet west from the shaft, a few men are at work in the vein stoping and picking out the ore. I observed at a car that two men were shoveling into it and two others stood by picking out the rock.

Further to the west is a cross cut to the north, which is in now 80 feet. They are hoping to strike the vein, which, as seen in the level above, has been thrown to the north.

Going down a winze on the west side of No. 3 shaft brings us to the 7th level, and the shaft is on its way to the 8th level, 450 feet below the surface. To the west of the shaft in this level they are drifting in mixed rock and ore.

To the east to No. 2 shaft the ground is standing almost entire up to the 6th level, and having some ground yet remaining in the 5th. The drift goes to No. 1 shaft. This is the best portion of the mine. The ore is cleaner, less mixed with rock. The vein is 14 feet to 20 feet in width, and pretty uniformly good. They are stoping in this level between No. 2 and No. 3 and between No. 2 and No. 1. No. 2 shaft is sunk to the 8th level, and east of it in the 7th level is a fine stope 18 feet wide, of very clean, blue ore, becoming of a reddish hue along the foot wall. Further east, near No. 1 but west of it, is a wide stope at the end of a large chamber, which is lighted with a Brush electric light.

Between No. 1 and No. 2 in the upper levels has been a fine deposit of ore, but it is worked out, and at the depth now reached the vein has narrowed up considerably.

Added to this there is no ore found at present east of No. 1 shaft, and the pitch of the lens has already carried it west of the shaft, so that No. 1 is likely, ere long, to become useless. The ore will have passed to No. 2.

The length of the mine is now about 500 feet, but there is not that amount of good ground. The main part of the mine is between No. 1 and No. 3, a length of about 250 feet. The ore vein is a mixed deposit, a sort of a conglomerate, widening out to 50 feet in places, but generally at the present depth having a width of from 10 to 18 feet, and affording clean ore only in portions

of it. The general dip is 70° north and the hanging wall a chloritic schist. The foot wall is somewhat similar, but becoming a friable, silicious black slate.

The ore is also varied. It is made up of a fine, soft specular blue ore, red hematite, and hard blue ore, all of good quality, high in metallic iron and fairly low in phosphorus—one of the best ores obtained on the "range."

In No. 4 they are mainly "scramming" west from the ragged open pit that lies between No. 3 and No. 4 shafts. There is an underground drift extending west from this open pit, in which some men are at work, but nothing new of importance has been developed. In the pit the ore has been worked out. It was heavily capped over with a coarse conglomeritic sandstone, horizontally bedded, and from 15 to 30 feet in thickness. It constitutes largely the elevation of the surface west from this pit.

From the shafts a gravity incline extends to the west with a descent of 75 feet and a length of 500 feet, down which the ore is run in the cars and out on the elevated track to the ore dock or pockets by the railroad.

About 1,000 feet to the north, they are boring with a diamond drill; are only in 50 feet.

In the engine house are four drums, five feet diameter, which operate all the shafts. Also in the pumping engine house, near No. 3 shaft, are four small drums for lowering timber, sinking winzes, etc. No power drills are used. The number of men employed is about 175.

The officers are Wm. R. Babcock, General Manager; Capt. Elisha Morcom, Superintendent; Capt. John Bodilly, Mining Captain.

The mine formerly belonged to the Menominee Mining Company, but has been sold, and on the first of July passed into the possession of the Cambria Iron Company of Johnstown, Pa. The Cambria also purchased of the Menominee Mining Company, besides the Quinnesec Mine, the Vulcan, the Cyclops, and the Norway Mines. Recently a new company has been formed, under the general mining laws of Michigan, to operate these mines. This new organization is designated as the Penn Iron Mining Company, with general office in Johnstown, Pa, and the Michigan office in Vulcan,—Powell Stackhouse, President; Wm. R. Babcock, General Manager; Wm. S. Robinson, Secretary and Treasurer.

The product of the Quinnesec Mine for the year 1881 was 43,711 tons, and the mine has yielded in the aggregate 164,662 tons.

THE INDIANA MINE.

The Indiana Mine is in the N. E. $\frac{1}{4}$ of Sec. 27, T. 40, R. 30. The main openings are near the east line of the property, near the northwest corner of Lake Fumeè, at the base of the hill, which rises to the north from the low land surrounding the lake. Here are two shafts and a number of test pits. The main shafts are about 100 feet apart east and west. The west one is now intended as a timber shaft and is worked with a derrick. The east shaft is furnished with a skip road, and the shaft house has an ore pocket on each side of it so that the skip may dump its load of ore directly into these pockets, and thence the ore will be discharged into the cars on the railroad track beneath. The engine house is situated a short distance to the north, and between it and the shaft is the stock pile. There are about 2,000 tons of ore in stock, soft specular blue ore, but it is somewhat mixed with rock.

The shaft is 75 feet in depth below the collar, at the surface of the swamp. The hanging and foot walls have not been satisfactorily determined, and too little has been done to ascertain how wide a deposit of ore has been entered. Enough is indicated, however, to insure a fair prospect for a successful mine.

A diamond drill boring was attempted a few hundred feet west, but only penetrated 150 feet, it being found too difficult to proceed. The hole would cave in and fill up as fast as it was bored. They are now operating the drill at a considerable distance to the south, west from the lake, but slight progress has as yet been made; the work having but recently been begun, and the ground being very wet and the rock deeply covered with drift, it is somewhat difficult to get to the ledge.

Some of the trial pits which were sunk east from the shaft are said to have reached the ore, but they are at present filled with water.

A branch from the Northwestern railway is nearly graded in to the mine. It starts from the main line east from Quinnesec and makes a circuit around the south and west sides of Lake Fumè, reaching the mine from the west, and will, if necessary, be extended to the Illinois mine.

The mining work is under the supervision of John Swartz, Mining Captain.

THE ILLINOIS IRON COMPANY.

The Illinois Iron Company's property lies adjacent to the Indiana Mine on the east, being the N. W. $\frac{1}{4}$ of Sec. 26, T. 40, R. 30. Some exploring work was formerly done here by an organization styled the Scandia. The lease was recently purchased by the parties representing the Illinois, and the latter company organized.

The present work is embraced in two shafts, the west one of which is down 91 feet below the surface; at the bottom of this vertical shaft a drift extends to the south 80 feet. The drift is in a brown, lean ore and rock. The shaft is near the line between the properties, and is called the Union Shaft. Three hundred feet further east is another vertical shaft, down to a depth of 94 feet, and from the bottom has a short drift to the south. Judging from the rock that has been hoisted no clean ore has been reached in this shaft. Work in it has for the present been discontinued, through the failure of the steam boiler. A new boiler, however, has been secured, and the work of extending the cross cut from the bottom of the shaft will be resumed.

The Superintendent of the operations is Capt. John Traverse, and a force of 11 men is now worked.

THE CORNELL MINE.

Northwest from the Indiana, in Sec. 20, E. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$, is the Cornell Mine. This location is on the rising ground to the north, and overlooking Lake Antoine, a beautiful sheet of water, along the pleasant margin of which runs the road leading from the mine to Quinnesec. The mine is idle and has remained so for some time. The ore deposit, which was worked, was exhausted, and no new ones were discovered; perhaps too little effort was made. The discovery of ore here was only made in 1879, and it is barely reasonable to conclude that the one deposit was all that exists. The strike of the formation is N. 55° W., and the dip 70° to the southwest. Capt. John Wood, the Superintendent, resides upon the property, but is about to remove to the St. Lawrence Mine. It is stated that it is the intention of the Cornell

owners to employ a diamond drill in exploring the location. The mine has produced, during the years it was worked: 1880, 30,856 tons; 1881, 11,816 tons.

THE KEEL RIDGE MINE.

