STATE OF MICHIGAN.

MINES AND MINERAL STATISTICS

BY
CHAS. D. LAWTON, A. M. C. E.,
COMMISSIONER OF MINERAL STATISTICS.

BY AUTHORITY

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STATE OF MICHIGAN,
OFFICE OF THE COMMISSIONER OF MINERAL STATISTICS.
Lawton, Michigan, April 10, 1890.

HON. CYRUS G. LUCE,
Governor of the State of Michigan:

SIR—In fulfillment of the duties of my office, I have the honor to submit herewith the following report upon the mines and mineral interests of the State.

Respectfully your obedient servant,

CHARLES D. LAWTON.
Commissioner of Mineral Statistics.

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INTRODUCTION.

At the date of submitting this Report the iron and copper mining interests of the upper peninsula are in a prosperous condition. Every available iron mine that contains any merchantable ore is now worked. The mines are already sending forward the ore to the several ports, ready to be transferred into vessels as soon as they shall arrive. There is far more ore in stock at the mines than ever before; the mines are generally fully opened, every preparation has been made to get out all the ore possible. Sales have been made of the greater portion of all the product at an advance of $1.00 above last year's prices, and there is every assurance that all the additional production will be absorbed. It is now assumed that there will be sent out the present season from the Lake Superior iron mines upwards of 10,000,000 tons of ore; more than ten times as much as was produced in 1873, when I first described the mines in the State Geological Report of that year. The progress has been rapid and the future is likely to be equally prosperous. There are still large areas showing such indications of ore as to make it certain that many other mines will be found to take the places of such as may become exhausted.

The condition of matters in the copper region is equally fortunate: the high market price of copper continues. Stocks that had so greatly advanced in value retain the high prices which they had acquired. Every effort is making to get out the largest possible production.

Laborers are well rewarded for their toil, they find abundant employment at remunerative wages. I have just returned from a trip occupying several weeks, through the several mining districts, and I find the best of feeling existing among all classes—officers and men. So far all is harmonious. The season of 1890 will be in all probability, one of the most active and prosperous ever experienced in the mines of Michigan.

I have brought the information given in this volume down to the latest possible moment. The tables of production end with 1889 but in all other particulars the report is nearly as if it had been written in April 1890. I trust it will be found to contain such facts as shall give to all who care for it, the information that they may require.

CHARLES D. LAWTON,
Commissioner.

THE COPPER INDUSTRY.

In speaking of this industry in my report for 1888, it is remarked that the extremes of fortune have been experienced within a brief period. In that year, from a greatly depressed state, the copper interest advanced to a condition of much prosperity. Then the failure of the copper syndicate reversed the status of the industry and brought on renewed misfortune. But now again, at the close of 1889, prosperity has returned to the copper mining industry and its fortunes are in the ascendant.

In point of fact at no time for several years has there been such an assurance of substantial and continued prosperity as now. The improved condition is based upon actual consumption of copper and thus there is a healthy demand for the raw material. The sales are legitimate and the governing price is no longer fictitious but true to the free working of the natural laws governing supply and demand.

The great French syndicate which held the delusion that it could control the world's supply of copper, and which for an indefinite period, gave, briefly, seeming relief to copper producers, suddenly collapsed in utter disaster and in the maelstrom of its destruction were drawn great corporate and individual ruin.

Looking back over its history, it is now seen that the syndicate had really no reason to have existed.

The copper mining industry is no better today that the syndicate was formed. It stimulated production and diminished consumption. The increased price for copper that was fixed by the syndicate, was a powerful incentive to increase its production, while at the same time the arbitrary and unnatural proceeding of thus fixing the prices at which the metal should be sold and maintaining it at such figures solely by the fiat of a corporation, which was neither a producer nor a consumer, called out the utmost antagonism of the manufacturers and caused them as a measure of retaliation to restrict their purchases of copper in the greatest possible degree. The result was a great accumulation of copper in the hands of the syndicate, which should have been consumed or have been in the hands of the manufacturers. The load became, finally, too great to be borne. The strained conditions brought about this natural outcome, the collapse of the entire fabric.

Naturally there was much speculation as to what the result would be *aprs le deluge*. Considerable uneasiness and alarm was felt on the part of those interested in copper mining, that the collapse of the syndicate would occasion great loss to mining companies by causing the price of copper to sink below the cost of production. Fortunately these seemingly well grounded apprehensions were not verified. By concert of action among the larger producers of copper, a wise and conservative policy was adopted. Sales were restricted to the actual demand of manufacturers at a moderate price that proved satisfactory to consumers. And thus the great surplus that threatened so much disaster to mining interests have gradually absorbed and the current production of the mines, as well, has been required to keep up the demand for the raw material. Thus at the close of the year not only is there, practically, no accumulated surplus, but the out put of the leading mines is all contracted three months in advance and that, too, at a price even greater than the one that was fixed in the contracts with the syndicate. Copper is now sold at 14½ cents, the syndicate price was 13½ with provision for division of any amount accruing above certain given figures. So that, thus without any forced conditions, simply through the normal workings of the forces of supply and demand a far better state of the copper industry, both as regards mining and manufacturing, has been secured, than existed through all the marshalling of the forces of the great syndicate.