The Keel Ridge Mine is owned by the Emmett Mining Company, and the estate comprises the S. $\frac{1}{2}$ of Sec. 32, T. 40, R. 30. The mine is situated upon the side hill facing the south, at a distance of about a third of a mile north from the main branch of the Northwestern Railway. The mine being in elevated ground affords excellent drainage, and also facilities for disposing of the rock and handling the ore to advantage.

Only one shaft is now worked, which is down to the 280-foot level, though they are now stopping in the 220-foot level. In this level the vein is from 15 feet to 30 feet wide, and is opened by a drift to the east from the shaft, a distance of 116 feet, and to the west 90 feet. The drift, each way, terminates in rock; the level above, 180 feet, was longer; the mine has shortened at both ends with each successive lift; formerly three shafts were worked. The one now operated is No. 2.

At the surface the vein was separated into two parts by a wedge of rock; the two portions unite further down and are now one vein. The ore in the south vein, or south part of the vein, is high in phosphorus, and is kept separate from the north vein ore, which is Bessemer. The strike of the vein is N. 75° W., and the dip is nearly vertical. The location is about midway between Iron Mountain and Quinnesec.

The mine produced in 1880, 11,445 tons, and in 1881, 19,011 tons. The estimated product for 1882 is 30,000 tons. The company employs 110 men. The local officers are: J. T. Jones, Agent; John Wicks, Mining Captain.

THE CYCLOPS.

The Cyclops is one of the mines recently purchased from the Menominee Iron Company, and now controlled by the Penn Iron Mining Company. Its appearance has very much improved of late, and from being what, by some, was regarded as an exhausted mine, it promises to again become a valuable property.

Work has recently been resumed in the Curran, or No. 2 pit, the most westerly one adjoining the Norway, with the best results. This pit had been abandoned by the former company, as it appears, just as the main body of the ore was reached. Captain Oliver has opened a tunnel, driven from the south, beneath the highway, on a level with the bottom of the pit, and cut away the timbers, the lower ends of which were planted in the ore and supported the overhanging sandrock, in the north wall of the pit, and driven on north 60 feet in ore. The open pit has been widened and extended, the rock cleaned away, and there is now exposed a face of ore, underlying the sandstone, of a width of 40 feet, east and west, and of a height of 15 feet, and the drift to the north is in 20 feet, and is still in clean ore; the bottom of the pit is all ore, so that they have thus far a width of this deposit of 40 feet, and a further extent to the north, as yet undetermined. The length of the deposit east and west is not yet known. It is a soft, blue ore, unmixed with rock, and is being very cheaply mined. The rock and ore are loaded into tram cars and run out through the tunnel to the rock dump and to the ore

cars. The overlying sandstone is a horizontally bedded conglomeritic rock, with pieces and bunches of ore scattered through it.

In No. 1 pit, west of the Curran pit, they have sunk a shaft 80 feet below the old bottom, and drifted to the east 100 feet. They now have a vein of blue ore 10 feet wide, in this drift, and are following it east. To the west is the same level; they have drifted 75 feet, and then branched off to the north, the drift to the west being also extended. No good ore has been found in either branch. It is decided to continue this north drift across the formation for several hundred feet, and if anything of value is found a shaft will be sunk to the ore.

Looking into the east end of No. 1 pit we see, near the lower line of the sandstone, horizontal seams of ore interspersed in the sand rock, succeeding and running into each other. The bottom of No. 1 open pit is rock, so that the underlying deposit in which the east drift is extending is a distinct vein.

Going to No. 4 and descending to the bottom we find a drift to the west in a mixed ore, and rock that is of no value; but a short drift to the north cuts a 5-foot vein of clean ore, in which they have drifted west 80 feet, and the ore still continues. At the west end they have "raised" in the ore 30 feet, and in this also it proves equally good. Going east from the cross cut the vein does not prove as good. It is mixed with rock.

No. 5 pit, which is at the head of the incline, has an ore vein 10 feet wide, in which they are now mining. A double track gravity incline railway runs from this shaft down to the level below. The mine is operated almost as a part of the Norway. The same Superintendent and Mining Captain looks after both mines.

The mine made its first shipments in 1878, 6,275 tons; in 1879 it yielded 46,472 tons; in 1880, 14,368 tons; in 1881, 12,644 tons.

THE NORWAY MINE.

The Norway Mine is the largest of the mines included in the recent purchases by the Cambria, of the Menominee Company. Heretofore it has been the largest producer of ore of any mine in the Range, and will only now, in the present year, be surpassed in the product, by the Chapin. The yield of the mine in 1881 was 137,077 tons, and the total for previous years was 279,288 tons. The mine is looking well, and there will be no difficulty in making the output, the present year at least, equal to that of the last. The formation is very much broken up and irregular, and the ore "makes" in pockets, but the pockets or lenses are large and seemingly persistent, or if the ore gives out in one place it reappears in equal magnitude in another level. And while it requires somewhat persistent searching to find it, there is no cause for alarm. The effort to find the ore is generally rewarded with success.

The mine openings are along the brow of the hill which slopes to the south to the swamp below the village of Norway. The length of the mine east and west from the Oliver shaft, the most westerly one east to the Perkins line, is 1,800 feet. In this distance there are nine working shafts, the deepest being at No. 1, the east end of the mine, where they have opened below the surface 250 feet; thence to the west the depth of the mine varies, being generally less than 100 feet; No. 2 is 240 feet; No. 3, 193 feet; No. 4, 190 feet; No. 5, 188 feet; No. 6, 188 feet; No. 7, 93 feet; No. 8, 95 feet.

There are four levels, but the eastern part of the mine is the only portion

that is down to the third and fourth levels. The third level is opened from the east end west 400 feet, mainly in drifts. The fourth level is in rambling drifts, the main one making a complete circle of about 150 feet in diameter, and 10 feet to 20 feet wide. It is entered in No. 1 and No. 2 shafts. The dip of the formation is south, and the strike northwest and southeast. Nos. 3, 4, 5, 6, 7, 8, 9 shafts are to the second level, and this comprises 1,400 feet of surface length of the mine. In all of these some work is being done. The great deposit that extended from No. 4 west 900 feet is worked out, and below the mine is a multitude of drifts and pockets opened in every direction, and in every position and shape.

Going to the west end of the mine we enter No. 8 pit; the Oliver shaft, further west, has not much depth, and has no ore; it will be further opened and proved, ultimately, by drifting under it from the east. In No. 8 is, apparently, to be seen a large body of ore, perhaps the largest which the mine affords. The bottom is 90 feet below the surface and is ore; the west end is a breast of ore, 30 feet wide on the bottom, 50 feet on top, and extending upward nearly to the surface, with the exception of the chamber opened above, to the west. Climbing up the stope 20 feet we enter this chamber, 50 feet wide and 100 feet long, having its roof, bottom, and south sides of ore. Following a drift to the northwest 100 feet, and then turning south 40 feet, we come into a chamber which is being opened in the same deposit. The ore here is 70 feet in width, but to the west end a horse of rock comes in across the vein. This has been broken through and a short distance beyond. No. 9 shaft is coming down and will soon be ready to work this end of the mine. A drift has been started in the ore towards the Oliver shaft, which is 300 feet west. The company has here, in No. 8 pit, an assured product, and a large one. This body of ore has a width of 50 feet and a length of 200 feet. This lens of ore, like all the others in the mine, in fact, similar to the ore in all the mines in this section of the range, inclines to the southwest; that is, the formation dips to the south and the ore pitches to the west.

The ore in the bottom of No. 8 open pit is mined from the west end, and shoveled into cars, in which is trammed to the shaft.

No. 7, next east from No. 8, is a long, open pit that is only worked by scammers; they sunk in the bottom 40 feet, and drifted south without finding any ore.