It is probable that the present favorable prices will continue, possibly, throughout the year 1890; certainly for a portion of it. There is a great increase in the world's consumption of copper, and the new industries springing up, the new channels opening, which require this metal for their development, bespeak a rapid increase of consumption, that must keep pace with the increase of production.

On the failure of the syndicate, there was a rapid fall of price of copper stocks, while under the stimulus of high price of copper and consequent large dividends, paid and in anticipation, had attained to a large market value. These stocks depreciated to a corresponding low degree and again have enhanced to their former large value, owing to the rise in the price of copper and the assurance of future dividends, made certain by this enhancement of value of the metal.

Naturally, some losses were experienced through the great depreciation of stocks; but those who held their stocks are again all right; the subsequent rise has brought them out of the shoal waters and landed them on dry ground.

And again, persons who purchased a few weeks ago, say in November, have realized a great advance on the stock purchased, and are in luck, which they, no doubt, duly appreciate.

Experience shows that the stocks of the leading Michigan copper mines are a pretty secure investment. They fluctuate in value but within safe limits; and the dividends which they pay give an average fair interest on the average cost of the stocks; they are safe to hold and are a safe property to buy for speculating purposes.

One can nearly always sell out for the cost, and frequently at a greatly increased price, thereby realizing a handsome profit on the investment.

The time is approaching, when the additional shafts, now sinking by the Tamarack, on section 11, and when the Tamarack, Jr. and the downright shaft of the Calumet and Hecla shall be producing; and, probably, the Centennial, also, and there must then be a great increase of production. Whether the world will absorb it all at the present remunerative price, remains to be seen. It is probable that this and all other increase of production will be met by a corresponding increase of consumption. On the whole, the outlook for the copper mining industry, of Lake Superior, was never better than now. Copper is selling at a satisfactory price; the mines are looking well; entire harmony prevails between the owners and the employés; newer methods, improved facilities, serve to increase the product and cheapen the cost. There is, probably, more profit in copper mining on Lake Superior, now than ever before. The copper is produced at a constantly diminishing cost, on the average.

It is a matter of much congratulation that the fire which a year ago was raging in the Calumet and Hecla mine has been extinguished and that this portion of the mine, in which the fire prevailed, is again producing copper. The effects of this extensive subterranean conflagration are rapidly disappearing and this great mine will soon assume its normal conditions and be yielding copper throughout its entire extent. Important changes in the mine and in the surface are in progress, making it apparent that the Calumet and Hecla management aims to keep pace with the developments that are rapidly making in the progressive Lake Superior copper mining industry.

This wonderful copper-belt,—the Calumet and Hecla conglomerate will within a few years be opened and worked far more extensively than now.

The shafts that are now sinking in the non-producing portion of the belt, between the Hecla and Black Hills mine, will reach producing ground before long when the mine will be opened and productive throughout nearly its entire length, a distance of two miles. The Bed Jacket shaft which is descending at a rapid rate, will have penetrated to the lode, 3,400 feet, vertically below the surface.

Of these vertical shafts there are seven which are already down or are descending to the conglomerate and when we consider the remarkable results that have obtained from the completion of the No. 1 Tamarack shaft, the only one that has produced copper—we may realize the vastly increased production that will accrue when the others shall be completed. In addition to the vertical shafts sinking by the Tamarack companies and the Calumet and Hecla, the Centennial is also sinking a deep exploring shaft in this lode, which will be continued to a great depth, if necessary.

In sinking these vertical shafts remarkable progress has been made in the past year, more rapid than was ever before achieved—100 feet per month, in hard rock, is extraordinary work.

Smelting all the copper on Lake Superior is another important advance step. Both the Calumet and Hecla and the Tamarack companies now have their own smelting works on Torch Lake where all the mineral of these corportions is reduced into ingots.

The Copper Boiling Mill recently put into operation at Dollar Bay by the chief owners of the Tamarack, is proving very successful. Copper wire and copper sheeting are manufactured, and the result is all that could be desired.

The Quincy Mining Co. has built a stamp mill at Torch Lake within the past year, which will soon be in operation. The Company has also constructed a railroad from the mine to the mill, and thus the Company is now in shape to somewhat increase its out put of copper.

In Keweenaw and in Ontonagon counties, there is little of additional importance to note. No discoveries have been made of copper deposits and no new developments made in addition to those already known. The minas in Ontonagon county are mainly worked by tributers in a small way; but, I understand, the work is proving profitable to the miners. Some large masses of copper are found.

In truth, there has not been much effort made in the way of new exploration for copper for a number of years; but the range from Ontonagon down to Portage Lake has great possibilities.

The stock of copper now on hand in this country, January 1, 1890, is given at 65,000,000 pounds, and, as previously stated, the product of the mines is all sold up, even to several months ahead, so it is plain to see that the market condition is greatly in favor of the mines. At the close of the year 1888, the amount of copper on hand in this country was reported to be 75,000,000 pounds, and the total in the world at that time was estimated at 180,000 gross tons. The total of the world's supply, visible and invisible, now on hand, is estimated at 127,000 tons, showing plainly that the production of the past year has not equaled the consumption.