Next east is No. 6; here they supposed that they had a wide bottom of ore, but in testing it, it was found to be rock covered with a foot or two of ore. The foot wall had suddenly flattened and reached out, horizontally, 800 feet to the south. They are now working south of the old bottom and following the ore in a drift under the hanging wall; but 70 feet below this drift two others have been driven to the south and southwest, and neither reached good ore, but in both a considerable stream of water was "cut." The ore from No. 6 comes from the upper, open level. In No. 5, going south from the shaft, they have a breast of ore on the south side, 40 feet wide and carried 25 feet high. A drift to the southwest, from this pit, 40 feet long, loses the ore; it comes in south of those from No. 6. To the southeast the drift is in ore. On this side the width of ore, as shown by the drifts, is 125 feet, and could soon be made available for a stope. The bottom and back are ore. It is a new pit, and a very promising one for present working, as well as for future product.

No. 5 is divided into two pits by intervening rock. Going into the east part through the aperture in the wall that divides them, in the second level, we find

a long drift 200 feet to the southeasterly, mainly in ore; the drift turns more to the east and continues 40 feet, to meet a drift from No. 3. Here also is a large body of ore that has thus been crossed for a distance of 200 feet. Near the wall in both pits they are mining out ore, and hoisting it from No. 5 shaft. Passing east up over a stope and through an aperture we come into No. 4, into a chamber of good ore, with a considerable quantity lying broken in the pit. Going east through a drift in ore 50 feet, which is succeeded by rock, and continues in it east 200 feet, it turns south and extends 100 feet, and will be continued to meet a drift from No. 5, making a complete circle. These drifts are made to explore the ground. Passing east we come finally into No. 3 open pit, and continuing we enter the large chamber down through which extends No. 3 shaft. Descending this to the third level, we find an opening to the west 170 feet long and 30 feet wide; below this floor, 70 feet down, and 175 feet west from the shaft, is a drift in ore. This would indicate that they have, at least, a body of ore 30 feet wide on top, 70 feet deep, and 175 feet long; 60 feet west of the shaft is a winze sunk to the fourth level, and stoping has just begun in this level.

Going east from No. 3 shaft in the third level, and turning north, we come into a large north vein running east and west. A drift is extending to the north to come under No. 3 open pit, to reach the ore that lies in that bottom.

Going west we descend to the fourth level, the bottom of the mine, coming into a chamber with ore on all sides, the meeting place of two veins,—the Stephenson, and the so-called B. B. vein, of Norway. The Bessemer and the non-Bessemer are producing deposits. A drift south 50 feet, in ore, intersects an east and west drift also in ore.

To the east 40 feet brings us to No. 1 shaft. This is all new opening, but recently penetrated, and is very encouraging, though it is not fully explored.

East 100 feet from No. 1 is No. 2, which will not be sunk any further as the ore pitches to No. 3. It furnishes but little ore. South from No. 1, through 75 feet of dead ground, brought them to ore in which they are driving, being in 20 feet. The ore from this drift, and from one other small stope is all that goes to No. 2 shaft.

Going up to the third level and around into No. 1 pit we come into what has, until recently, been one of the most productive portions of the mine; but it is getting to the end, and will be replaced by the same shoot now opened in the fourth level, previously described.

Going through the Norway one is convinced that the mine has an abundance of ore. There is nothing regular or certain about the deposits; they work out or are cut out by the foot wall or protruding horses of rock. A large amount of drifting is done, as of necessity there must be, if the product is kept up. These drifts ramify in all directions, and are mainly satisfactory in results.

Capt. Oliver evidently comprehends the situation, and strives to keep the mine well opened ahead, so that he may calculate on his product and know where it is coming from. Comparatively but little timber is used in the Norway Mine. The rock and the ore deposits are tolerably firm, and thus far the necessity for the use of timber has been avoided. Perhaps no mine on the range mines its ore more cheaply than the Norway. The facilities for handling ore are excellent. The railroad track has a descent sufficient to run the cars down to the ore pockets or docks, and thence out on the line.

Above, running from No. 9 shaft east is an automatic railway, which carries

the ore from the most of the shafts to the pockets. Nos. 5 and 6 yielding non-Bessemer ore, it is trammed to separate pockets. A new stone compressor and pumping engine house have been recently built and furnished with a single compressor and an 18x48-inch pumping engine, made at Iron Bay Foundry, Marquette.

The weekly product is now 2,500 to 3,000 tons; for the week ending July 8 the product was 1,859 tons of ore, 529 tons of rock, but this week included one holiday, and was also the first week in the month, when there is always less ore hoisted than in the other weeks of the month, for the reason that the last week the miners always clean up all the ore that is broken in the mine.

The Superintendent, Capt. John Oliver, is evidently a thorough miner and a good manager, and he has a competent assistant in Capt. James Watkins.

A force of 500 men is employed, and there are about 200 buildings on the location, including dwellings, shops, etc. The adjacent village of Noway is one of the most thriving towns on the range.

The ore is of good quality. The so-called vein matter is sufficiently characteristic to be readily distinguished. It is a somewhat soft, yellowish conglomeration, made up of bits of ore and rock. Drifting in this costs from \$4 to \$6 per foot, depending on the air.

The description of the land in which the mine is located is the N. E. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Sec. 5, T. 39, R. 29.

THE PERKINS MINE.

The Perkins Mine joins the Norway on the east. In the third level in No. 1 pit in the Norway you may pass into the Perkins through an opening between the mines. The Perkins has been, and still continues to be a very profitable mine, though it is a short one, and is now shortening up rapidly at the east end. There are three working shafts numbered from the west, next to the Norway, toward the east.

Descending No. 3, the east shaft, we arrive at 85 feet at the first level, where there is no work doing; a drift was run to the east 175 feet, and a cross cut south 25 feet, but no ore was found. Twenty-eight feet further down we come to the second level; at the foot of the shaft is a cistern with a double action Knowls pump, 8-inch cylinder, 6-foot stroke. The ore to the east of the shaft was shortened 35 feet in length from what it was in the level above.

Descending again 30 feet to the third level, they found the ore held out 75 feet east of the shaft to a width of 6 feet, when it was cut out by the underlying rock. A drift was extended east 150 feet, all in rock; they are still working this drift with little prospect of success. The vein-rock, in which they are drifting, has almost the appearance of ore. A boy with a hand machine is kept at work blowing air into the drift for the men.

Fifty feet east of No. 3 shaft they run a drift to the south a distance of 75 feet, all in the vein rock, but found no clean ore. The drift terminated in the slate hanging wall. In this level, west from the shaft for 20 feet, the bottom is rock, when it drops down to the bottom of the next level, the rock again occurring in the east end of this, the fourth level, in the same manner, driving the ore further west, or rather cutting it out on the east.

Going down to this level we find that they have drifted to the east 20 feet in mixed ore, etc., and are sinking the shaft in the same. The shaft is down 30 feet below the bottom and will be sunk 100 feet to prove the ground.

West from No. 3 shaft in this level they are working a breast of ore 15 feet wide that has a run of 40 feet to the breast on the opposite end of the same block in No. 2 pit. The foot wall, however, in the bottom is crowding the ore out against the hanging. The pillar on the west side of the shaft has been taken out, as the rock bottom, which must remain, will suffice to support the walls. Ascending the stope to the west and passing around the north side of a pillar, we come to the stope on the west end in No. 2 pit. This body of ore is 30 or 40 feet high, 40 feet long, and 15 or 20 feet wide. Descending the stope to the west, we are in No. 2 pit east of No. 2 shaft, where they are working east towards No. 3.