There will be more copper produced in 1890 than there was in the previous year. The surplus has been decreased and what surplus there is, is in the hands of those who will hold it so that it will not be used to depress the market.

**Copper production by States.*

	1888.	1889.	
	Pounds.	Pounds.	Long Tons.
Lake Superior	86,384,124	86,000,000	38,393
Arizona	31,497,300	32,000,000	14,286
Montana	97,897,968	105,000,000	46,875
New Mexico	1,631,271	3,400,000	1,518
California	1,570,021	1,700,000	759
Colorado	1,300,000	3,000,000	1,339
Utah	2,181,047	2,400,000	1,071
All other sources	3,241,725	3,000,000	1,339
Domestic production	227,853,456	236,500,000	105,580
From imported ores	5,000,000	5,100,000	2,277
Total production	232,853,456	241,600,000	107,857
Stocks, beginning of year	40,000,000	75,000,000	33,482
Available supply	272,853,456	316,600,000	141,337
Deducts exports in ore, matte, ingots	78,000,000	82,000,000	36,607
Consumption	119,853,456	169,600,000	75,714
Stocks on hand end of year	75,000,000	65,000,000	29,018

*From the Engineering and Mining Journal, N. Y.

**Copper Production of the United States.*

	1882.	1883.	1884.	1885.	1886.	1887.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
Lake Superior	56,982,765	59,702,404	69,353,202	72,148,172	70,890,798	75,471,890
Arizona	17,984,415	23,874,963	26,734,345	22,706,866	15,657,035	17,720,462
Montana	9,058,284	24,664,346	43,093,054	67,798,864	57,611,621	78,699,677
New Mexico	809,480	823,511	59,450	79,839	558,385	283,664
California	826,685	1,600,862	876,166	496,029	430,210	1,600,000
Colorado	1,494,000	1,152,652	2,013,125	1,146,460	409,306	2,012,067
Utah	605,880	341,885	265,328	186,199	500,000	2,500,000
Wyoming	100,000	962,468	....	....	....	....
Nevada	350,000	288,077	100,000	5,871	50,000	....
Idaho	....	....	46,667	40,381	....	....
Middle States	294,695	324,706	252,154	190,000	....	....
New England	1,555,000	612,124	904,423	231,602	313,719	200,000
Southern States	400,000	396,175	817,711	40,199	29,511	....
Lead refiners	125,000	782,880	950,870	910,144	1,282,496	2,432,804
Domestic production	90,646,232	115,526,053	144,946,653	165,875,766	156,735,381	180,920,524
Imported ores	1,000,000	1,625,742	2,858,754	5,086,841	4,500,000	3,750,000
Total production	91,646,232	117,151,795	147,805,407	170,962,607	161,235,381	184,670,524
Stocks, January 1	....	....	30,000,000	30,000,000	35,000,000	40,000,000
Available supply	....	....	177,805,407	200,962,607	196,235,381	224,670,524

*From the Engineering and Mining Journal, N. Y.

There is no danger of the menace of a surplus. This much, possibly, may be put to the credit of the syndicate, that it gathered up the surplus copper, where it will be held to the advantage of the producers.

Thus while the market is as of old, the producer selling directly to the consumer, the demand being at least equal to the consumption, there is a natural condition of affairs and the producers are realizing more than they did under the syndicate.

With bar and flat copper at 14½c and ingot at 14c and the consumers willing to make long contracts at the latter

rate it is not surprising that copper mining men regard the future with hope and confidence. Every branch of the industry is in a healthy, active condition. There are no clouds portending and no indications of disaster.

**The Principal Copper Supplies of the World.*

Countries.	1888. Tons.†	Countries.	1888. Tons.†	Countries.	1888. Tons.†
Algiers	50	Italy	2,500	Mason & Barry	‡7,000
Argentine Republic	150	Japan	‡11,000	Sevilla	1,700
Australia	7,450	Mexico:		Portugueza	‡900
Austria	1,010	Boleo Co.	2,506	Other mines	‡7,200
Bolivia — Coro-coro	1,450	Other Mexican	300	U. S. of America:	
Canada	‡2,250	Newfoundland:		Lake Superior	38,772
Chili	31,240	Betts Cove	1,300	Montana	43,973
Cape of Good Hope:		Tilt Cove	750	Arizona	14,821
Cape Copper Co.	5,800	Norway:		Other States	5,562
Namaqua Copper Co.	1,700	Vigsnaes	1,020	Venezuela:	
England	‡1,500	Other Norwegian	350	New Quebrada	4,000
Germany:		Peru	250		
Mansfeld	‡13,380	Russia	4,700	Total production	261,852
Other German	‡1,850	Sweden	‡900		
Hungary	858	Spain and Portugal:			
		Rio Tinto	‡32,000		
		Tharsis	‡11,500		

* Compiled by Henry R. Merton & Co., London.
† In English tons of fine copper.
‡ Estimated.
Average of prices on the 1st of each month { Chili Bars, £82 7s. 6d. / G. M. Bs. 76 } .... £42 3s.