The bottom is ore, 110 feet long and 25 feet wide, and a winze sunk in this bottom between the stope and No. 2 shaft is in ore, as is also the shaft, which has been sunk to another level. This body of ore continues to No. 1, 210 feet, with a width in the bottom of 20 feet to 30 feet. In this No. 2 pit the foot wall comes down cutting under to the south, but the hanging wall seems to make off correspondingly, so that it is probable that the ore holds its size. Going west, up over the stope and through an arch in a pillar, we come into No. 1 pit, in the east end of which is a stope 20 feet wide and 30 feet high. The bottom of the pit is ore, with an average width of 18 feet. Another level sunk below this shows equally well. Going west of No. 1 shaft the ore deposit widens out and has been worked for 50 feet, having a breast of ore in this level of 15 feet wide and 80 feet or 90 feet long, to the Norway line. The width is, apparently, much greater, owing to the increased flatness of the vein at this point. It probably makes a run off to the south as it goes down, and will be found below to correspond with the lens formed in the 4th level in No. 1 in the Norway.

No. 1 and No. 2 shafts have each a skip road. Until recently they were both worked with bucket.

Ascending in No. 1 to the next level, we see that they are driving around north of the shaft to take out some of the ore that is standing east of the line.

The vein is wide; it has been opened to a width of 30 feet against the foot wall, and there is fully 40 feet of standing ore towards the hanging.

The bottom of this level is 235 feet below the collar of No. 1 shaft. The bottom of the level below is 275 feet under the surface. The back of the upper level is ore, left very thick to support the heavy weight of sand and refuse that rests upon it in the open pit above. Ultimately this refuse will be let down below and the ore that supported it will be taken out.

The dip of the walls is about 70° and quite regular in the west part of the mine for a depth of 230 feet, when they flatten off to the south. The mine is opened close to the north line.

The weekly product is about 1,600 tons, and there are about 10,000 tons in stock. The product will be about the same as last year. The force employed is 200 men.

The shaft houses are on the north side of the open cut, so that the elevated tracks to the ore pockets pass over it. There are six double ore pockets, one for each shaft. The railroad cars pass under the pockets with a descent to admit of their running down by force of gravity.

The engine house contains four Lane drums, five feet each diameter, and two small ones for use underground in sinking winzes and also in lowering timbers. Some very long, heavy timbers are used in the west end of the mine.

The description of the location is the S. W. $\frac{1}{4}$ S. W. $\frac{1}{4}$, Sec. 4, T. 39, R. 29. The company also holds three forties to the east, on one of which, east from the mine, an attempt has been made to sink a shaft, which is down to a depth of 93 feet in drift, when the water proved too abundant for the pump. A larger pump has been set to do this work, and further effort to lower the shaft will be made.

The mine is the property of the Saginaw Mining Company. Capt. Sam Mitchell, Agent, Stoneville, Mich.; Capt. John Perkins, Superintendent, etc., Norway, Mich.

The product of the mine in 1881 was 60,406 tons, and the aggregate yield to the same date is 123,331 tons.

THE STEPHENSON MINE.

The Stephenson Mine, joining the Perkins on the north—being the N. W. $\frac{1}{4}$ S. W. $\frac{1}{4}$ Sec. 4, T. 39, R. 29—is idle. The ore deposit in which the mine was worked has passed to the Perkins side of the line, and no other discoveries having been made, there was no longer any ore to mine.

The mine produced in 1881, 10,856 tons, and the product for previous years was 24,129 tons.

It is the property of the Lumbermen's Mining Company. Hon. H. Ludington, Milwaukee, President; Hon. Isaac Stephenson, Marinette, Wis., Secretary; Geo. E. Stockbridge, General Manager.

THE BRIAR HILL MINING COMPANY.

The Briar Hill Mining Company has a small mine, east from the Perkins and joining the Curry on the west. They are working one shaft, which is situated in the northwest slope of the bluff. The ore drawn up from the shaft in buckets is dumped on the west side or into cars, which tram it on an elevated track 400 feet south to the railroad. The ore is soft blue specular of the quality that is esteemed so highly by the steel makers. The ore lying below on the west side of the shaft is drawn up an incline on to the elevated tramway, whence it is run out to the cars. There are about 5,000 tons in stock. The shaft is vertical, 180 feet in depth, and there is a stope of ore in the west end of the bottom drift, but nothing in the east end. The ore deposit dips south and pitches west, and is rapidly cut out in the east.

An exploring shaft is sinking 100 feet south of the engine house, and near the east line of the property between it and the Curry a diamond drill is boring to the north, across the formation, at an angle of 70°.

The machinery comprises two three-foot drums worked by two 10x14 Rochester engines.

The work is in charge of Thomas W. Williams, Superintendent, etc., and a force of 45 men is employed.

THE CURRY MINE.

Next east from the Briar Hill is the Curry Mine, situated in the N. E. $\frac{1}{4}$ N. E. $\frac{1}{4}$ Sec. 9, T. 39, R. 29, and joining the Vulcan on the west. The mine has been worked since 1879, producing in the aggregate 52,285 tons of ore. The yield in 1881 was 17,534 tons. The mine has now narrowed down to small dimensions—to a single stope in the west end of the bottom drift.

The shaft is down 200 feet below the surface. The formation is vertical for 80 feet, and then makes a slight underlay to the south. In the bottom the ore has been followed to the west 100 feet, having an average width of 7 feet. At the end, however, the stope is about 12 feet wide, from which they are mining an average of 50 tons per day (July 14th). The ore pitches to the west, and has been rapidly shortened to the east by the undercutting rock. In tramping from the stope to the shaft, the car has to be run up an incline of rock that occurs in the bottom lengthwise with the drift. A winze has been sunk for taking out another level. The winze is in ore.

The number of men now employed is 50. The engine house is supplied with three 3-foot drums. The ore is the soft blue specular of the Vulcan Mine.

The stock is mainly held by Joseph Outhwaite, Cleveland, Ohio. The Agent is Wm. Ross, Vulcan, Mich.; Mining Captain, Wm. Wilcox.

THE WEST VULCAN MINE.

Next east to the Curry a short distance is the West Vulcan Mine, so well known and esteemed among furnace men for the excellent quality of its ores. The mine is on the southerly slope of the hill which extends indefinitely east and west, and at this location terminates finally, 100 rods to the south, in a small lake. The location has very much improved in appearance within the past year. The fallen timber has been cut up into wood, the worthless logs and brush got together and burned up. Yards, gardens, and cultivated fields appear where but recently were only logs and brush. The dwellings have been repaired, painted, and made neater and more comfortable, and thus altogether the surface outlook is much more inviting.

This improvement has not been confined to the surface. An effort, which is far from being devoid of excellent results, has been made to change for the better the mines themselves, and thus the evidence of the control of a thorough master is generally manifest. The West Vulcan was, until about two years ago, worked in open pits, and at the east end of the mine is a pit 50 to 75 feet wide, 200 feet long east and west, and 50 feet deep, in the center of which the shaft descends below the bottom dipping to the south and rising to the surface on the north side of the pit. The ore that is hoisted in this shaft is brought up to the bottom of the pit and dumped into cars, in which it is trammed out to the south through a tunnel under the road way to the pockets and ore dock. After this season the ore will be hoisted to the surface, to the top of the shaft house, on the east and west sides of which are pockets for receiving the ore. A trestle will be made over the chasm to carry the tramway, and the ore from all the shafts to the west will be brought east, and thence over this trestle to the pockets and ore dock. The waste rock that must be removed from the mine will be dumped into this old chasm. In the west end and in the southwest course of this open pit, some miners are scrambling in small pockets of ore.

West from this No. 1 pit, 180 feet, is No. 2 shaft, which goes down from the surface inclining to the south, and in it has lately been placed the new Cornish plunger pump. Close by the shaft on the southwest corner is the Stone pumping engine and compressor building.

Directly north of No. 2 about 300 feet is No. 3 shaft, and close by it to the west they are now opening and lining up a shaft for taking down timber into the mine.

Just east of No. 3 is the main engine house, which is furnished with three 5-foot drums, one Rochester, and two Frazier & Chalmers. There is a small drum in the pumping engine house for operating the timber shaft near No. 3.

One hundred feet further north and 400 feet west of No. 3 is No. 5 shaft, and between the two is No. 4. The depths of the shafts are as follows: No. 1 is down to the fourth level, 300 feet below the surface; No. 2 is down 220 feet; No. 3, 220 feet; No. 4, 312 feet; No. 5, 200 feet.

The ore from Nos. 3, 4, and 5 shafts is run down a gravity incline to the pockets and ore dock. This arrangement, as before stated, will be changed, so that the ore from these shafts will be taken around over No. 1 pit on the trestle. Passing through the tunnel into No. 1 open pit, and descending the shaft to the first level we notice that they have gone into the hanging a short distance, and from the end of the cross cut are drifting east in a vein of soft blue ore 8 feet wide. West from the shaft, in this level, the vein is worked out, having an open chamber 70 feet wide. A cross cut, started 50 feet west from the shaft, south into the hanging, intersected at a distance of 23 feet, a narrow vein of blue ore, in which they are now drifting east and west. A characteristic of this vein is the occurrence in it of bunches of hard jasper. It is intended to continue cross-cutting to the south until the hanging wall is reached.

Going west to No. 2 shaft in this level we notice that it is sinking in rock, in the foot wall, so that we pass through a cross cut 50 feet north to reach it. The pump in it is a 12-inch plunger, 6-foot stroke, and would suffice for much more work than is at present allotted to it.

The first level is mainly worked out, leaving wide chambers with the roof supported by pillars and timbers.

In the second level, in which they are now working, the foot wall makes a roll to the south and then goes down as before; the ore deposit is thus greatly narrowed. A cross cut to the south into the hanging wall intersects a lens of ore, which has been drifted in some distance, and which will be opened into from the level below. Down 40 feet towards the third level from the second the vein has narrowed to about 40 feet.

The plan is to take out all the ore except the pillars on each side of the shafts, replacing with timbers, arranged after the Nevada system. In No. 1 level a bottom has been left because the timbers from below do not exactly come under these in this level. The water in this level is run to a cistern at the pump shaft into which is also elevated the water from below, using a No. 6 and a No. 10 Knowls pumps. The plunger pump thence takes it to the surface. The cross cut to the lens in the hanging wall is much shorter, but the width of the vein is about the same as above. The main lens narrows, and so continues to do in the levels below.

Near No. 1 shaft a drift to the south 15 feet long is yet in rock, but it is probable that the ore will be struck still further south. At the shaft is placed a small drum and compressed air engine, used in sinking the shaft.

Descending to the third level and going west about 40 feet through a drift in rock, and turning south through a cross cut 30 feet, we come into ore, in which they are now driving east, and have a breast of clean blue ore that appears to widen out by opening, on the south side, more into the foot wall. West of the shaft 10 feet is a cross cut south, which, after going through 30 feet of rock, comes into the same lens of ore in which the cross cut continues 25 feet, without yet reaching the hanging wall. Further west from the shaft

is another cross cut to this ore, and a winze has been sunk in it to the fourth level. It is a deposit south of the main lens. One hundred and ninety feet west from the shaft is a stope 20 feet wide, which they are now working. The shaft has been sunk to the fourth level, the winzes also sunk and some drifting done and cross cuts made; the vein has an average width of about 20 feet, having narrowed from the first level when it was 70 or 80 feet wide. In this third level a cross cut is driving north in the foot wall to the pump shaft. The shaft is 130 feet distant and the cross cut is now in 70 feet, and in rock, or mixed vein rock. The fourth level is 75 feet below the third.

There is as yet no connection, though underground, to No. 3; so ascending to the surface and catching a momentary enjoyment of sunlight while passing over to No. 3, we again take to the ladders and are soon dependent upon the feeble light of our candles to find our way through, otherwise, impenetrable darkness.

The timber shaft at No. 3 has been made by sinking from the surface to the old workings. It proves a great convenience, saving any interference with the main hoisting shaft.

At the bottom they have a 4-foot vein, east from that shaft, but are not now working in this direction. They intend to wait until the shaft is completed to the fifth level, and then to drift east and open out above. The ore here seems to pitch to the east and ought to widen out in that direction as they go down. A cross cut will be made south to No. 2, and water from No. 3 run to No. 2 pump. West from No. 3 shaft, in the fourth level, the vein is 10 to 15 feet wide, increasing further west to 25 feet. The men are stoping above, dropping the ore against the lagging that stands obliquely over the drift, from behind which it is drawn out through apertures into the cars, in which it is trammed to the skip. To the west, 90 feet east of No. 4, is a winze to the fifth level. The vein looks poor, as it also does in the drift which is run 50 feet from the bottom. The water is conducted to a cistern west of No. 4 shaft, where a plunger pump takes it to the surface. A No. 10 Knowles pump, double action, has been placed here to be used in case of accident to the main pump. The water in this part of the mine rises very rapidly, and a short time ago, through stoppage of the pump, got the better of them and gave much trouble, causing the mine to lie idle nine days. A small hoisting engine is also in place here, and is used in sinking the shaft. A second Knowles pump has lately been placed near the foot of this shaft, to be used in raising water to the boilers in case the necessity arises, through temporary failure of the pump in the engine house. About one-half the entire product of the mine is taken from this pit, the ore being hoisted, mainly, in No. 4 shaft. To the west 50 feet from the shaft the foot wall comes in and narrows up the vein. The foot wall is much broken up.

Ascending No. 4 shaft to the third level, and going west towards No. 5, we see that the vein has been large, 40 feet wide, but that it has been squeezed out, below, by the foot wall. This part of the mine, in the vicinity of No. 5 shaft, was abandoned, but some work is again being done in it, and the ore, here and there, in places where it occurs, is being scrambled out. Behind the shaft, north of it, is a short drift in a fine deposit of blue ore, and the same deposit is cut in a cross cut further west, but it is only 2 feet wide. This last cross cut is driven to the south 400 feet and is now in the Norway formation. It is continuing with the hope of striking the Norway ore. The drift is 170 feet below the surface, in the second level.

No. 5 shaft is not sinking, but a drift from the east is coming under it, and if it is found to have no ore, at greater depth, the pillars will be mined out and the shaft abandoned. The machinery for this part of the mine is a 5-foot Rochester drum and engine for No. 4 shaft, and a small drum for No. 5. The pump is hardly of sufficient capacity for the work it has to do. It is making ten strokes per minute where it ought to make but six or seven. When the cross cut is made from No. 3 to No. 2 a portion of the water will be distributed in that direction.

The Mining Captain at the West Vulcan is E. S. Roberts, who came here at the beginning of the year, January 1, and since the same date the direction of affairs here, as well as at the East Vulcan, has been in the hands of Mr. A. C. Davis, who, since 1848, has been much of the time a mining agent mainly in the copper district, at the Norwich, Amygdaloid, and Minong Mines. The application of his energy and experience is apparent, to the advantage of the mines now in his charge.

THE EAST VULCAN.

The East Vulcan is a mile distant. The workings here are embraced in three separate and distinct mines, or shafts, the center one of which is No. 1, and is 1,300 feet and 1,400 feet respectively distant from No. 2 and No. 3, the east and the west shafts. These shafts were formerly crude affairs, sunk in the bottoms of open pits and lagged up with poles, and operated with buckets and derrick. The shafts are now being well timbered. No. 2 is divided into three compartments, two of them for a double cage and the other for pump. It is down 260 feet, and is a very wet pit. At 200 feet below the surface a drift to the east 175 feet long, from the main pit, is all in ore, the vein showing a width of from 4 feet to 8 feet. A winze will be sunk and a stope made as soon as the shaft is ready for hoisting. The ore is the best—soft, blue specular. The timbering in this mine is somewhat different from that adopted in the other mines on the Range, and possesses an advantage on the score of simplicity and cheapness. The posts are of the same length, 7 feet high, and are set at equal distances apart, in rows at right angles to each other. The cross pieces are of the same length and reach from post to post, so that the top of each post has the ends of four cross pieces resting upon it. The whole bottom is curved in this way, the timber floor on top of the posts, dividing the space into squares. On these timbers the lagging is placed for a floor, to take out the back for another rise, when another set of posts, directly in line with those below, are placed above them and capped as before with the cross timbers; and so on, in successive stages, this arrangement will be continued to the bottom of the mine. There is no mortising, but a dowel, or short tenon is made on the end of each post, against which the ends of the cross pieces are pressed, and thus prevent any sliding or tipping of the posts. The outside posts are stayed by short pieces passed between the posts and the wall. The whole frame work is thus firm, and the posts are kept vertical to receive the downward pressure.