Average Price per pound of Lake Copper at New York.

* Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.	cts.
1860	22⅜	23⅞	23⅞	23¾	22⅞	22⅛	21⅝	21½	21⅝	21¾	20⅞	20	22⅛
1861	19⅝	19¼	19½	19⅜	19⅝	18⅛	17¾	18⅝	19⅝	20⅛	21⅞	24¾	19⅝
1862	27½	26⅛	24	22¼	21⅝	21⅞	23⅛	24¼	25⅛	29⅞	31⅞	31	25¾
1863	33	36	34	30⅛	30¼	30¼	30⅛	30	31⅞	33⅞	30¾	33⅝	32⅞
1864	40⅝	41⅞	42	43¼	43⅝	46⅛	59¾	51¼	50	47½	48	49¼	46⅛
1865	48¼	45	39¼	34½	32	29⅛	29⅛	31⅛	31⅞	32⅛	39⅛	42⅞	38⅛
1866	40	39¾	32½	29¼	29⅞	32½	32¼	30⅝	31⅛	30⅞	29¾	27¾	31¾
1867	28⅛	27⅛	25¾	24	24⅛	24¼	25	26	26¾	24¾	22⅞	22⅝	2 ⅛
1868	22⅛	23¼	23⅛	23¾	24⅛	23⅞	23¾	24⅛	23⅞	23⅛	23¼	24⅛	23⅝
1869	25	26⅛	25⅞	23⅝	24	22⅞	22	22⅛	22⅛	22⅝	22¼	21¾	23⅝
1870	21⅞	20⅞	19¾	19⅛	19	19¾	20⅝	20⅛	21⅛	21¾	22¼	22¼	20⅝
1871	22⅛	21⅞	21½	21½	21¼	21⅞	22⅛	22¾	23⅝	23⅛	24⅛	26⅛	22⅝
1872	27¾	28⅝	33	41¼	36⅛	35⅛	33¼	33⅛	33⅛	32⅛	31⅞	32¼	33
1873	34¼	34⅝	34¼	33⅝	31⅛	29¼	27¾	27⅛	26	23¼	22⅛	24¼	29
1874	24¾	24⅝	24⅞	24⅞	24¾	24⅞	21⅞	20	21⅛	21¾	2 ⅜	23¼	23¼
1875	22¼	22¾	21½	21½	21⅛	22¾	22¾	23	23¼	23⅛	23	23⅝	22⅝
1876	23⅛	2 ⅞	22	22	21⅞	20	19¾	19	20	20⅜	20¼	19¾	21
1877	19¼	19¼	19¼	19⅜	19⅝	19⅛	19	18⅛	18	17⅞	17⅝	17⅝	18⅝
1878	17½	17¼	17	16⅞	16½	16¼	16⅛	16⅛	16	15¾	15⅝	15⅞	16⅝
1879	15¾	15⅛	15¾	15⅞	16	16⅛	16	16⅛	16½	19⅛	21½	21¼	17⅝
1880	23	24⅛	23¼	21¾	19	18⅛	18½	19	18¾	18¾	18¾	19	20⅝
1881	19¼	19¼	19⅛	18⅞	18⅛	17	16¼	16⅞	17½	18⅛	18⅛	19¾	18⅝
1882	20¼	19⅝	19	18⅞	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18	18	18⅝
1883	18	17¾	17¼	15⅞	15⅞	15⅛	15	15	15⅛	15⅛	15	14⅞	15⅞
1884	14⅞	14⅞	14⅞	14½	14¼	14⅛	14	13⅞	13⅛	13	12¾	11⅞	13⅞
1885	11¼	11⅛	10⅞	11	11⅛	11⅞	11⅛	11⅛	11⅛	11	11	11¼	11⅛
1886	11⅞	11⅞	11⅞	11⅜	10⅛	10	10	10	10⅛	11¾	12	12	11
1887	11⅝	11	10⅛	10¼	10	10	10⅝	10½	10½	10⅝	12⅝	17	11⅛
1888	16¼	16⅝	16⅛	16⅝	16⅞	16½	16¾	16¾	17¼	16½	16½	16½	16¾
1889	17⅛	16⅞	16¼	16⅛	12¾	12	12	12	11	11	12⅝	14⅝	13¾

* From the Engineering and Mining Journal, N. Y.

Dividends paid by Michigan Copper Mines in 1889 with total to date.

Name of Company.	No. Shar's	1889.	Total.
Calumet and Hecla	100,000	2,000,000	33,350,000
Central	20,000	40,000	1,930,000
Franklin	40,000	80,000	880,000
Osceola	50,000	50,000	1,222,500
Quincy	40,000	280,000	5,250,000
Tamarack	80,000	440,000	1,200,000
Atlantic	40,000	80,000	560,000

FLUCTUATIONS OF PRICES OF MINING STOCKS IN BOSTON, DURING 1889.