No. 1 pit is well opened and has several good stopes of ore to work as soon as the shaft is ready to hoist. This is called the Lowell pit, and the product goes by the name of Lowell ore. It has a new engine house, in which is a 5-foot Rochester drum.

No. 3, 1,400 feet to the west, is further up the hill, and the ore is brought

down to the railroad on a gravity incline. No ore is now hoisted from the shaft, the mining work being deferred until the shaft is completed. The several pits are in condition to afford a good weekly product, and will be worked as soon as the shafts are ready.

The Mining Captain is John U. Curnow, who has been at the mine since January 1.

The East Vulcan is in the S. $\frac{1}{2}$ of the S. $\frac{1}{2}$ of Sec. 11, T. 39, R. 29.

The Vulcan Mines are now owned and operated by the Penn Iron Mining Company, being one of three included in the Cambria purchase. Possession of these mines was taken on January 1, 1882, by the new owners, though they are worked the present season to fill the contracts previously made by the Menominee Company.

The product of the Vulcan in 1881 was 85,274 tons, and the aggregate of its yield to that date is 258,751 tons.

THE GARFIELD MINE.

Another location just east from the Vulcan may be noticed, since it is so near by. It is called the Garfield Mine. It is about 300 feet east from the east shaft of the East Vulcan. They are sinking two shafts about 200 feet apart, and each is about 50 feet deep. They have a small hoisting and pumping engine, etc. No ore has yet been reached.

Further east, at Waucedah, are the now idle Breen and Emmett Mines, which are among the first locations that were explored in the Menominee range.

THE BREEN MINE.

The Breen Mine is located on the N. W. $\frac{1}{4}$ N. E. $\frac{1}{4}$ Sec. 22, T. 39, R. 28, the company also owning the N. W. $\frac{1}{4}$ of the same section. This mine, which geologically presents some interesting features, was very fully described in the report of 1878. The mine product up to the close of 1880 was 17,440 tons, since which time it has remained idle. Just now some parties are exploring it on an option. They began about May last, and sunk one shaft 45 feet, and found 4 feet of ore which they lost in the foot wall. Concluding not to drift for it, they sunk another shaft, and have now in this latter a four-foot vein of blue ore which is widening out. Their progress is somewhat seriously deterred by water.

THE EMMETT MINE.

At the Emmett Mine no work has recently been done, though it produced in 1881, 648 tons of ore, and in all has yielded 66,655 tons. This mine, with the general geological features, etc., was also fully described in the Commissioner's report for 1878.

FELCH MOUNTAIN RANGE.

The mines in the Felch Mountain Range will soon be made accessible through the completion of the Escanaba and Felch Mountain branch of the C. & N. W. Railway. The road is already graded for a distance of about 20 miles, and it is estimated the whole will be completed by September next, thus bringing the much talked of mines of this district to the front as shippers of ore. The mines of the Felch Mountain district lie north of the Vulcan, etc. mines, in ranges 28 and 29, towns 41 and 42, and until the railroad is completed they are nearly inaccessible. The wagon road which extends from Norway to Felch Mt., 20 miles, is a very rough one.

The principal mines in this range, the ones which have in any measure been developed, are the Northwestern, Metropolitan, Calumet, and the Hecla.

The former is in the N. W. $\frac{1}{4}$ of Sec. 32, T. 42, R. 28. The work was mainly done in the winter of 1880 and 1881. Near the east side of the property a shaft was sunk 47 feet deep, 32 feet of which is said to be good ore free of rock, which analyzed 62 % in metallic iron. From the bottom of this shaft a drift was run to the south 22 feet, and continues all the way in ore. As generally happens in exploring work done at a distance in the woods, they had poor facilities for getting rid of the water. The strike is east and west, and the dip at this point is 60° to the south. The hanging wall is quartzite, in contact with which is the blue ore, succeeded by the red ore. The ores are, however, separated by jasper.

West from this shaft 150 feet, they sunk another one, going 35 feet through sandstone and coming to ore. The ore was not sunk in, it is said, on account of the water. Still further west, 400 feet, a third shaft was sunk 45 feet, but they did not get through the sandstone owing to the water. From this point south 80 feet, they again sunk 45 feet, the first 25 feet being in sandstone, then 2 feet of quartzite and jasper, succeeded by 7 feet of soft blue ore. These openings are on the east "forty;" the west forty has had much more work done on it. On this a space, 160x200 feet, has been stripped, the drift being from 2 feet to 5 feet thick. Here, in this space, is exposed what is assumed to be the ore ledge, showing the soft blue ore similar to the Vulcan, etc. ore, but no sinking has been done in it.

An ore dock has been built and other preparations made for mining and shipping ore when the railroad is built.

THE METROPOLITAN.

The Metropolitan lies east of the Northwestern, and the Company has done more work and holds a much larger estate. They have 7,000 or 8,000 tons in stock awaiting shipment. The ore is the soft blue specular variety. They

are mining in three open pits, and are opening a fourth one south of the marble. The ore on the surface is 40 feet to 50 feet wide, but narrows down to 20 feet in the bottom of the pits, at a depth of 50 feet. These pits, with the intervening ground, comprise a length east and west of 500 feet. To the south is the Marble, and in that direction 500 feet is No. 4 pit. The ore from it is harder—hard blue hematite ore. The mine is in the west part of Sec. 33, R. 28, T. 42.

THE HECLA MINE.

The Hecla Mine and the Brotherton Mine, both in Sec. 8, T. 41, R. 28, are said to be valuable "finds."

And the Calumet Mine is, according to the reports of those interested, proving a bonanza. A force of 65 men is employed, and the ore vein has been cross cutted 54 feet without either hanging or foot wall being reached.

AGOGEBIC IRON RANGE.

Exploration continues active in this region and important results are reported. This iron range extends from the Montreal river, in T. 47 N. in R. 47 W., east across ranges 46, 45, and 44. The larger number of the discoveries which have thus far been made have been in T. 47, R. 46, in Secs. 15, 16, 17, and 19. The best "finds" are in Sec. 15, held by the Cambria Iron Company and Messrs. Sedgwick, Maitland, et. al. Messrs. Merritt, Mills & Fay have promising deposits in Secs. 17 and 19. Good ore has been found as far east in this range as Sunday lake in Sec. 9, T. 47, R. 45.

All tools, provisions, etc., necessary for work, must be borne in on the backs of men, which, when the remoteness of the locality is considered, one may realize is a very laborious and expensive undertaking. Ultimately the region will be penetrated with railroads, when will result the development of another important iron region in our state.

STATISTICAL TABLES.

STATISTICAL TABLES.