Name and Location of Company	Par value.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Sales.
		H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Allouez, Mich.	25	**4.88**	3.63	4.10	3.00	3.00	1.00	1.25	.90	1.06	.95	1.00	.90	.90	.63	.75	.70	.70	.63	1.00	**.50**	1.10	.60	1.63	.90	38,660
Arnold, Mich.	25	**-25**		.20														.07	.06	.07	**.05**					1,800
*Atl'ntic, Mich.	25	**18.50**	13.00	14.75	14.00	13.50	10.00	10.00	9.00	10.25	8.25	9.50	9.00	9.25	9.00	9.75	9.00			8.75	**7.50**	13.50	10.50	15.00	12.25	13,908
Aztec, Mich	25																	.05		**.07**	**.05**			.08		2,200
*Cal.&Hec. Mich.	25	**300.**	269.50	268.00	260.00	263.00	214.50	228.00	202.00	220.00	**199.**	219.00	206.00	215.50	205.00	230.00	215.00	220.00	209.00	225.00	211.00	240.00	224.00	260.00	245.00	12,976
*Central, Mich.	25	**20.00**	18.00					**10.00**																14.00		195
*Fr'nklin Mich.	25	**17.00**	13.25	16.00	13.75	15.00	10.00	11.00	9.00	10.50	**8.50**	10.00	9.25	9.75	8.75	10.13	9.25	9.88	8.75	11.00	8.75	16.38	11.00	**18.00**	14.75	2,379
Humboldt, Mich.	25																					.15	.13	13.		150
Hungarian Mich.	25																					.20	.15			400
Huron, Mich.	25	**6.00**	4.13	5.25	4.00	3.00	2.00	2.50	2.00			1.25		.75		1.00	.88	.75		.75	**.63**	2.75	2.00	3.50	2.00	10,400
Kearsarge Mich.	25	**12.00**	8.00	10.50	8.00	8.00	6.88	6.00	5.00	5.58	5.00	5.50	5.00	6.00	5.00	6.00	5.88	5.00	4.25	6.75	**4.25**	8.60	6.25	10.88	6.50	20,014
Mesnard, Mich.	25	.43	.30																					.60	.50	1,200
National, Mich.	25	**7.63**	4.75	5.38	3.50	4.00	2.00	2.00	1.75	1.50	.75			1.00	.50	1.10	1.13	1.00	.88	1.00	**.75**	3.00	1.25	3.00	2.00	18,615
*Osceola, Mich.	25	21.00	16.00	18.50	12.50	15.50	12.50	13.00	9.00	10.00	**7.13**	10.00	9.50	9.75	8.50	12.00	9.50	11.00	9.50	12.00	10.00	19.00	12.00	**24.25**	17.00	29,749
Pewabic, Mich.	25			5.00	4.68	5.00	3.25	3.25		3.25	**2.25**							3.00	2.25	3.00		**5.50**	3.63			10,685
Pontiac, Mich.	25	.40	.30																					.25	.23	1,000
*Quincy, Mich.	25	**85.00**	68.80	71.00	66.38	67.00	46.00	50.00	49.00	54.50	47.00	54.00	51.00	57.50	49.00	54.00	51.00	54.00	49.50	54.00	**50.00**	70.00	55.00	70.00	67.00	4,712
Ridge, Mich.	25	1.88																				1.25				1,794
South Side Mich.	25																							.25	.20	.....
*Tamar'ck Mich.	25	**159.‡**	3.50†	152.00	140.00	144.00	120.00	125.00	105.00	110.00	102.00	107.00	103.00	102.50	**96.00**	105.00	100.00	108.00	100.00	124.50	104.00	101.00	120.00	155.00	129.00	17,104
Washingt'n Mich.	25																					.23				100

* These companies paid dividends in 1889. † Rights. ‡ Cash. Total sales, 256,554.

THE ALLOUEZ MINE

was in operation at the beginning of the year. As explained in the last report everything about the location had been put into excellent condition. New machinery was added and the equipment thus made adequate to working on a larger scale than had theretofore been done. At the time the company resumed control of the work in the mine there was no advanced opening. The tributes had exhausted all the stopes. The policy of the company was to sink the shafts deeper and extend the drifts and get the mine in shape to produce more rock, hoping to find enough that was good to give better results for mining than had been obtained previously. No conspicuous success, however, has attended the effort.

The rock has proved no richer, on the average than formerly and work for some time has been partially suspended. Recently an assessment of 50c per share has been called to raise money to resume work in full force again.

This assessment is the twenty-second I believe, that has been made and although copper is 14½c per lb., it maybe that this assessment will not be of any more avail than those which preceded it. It is clear that the Allouez is a poor mine. The percentage of copper in the lode, on the average, is too low to be profitably worked except under favorable circumstances. The mine contains some very rich rock. So does the Peninsula .and the Conglomerate, all in the same conglomerate belt, and in all of them the general character of the lode is lean and barren. One would think that somewhere it would prove rich enough to be profitable, but so far such a portion of the belt has not been found and unless more good ground can be opened in the Allouez than has ever yet appeared at any one time, I cannot see how it can be expected that it will pay in the future better than it has in the past.

I saw it stated that the Atlantic rock yielded a lower percentage than the Allouez. But it must be remembered that in the Atlantic mine all the rock is taken. There is no selection made, only such pieces of trap, that break down from the hanging wall, are thrown out. This, with the facts that the deposit is of good width, that it dips at a favorable angle, that it is easily broken down in the mine and treated in the stamp mill, that many of the arrangements, especially the railroad and stamp mill are the best, enables the company to operate with a profit, notwithstanding the extraordinary low percentage of copper in the rock. But the Allouez belt, being a conglomerate, is not so easily mined and manipulated. The cost is greater, and if the stamp mill facilities were as good as those of the Atlantic, even then more good rock must be found than has appeared heretofore. The Allouez conglomerate is not the only copper belt crossing the property underlying it, southeast are the Calumet and Hecla conglomerate and the other important belts, which may, on investigation, prove rich in copper.

These same belts also cross the Kearsarge, Iroquois, Seneca and other properties and will be investigated in time. The Allouez is in good shape, it is now well equipped with machinery and every other essential for extensive work and if the conglomerate were a little richer it could be profitably worked, perhaps even as it is, if copper shall continue to bring as high a price as it does now, with the improved facilities for working, the mine may be carried on with profit. No doubt the policy, which prevails at some of the other mines, of opening the mine extensively, if carried out here would be of great advantage. In fact it is of absolute necessity. On no other basis can success be hoped for, to open the mine extensively and select the ground is the only way that good fortune can be attained. In February, ten drills were at work in the mine, sinking and drifting. The only way is to open the mine largely, not just enough ahead to keep the mill supplied with rock, but far enough ahead to crowd the mill with selected rock, leaving the poor rock standing, as far as possible, in the mine. A limited test was made of the amygdaloid which is 500 feet east of the conglomerate; a test pit 50 ft. deep was sunk but the belt at that point was found to be poor.

The Allouez mine has been operated cheaply enough but not extensively enough. The mining cost, 85 cents per ton, stamp mill, 42 cents, a total manipulating and transportation cost of $1.50 per ton of rock mined is low, certainly. But still the copper costs nearly 13 cents per pound, so that it is evident that there must be a greater production. More rock and better rock, if possible must be mined.

No. 1 shaft is down to the 11th level and will be connected with the 12th by an uprise. No. 2 is to the 18th. It is in contemplation to supply a new compressor, for which they have abundant steam power; and to add some additional machinery to the rock house—a Blake crusher.

In the agent's report it is stated that 131,400 tons of rock were broken, 5,275 toils of which were rejected in the mine, and 9,517 tons were rejected in the rock house, making a total of 14,792 tons rejected, being 11.25 per cent of that mined. This would require more compressor power and drills, and the investment of more capital in extended openings.

Since the copper market has had such an unexpected change for the better, the directors have decided to follow out this course, and they expect that the 50 cents assessment, which has been called, will provide sufficient funds to do this. The stamp mill will, it is expected, start up on the 1st of May, next, by which time sufficient ground will be opened to allow of a regular output of 500 tons daily, which, if it yielded no more than it did before the mine was closed down the last time, would give a monthly product of about 100 tons of refined copper.

The following shows the operations during the past year.

Receipts.

1,762,816 lbs. copper, product of 10 months	$213,019 26
Assessment No. 19 (balance)	158 50
Assessment No. 20	40,000 00
	$253,177 76

Expenditures.

Running expenses at mine for 10 months (Jan. to Oct.), as per detailed statement hereafter	$196,878 23	
Freight	3,709 61	
Smelting	18,512 16	
Brokerage	1,937 66	
Insurance	252 88	
Expenses	4,125 57	
Storage	59 25	
Taxes on copper	130 82	
	$225,585 35	
—Add—		
Expenses for Nov. and Dec.	5,175 41	
Construction account	6,054 96	
Interest on loans	1,075 41	
Total expenditure		$248,791 53
Excess of receipts		$14,386 23
The balance from 1888 was		15,034 26
Leaving balance Dec. 31, 1889		$29,420 49

as shown in detail in the following statement of assets and liabilities:

Assets.

Cash		$8,224 96
Copper on hand		5,540 00
Loans		10,000 00
		$23,764 96

At Mine.

Cash	$38 42	
Supplies and fuel	8,771 73	
Wood and timber (standing)	600 00	
Accounts receivable	975 33	
		10,385 88
Total assets		$34,150 34

Liabilities.

Indebtedness at Mine	$2,548 71	
Accounts payable	2,181 04	
		4,729 75
Balance of assets		$29,420 49

The following summary of the results for the year is, we think, very creditable, indeed, to the mine managers:

Tons of rock mined	131,400
Tons of rock hoisted	130,125
Tons of rock treated at mill	116,608
Refined copper per ton of rock mined	13 41-100 lbs.
Refined copper per ton of rock milled	15 11-100 lbs.
Total yield of mineral	2,546,480 lbs.
Total yield of refined copper	1,762,816 lbs.
Cost of mining, per ton of rock milled	$0.8578
Cost of hoisting, per ton of rock milled	.1318
Cost of selecting and breaking, per ton of rock milled	.1478
Cost of general surface expenses (less rents) per ton of rock milled	.0532
Cost of transportation to mill, per ton of rock milled	.0520
Cost of stamping and separating, per ton of rock milled	.4288
Cost of expenses on mineral, per ton of rock milled	.0270
Total net working expenses, per ton of rock milled	1.0884
Total net working expenses, per ton of rock mined	1.4980
Cost of freight, smelting, and marketing product, including New York office expenses, per ton of rock milled	.2465
Gross value of product, per ton of rock milled	1.8268
Cost of copper marketed and all expenses paid, per pound	.1280

JOHN STANTON, Sec. and Treas., New York.
FRED SMITH, Agent, Allouez, Mich.