The following table shows the amount of the various grades of salt inspected in Michigan since 1869, the first year of the establishment of the State Salt Inspection :

| Years. | GRADES OF SALT IN BARRELS. | | | | Total for each year in Barrels. |
|------------|----------------------------|----------|--------|-----------------|---------------------------------|
| | Fine. | Packers. | Solar. | Second quality. | |
| 1869 | 513,989 | 12,918 | 15,264 | 19,117 | 560,818 |
| 1870 | 568,326 | 17,869 | 15,507 | 19,650 | 621,350 |
| 1871 | 655,923 | 14,677 | 37,645 | 19,930 | 728,175 |
| 1872 | 672,034 | 11,110 | 21,461 | 19,876 | 724,481 |
| 1873 | 746,702 | 23,671 | 32,267 | 20,706 | 823,346 |
| 1874 | 960,757 | 20,090 | 29,391 | 16,741 | 1,028,979 |
| 1875 | 1,027,886 | 10,233 | 24,336 | 19,410 | 1,081,865 |
| 1876 | 1,402,410 | 14,233 | 24,418 | 21,668 | 1,462,729 |
| 1877 | 1,590,841 | 20,389 | 22,949 | 26,818 | 1,960,997 |
| 1878 | 1,770,361 | 19,367 | 33,541 | 32,615 | 1,855,884 |
| 1879 | 1,997,350 | 15,641 | 18,020 | 27,029 | 2,058,040 |
| 1880 | 2,598,037 | 16,691 | 22,237 | 48,623 | 2,676,588 |
| 1881 | 2,673,910 | 13,885 | 9,683 | 52,821 | 2,750,299 |

Previously to 1869 the salt production of the State was as follows :

| Years. | No. of Bbls. | Years. | No. of Bbls. |
|------------|--------------|------------|--------------|
| 1860 | 4,000 | 1865 | 477,200 |
| 1861 | 125,000 | 1866 | 407,077 |
| 1862 | 243,000 | 1867 | 474,721 |
| 1863 | 466,356 | 1868 | 555,690 |
| 1864 | 529,073 | | |

The average price which Michigan salt sold for per barrel in different years is as follows :

| Year. | Price. | Year. | Price. |
|------------|--------|------------|--------|
| 1866 | \$1 80 | 1874 | \$1 19 |
| 1867 | 1 77 | 1875 | 1 10 |
| 1868 | 1 85 | 1876 | 1 05 |
| 1869 | 1 58 | 1877 | 85 |
| 1870 | 1 32 | 1878 | 85 |
| 1871 | 1 46 | 1879 | 1 02 |
| 1872 | 1 46 | 1880 | 75 |
| 1873 | 1 37 | 1881 | 85 |

Michigan is now the largest salt producing region in the United States. Its only competitor, to any extent, is Onondaga, which latter it largely leads in production, as will be seen from the following table, which shows the product of the Michigan wells and of the Onondaga wells for the years given:

| Years. | No. of bushels produced in the Onondaga District. | No. of bushels produced in the Saginaw District. |
|-----------|---|--|
| 1877..... | 6,427,983 | 8,303,985 |
| 1878..... | 7,176,197 | 9,269,545 |
| 1879..... | 7,934,854 | 10,390,200 |
| 1880..... | 8,481,473 | 13,382,940 |

The salt is all obtained in what is known as the Saginaw Valley. The following table shows the relative amounts produced in different localities in 1880:

| Counties. | Barrels. |
|-------------------|------------------|
| Bay..... | 1,081,841 |
| Saginaw..... | 1,148,644 |
| Huron..... | 256,841 |
| Iosco..... | 147,800 |
| Midland..... | 41,462 |
| Total..... | 2,676,588 |

STATISTICAL TABLE Showing the Total Number of Gross Tons of Pig Iron Produced by the Blast Furnaces of Michigan, by Charles E. Wright, M. E., Commissioner of Mineral Statistics.

| NAME OF FURNACE COMPANIES. | Previous to 1872. | 1872. | 1873. | 1874. | 1875. | 1876. | 1877. | 1878. | 1879. | 1880. | 1881. |
|--|-------------------|---------------|----------------|----------------|----------------|---------------|---------------|---------------|---------------|----------------|--------|
| 1 Pioneer Furnaces a..... | 57,577 | 7,050 | 7,388 | 10,708 | 15,902 | 11,205 | 2,801 | 9,768 | 13,169 | 18,269 | 17,080 |
| 1 Iron Cliffs Furnace a..... | 36,566 | 3,431 | 2,000 | 4,784 | 5,838 | 3,982 | ..... | ..... | ..... | ..... | ..... |
| 1 Collins Iron Company + a..... | 15,059 | ..... | ..... | ..... | 5,977 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Northern Iron Company + a..... | 35,021 | 4,350 | 4,100 | 3,688 | 5,377 | 3,278 | 663 | ..... | ..... | ..... | ..... |
| 1 Bancroft Iron Company + a..... | 31,602 | 5,006 | 6,324 | 5,973 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Morgan Iron Company + a..... | 20,512 | 4,001 | 3,949 | 1,531 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Champion Iron Company + a..... | 23,344 | 4,212 | 4,467 | 6,631 | 3,698 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Michigan Iron Company + a..... | 25,140 | 2,800 | 4,416 | 4,839 | 1,595 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Greenwood Iron Company + a..... | 24,626 | 9,962 | 11,966 | 11,079 | 10,647 | 10,015 | 3,960 | 10,594 | 8,066 | 9,739 | 4,680 |
| 2 Fayette Iron Company + a..... | 7,557 | 2,800 | 2,287 | 6,092 | 2,603 | 2,439 | 3,280 | ..... | ..... | ..... | ..... |
| 2 Munising Iron Company + a..... | 7,095 | 4,900 | 8,760 | 8,339 | 4,923 | 2,403 | 4,280 | ..... | ..... | ..... | ..... |
| 1 Bay Furnace + a..... | 7,833 | 2,730 | 3,447 | 6,324 | 4,615 | 8,119 | 4,280 | ..... | ..... | 2,691 | 7,831 |
| 1 Deer Lake Iron Company + a..... | 1,610 | 4,954 | 7,800 | 3,238 | 10,940 | 10,514 | 6,866 | ..... | ..... | 2,609 | ..... |
| 1 Marquette & Pacific R. M. Co..... | ..... | ..... | ..... | 3,546 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 * Grace Furnace +..... | ..... | ..... | ..... | 1,431 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1 Carp River Iron Company..... | ..... | 116 | 509 | 1,431 | ..... | 1,272 | 3,176 | 4,917 | 5,929 | 5,356 | 10,253 |
| 1 Excelsior (Peat Furnace)..... | ..... | ..... | ..... | 4,702 | 5,780 | 4,829 | 5,647 | 3,034 | 6,750 | 7,776 | 8,336 |
| 4 Menominee Iron Company..... | ..... | ..... | 2,209 | 5,902 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 2 Escanaba Furnace Company a..... | ..... | ..... | 2,175 | 5,902 | 1,920 | ..... | ..... | ..... | ..... | ..... | ..... |
| 5 Michigan Central Iron Company a..... | 19,518 | 3,551 | 4,848 | 3,451 | 1,920 | ..... | ..... | ..... | ..... | ..... | ..... |
| 5 Bangor Furnace Company a..... | ..... | ..... | 3,606 | 6,219 | 8,659 | 10,350 | 10,957 | 11,903 | 11,940 | 13,465 | 14,119 |
| 6 Peninsular Iron Company a..... | 33,752 | 4,834 | 4,533 | 2,049 | 9,450 | 2,472 | 5,310 | 5,254 | 7,683 | 87,500 | ..... |
| 6 Eureka Furnace a..... | 60,000 | 2,078 | 3,572 | 2,049 | 2,255 | 3,421 | 4,438 | 525 | 9,365 | 16,925 | ..... |
| 7 Leland Furnace a..... | ..... | ..... | ..... | 549 | ..... | 3,000 | 2,000 | ..... | ..... | ..... | ..... |
| 7 Leland Furnace a..... | ..... | ..... | ..... | 549 | ..... | 3,000 | 2,000 | ..... | ..... | ..... | ..... |
| 8 Frankfort Furnace a..... | ..... | ..... | 6,200 | 3,656 | 4,051 | ..... | ..... | ..... | ..... | ..... | ..... |
| 9 Elk Rapids Furnace a..... | ..... | ..... | ..... | 5,983 | 2,033 | 7,100 | 11,925 | 13,445 | 12,477 | 12,384 | ..... |
| 9 Detroit & L. S. Iron Manufacturing Co..... | 36,494 | 4,731 | 4,081 | 3,808 | 7,100 | 3,880 | 4,805 | 4,767 | 4,767 | 7,149 | 5,028 |
| 10 Union Iron Company a..... | ..... | 1,421 | 4,900 | 1,670 | 2,916 | 3,680 | 4,275 | 5,347 | 8,797 | 4,949 | 9,598 |
| 10 Fruitport Furnace a..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16,293 |
| 11 Martell Furnace a..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 4,109 |
| 6 Detroit Iron Furnace Company a..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 12,000 |
| Totals..... | 443,806 | 74,731 | 104,785 | 116,233 | 110,556 | 86,454 | 74,375 | 65,030 | 89,463 | 108,728 | ..... |