Table of Products.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1869	1	1,575	1881	736	1,007
1873	10	1,161	1882	841	1,557
1874	504	130	1883	875	1,337
1875	692	1,574	1884	964	174
1876	780	1,785	1885	1,085	476
1877	650	479	1886	962	1,169
1878	565	1,146	1887	442	1,010
1879	715	1,452	1888	157	198
1880	656	471	1889	883	836
Total				11,427	1,747

THE CENTRAL MINING COMPANY

works in a fissure vein in the south side of the mineral range in Keweenaw county. It is an old mine and has uniformly, from the first year of its working, been a profitable one. I have given the history of this interesting and valuable mine in the earlier reports of this office, and

at the present time I know of little to add. The mine is one of the deepest, 2,800 feet vertically down, and is penetrated by a single hoisting shaft, that descends to the 30th level and a main engine shaft that reaches to the 22d level. There is also an inclined shaft that conforms nearly, in inclination, with the dip of the formation and that goes down to the 9th level.

Though deep, the mine is a short one. From the 9th level to the 22d, the length of ground stoped anywhere is scarcly above 300 feet. They have followed down a portion of the vein that has been found to be paying ground, and have not gone much beyond it.

There was a slight angle in the shaft near the top which has been taken out and the shaft straightened, much to the advantage of the subsequent work. The hoisting machinery is of the best. Just now the mine is poor in the bottom, but a change may appear for the better any time.

Table showing Product of Central Mine—refined Copper.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1856	82	403	1873	751	1,137
1857			1874	870	900
1858	71	1,011	1875	733	952
1859	84	812	1876	1,080	1,400
1860	125	1,370	1877	907	1,040
1861	70	139	1878	945	1,033
1862	133	1,072	1879	899	1,495
1863	278	1,548	1880	1,013	78
1864	381	1,855	1881	709	495
1865	346	1,200	1882	676	1,595
1866	574	1,842	1883	634	599
1867	678	745	1884	723	747
1868	1,353	1,827	1885	1,078	1,408
1869	901	1,801	1886	1,256	886
1870	603	1,136	1887	1,099	1,133
1871	716	912	1888	908	737
1872	623	56	1889	695	592
Total				20,355	1,990

John Dunstan, Agent; Samuel Bennett, Mining Captain; J. F. Lobert, Clerk; John Stanton, Secretary and Treasurer, New York.

CENTRAL MINE REPORT.

The directors present the following statement of the operations during the year 1889:

The production of mineral was 803 tons, 1,205 pounds, which yielded about 79 per cent, or 1,270,302 pounds of refined copper, which, at 12.57 cents, gave		$159,704 73
Add interest received		5,815 78
		$165,520 51
Costs.		
Working expenses at mine	$143,475 89	
Smelting, freight and all other expenses	24,388 18	
Net running expenses	$167,864 07	
Cost of straightening and repairing No. 2 shaft, new shaft house, guides, skips, etc.	24,232 03	
Making the total expenses		192,096 10
Excess expenditures over receipts		$26,575 59
Surplus from 1888	$225,502 79	
Credit real estate for stumpage	5,588 48	
		231,092 27
Net surplus Dec. 31, 1889		$204,516 68

From this surplus a dividend of $1 per share, or $20,000 was paid Feb. 1, 1890.

The average price obtained for our copper was about 2¼ cents per pound less than in 1888, while the production was nearly one-third less. This diminution in both quantity and price accounts for the reduction in receipts.

For about three months of the year nearly the entire force was engaged in the work of straightening, enlarging and retimbering our main working shaft which had attained a depth of about 2,900 feet. The upper portion of the shaft had—many years ago— been sunk on the dip of the vein, as was customary in those days, and, while not departing from the vertical to any great extent in any place, yet it was too small and crooked to admit of hoisting loads of sufficient size, or with sufficient rapidity to compensate for the increasing depth, and its reconstruction had become indispensable.

To the actual cost of this work and of new shaft house and other appliances should be added the loss sustained by interruption of production for three months, during which time a large part of the usual expenses were running on. An estimate, based upon the average product while working, justifies the directors in assuming that if no interruption had taken place the net earnings would have been about $20,000, and they therefore decided to pay out of the surplus a dividend of $1 per share.

At this time it is more difficult to forecast the future than at any former time at which your directors have been called upon to report. Although the product continues fair in amount, yet the prospects at the bottom of the mine are not encouraging. The vein after passing through a belt of "amygdaloid" in which it became split up and disordered, is entirely cut off on reaching a thick belt of "conglomerate." There is no reason to doubt that the vein exists in the "conglomerate" and in the underlying belts, but the formation seems to have been displaced at the point of contact between the "amygdaloid" and the "conglomerate," carrying the vein with it, and its location has not yet been determined. How soon the vein will be found, or what its value will be, is of course uncertain.