¹ Includes Carp River & P. R. M. Furnaces' product.
² Caseville Furnace—No returns.
³ Ward Furnace—No returns previous to 1878.
⁴ Hamtramck Furnace—Not in blast since 1873.
⁵ Charcoal.
⁶ Estimated.

⁸ Furnace in Benzie County.
⁹ Furnace in Antrim County.
¹⁰ Furnace in Muskegon County.
¹¹ Furnace in Mackinaw County.
¹² Swinford's History.
¹³ Previous to 1874.
¹⁴ Coal or Coke.

¹ Furnaces in Marquette County.
² Furnaces in Delta County.
³ Furnaces in Schoolcraft County.
⁴ Furnaces in Menominee County.
⁵ Furnaces in Van Buren County.
⁶ Furnaces in Wayne County.
⁷ Furnace in Leelanaw County.

STATISTICAL TABLE Showing the Total Number of Gross Tons of Iron Ore Shipped from Lake Superior Iron Mines. By Chas. E. Wright, M. E., Commissioner of Mineral Statistics.

| | Marquette Dis- trict. | Menominee District. | Totals. |
|-----------------------|--------------------------|------------------------|------------|
| Years Unknown..... | 75,083 | | 75,083 |
| 1854..... | 3,000 | | 3,000 |
| 1855..... | 1,449 | | 1,449 |
| 1856..... | 6,790 | | 6,790 |
| 1857..... | 25,646 | | 25,646 |
| 1858..... | 22,876 | | 22,876 |
| 1859..... | 68,832 | | 68,832 |
| 1860..... | 114,401 | | 114,401 |
| 1861..... | 49,909 | | 49,909 |
| 1862..... | 124,169 | | 124,169 |
| 1863..... | 203,055 | | 203,055 |
| 1864..... | 247,059 | | 247,059 |
| 1865..... | 193,758 | | 193,758 |
| 1866..... | 296,713 | | 296,713 |
| 1867..... | 465,504 | | 465,504 |
| 1868..... | 510,522 | | 510,522 |
| 1869..... | 639,097 | | 639,097 |
| 1870..... | 859,507 | | 859,507 |
| 1871..... | 813,984 | | 813,984 |
| 1872..... | 948,553 | | 948,553 |
| 1873..... | 1,195,234 | | 1,195,234 |
| 1874..... | 899,934 | | 899,934 |
| 1875..... | 881,166 | | 881,166 |
| 1876..... | 993,311 | | 993,311 |
| 1877..... | 1,014,724 | 10,405 | 1,025,129 |
| 1878..... | 1,030,986 | 96,597 | 1,127,583 |
| 1879..... | 1,149,969 | 270,776 | 1,420,745 |
| 1880..... | 1,379,725 | 592,288* | 1,971,913 |
| 1881..... | 1,581,215 | 728,858* | 2,309,074 |
| Total gross Tons..... | 15,796,181 | 1,698,824 | 17,494,006 |

* Includes Commonwealth and Florence Mines.

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

| YEARS. | Land Plaster. Tons. | Stucco—Bbls. 300 lbs. each. |
|----------------------------|------------------------|--------------------------------|
| 1866 | 14,604 | ----- |
| 1867 | 17,439 | ----- |
| 1868 | 28,837 | 34,966 |
| 1869 | 29,996 | 41,187 |
| 1870 | 31,437 | 46,179 |
| 1871 | 41,126 | 48,685 |
| 1872 | 43,536 | 59,767 |
| 1873 | 44,972 | 82,453 |
| 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 | 44,667 | 50,800 |
| 1880 | 49,570 | 106,004 |
| 1881 | 33,178 | 112,813 |
| Total | 562,618 | 894,155 |
| For years previous to 1866 | † 100,000 | † * 80,000 |
| Total | 62,618 | 974,155 |

† Partly estimated.

* Stucco for years previous to 1868.

TABLE Showing the Number of Tons of Quartz Shipped from Lake Superior in 1881:

| Name of Locality. | No. of tons. |
|-------------------|--------------|
| Carp River | 8,460 |
| Lake Fairbanks | 6,560 |
| Total | 15,020 |

TABLE Showing the Amount of Coal Produced in Michigan for 1877-78-79-80-81, Total for Previous Years Partly Estimated.

| | Y'rs previ- ous to 1877. | 1877. | 1878. | 1879. | 1880. | 1881. |
|-------------------------------|-----------------------------|--------|--------|--------|---------|---------|
| Jackson mines | ----- | 67,697 | 61,785 | 65,000 | ----- | ----- |
| Corunna mines | ----- | ----- | 22,537 | 16,215 | ----- | ----- |
| Other mines | ----- | 1,500 | 1,000 | 800 | ----- | ----- |
| Stope Mine (Jackson Coal Co.) | ----- | ----- | ----- | ----- | 66,780 | 61,666 |
| Eureka Mine (Jackson) | ----- | ----- | ----- | ----- | 30,000 | 37,477 |
| Michigan Coal Co. (Jackson) | ----- | ----- | ----- | ----- | 20,021 | 23,987 |
| Corunna Coal Co. (Corunna) | ----- | ----- | ----- | ----- | 12,252 | 7,000 |
| Other localities | ----- | ----- | ----- | ----- | 1,000 | 2,000 |
| Total net tons | 350,000 | 69,197 | 77,715 | 82,015 | 130,053 | 132,130 |

TABLE Showing the Amount of Land and Calcined Plaster Produced by the several Plaster Companies in Michigan for the Years Given.

| NAME OF COMPANY. | Tons of Land Plaster. | | | Barrels of Stucco. | | |
|---------------------------------------|-----------------------|--------|--------|--------------------|---------|---------|
| | 1879. | 1880. | 1881. | 1879. | 1880. | 1881. |
| ¹ Godfrey & Bro. | 9,117 | 9,000 | 6,422 | ----- | 23,000 | 27,500 |
| ¹ Grand Rapids Plaster Co. | 8,970 | 12,000 | 6,375 | ----- | 23,500 | 20,400 |
| ¹ Geo. H. White & Co. | 1,900 | ----- | ----- | ----- | ----- | ----- |
| ² Wyoming Mills Co. | 7,000 | 10,000 | 6,093 | ----- | ----- | ----- |
| ² Union Mills Co. | 4,500 | 7,500 | 6,716 | ----- | 35,000 | 34,913 |
| ¹ Taylor & McRingolds. | 10,585 | 9,570 | 6,572 | ----- | 24,504 | 30,000 |
| ³ Smith, Bullard & Co. | 1,586 | 1,500 | 1,000 | ----- | ----- | ----- |
| Total | 44,667 | 49,570 | 33,178 | ----- | 106,004 | 112,813 |

¹ Quarry, etc., at Grand Rapids.² Quarry, etc., at Grandville.³ Quarry at Alabaster.

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