For some months past we have been driving a crosscut from the nineteenth level towards the "Northwestern" vein, approximately 1,640 feet distant from and parallel with the "Central" vein. The drift is now about 560 feet from the objective point, and as the "Northwestern" vein was worked many years ago to a depth of about 400 feet and produced some large masses of copper, we expect to find something of value when we reach it, which we should do before the close of the current year.

While it is not pleasant for your directors to chronicle a check in the uniformly successful career of the past 26 years, yet a full statement of the situation is due to stockholders. There is good reason to believe that the "Central" vein will be recovered, in which event the equipment of the mine is ample to reach a far greater depth than we have attained, and it is probable that the "Northwestern" vein will prove productive when reached. Work is being energetically pushed, and it is hoped that in a very short time our usual condition of prosperity will be restored.

JOSEPH E. GAY,
WM. C. STURGES,
R. PORTERFIELD,
EDWIN H. MEAD,
A. S. SWORDS,
JOHN STANTON,
Directors.

NEW YORK, March 26, 1890.

ASSETS AND LIABILITIES.

DECEMBER 31, 1889.

Exclusive of Real Estate and Mine Plant.

Assets.

Cash		$15,619 78
Loans		117,040 00
Accounts receivable		45,119 22
		$167,779 00
At Mine.		
Cash at mine	$3,287 35	
Merchandise in store	25,303 30	
Supplies	25,503 60	
		54,106 25
		$229,885 25
Liabilities.		
Agent's drafts	$3,057 35	
Indebtedness at mine	18,181 54	
Accounts payable	4,119 68	
		25,358 57
Balance of assets		$204,546 68
(Less the dividend of Feb. 1, 1889, of $20,000.)		

SUMMARY OF RECEIPTS AND EXPENDITURES OF CENTRAL MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1889.

Receipts.

Capital stock paid in	$100,000 00
Copper sold, including silver	8,833,199 04
Profit on timber sold	79,011 75
Total receipts	$9,012,210 79

Expenditures.

Net expenditure for mining operations, building and machinery, smelting and marketing copper, and incidental expenses	$6,858,972 07	
Net cost of "Madison," "Northwestern" and "Eagle River" lands	18,732 04	
Total expenditures		6,877,804 11
Balance of receipts		$2,134,516 68
Deduct dividends paid		1,930,000 00
Net surplus December 31, 1889		$204,516 68
(As shown in statement of assets and liabilities.)		

AGENT'S REPORT

CENTRAL MINE, KEEWENAW CO., MICH.,
January 1, 1890.

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

DEAR SIR—The following report of operations at our mine during the year 1889, is respectfully submitted:

Ground Broken.

Sinking in shafts and winzes, 244 and 8-12 feet, average cost	$17 80
Drifting on vein and crosscuts 193 and 11-12 feet, average cost	7 75
Stoping on vein, 2,250 and 14-36 sup. fathoms, cost	13 25
Stoping on plats, etc., 400 cubic fathoms.	
The total amount of ground broken in openings and stopes, exclusive of crosscut to "Northwestern," is 3285 cubic fathoms.	

Production.

1,030 bbls. stamp copper, weighing	1,453,715 lbs.
34 hhds. barrels copper, weighing	99,320 "
32 mnesse copper, weighing	54,170 "
Total	1,607,205 lbs.
Or 803 and 1205-2000 tons.	
Average yield of mineral per fathom of ground broken	489 lbs.
Average yield of ingot per fathom of ground broken	287 "

The total expenditures for the year are as follows:

Mining and surface expenses	$130,078 77
Stamp mill expenses	15,197 64
Taxes	2,250 32
Construction account and work on No. 2 shaft	24,252 08
	$171,778 77
Less rents received	4,070 85
Total expenses	$167,707 92

SINKING.

No. 2 shaft has been sunk from the 29th level to 16 feet below the 30th level, and a winze has been sunk from the 29th to the 30th level. In sinking this winze we passed through a very thick belt of amygdaloid. In this belt the vein was so split up that it was impossible to follow the right vein; therefore, when the winze was down to the 30th level we had no vein to follow, and crosscutting will have to be done to find the vein at this level.

DRIFTING.

The 29th level has been extended north 332 and 3-12 feet. About 100 feet of this drift has opened up a good vein, varying from one to four feet thick. This level has also been extended south 181 feet. This drift has been poor throughout.

The 28th level has been extended north 103 and 10-12 feet, and south 138 7-12 feet. These drifts have been very changeable, but altogether have opened up about 300 feet of good stoping ground but have shown no mass copper.

The 27th level south has been extended 147 and 2-12 feet. This level has shown up a good vein producing good stamp rock, barrel work and some small masses.

The 26th level has been driven south 88 feet through poor ground and is discontinued for the present.

At the 30th level but very little drifting has been done, only 48 feet south and 11 and 9-12 feet north, and as this has been done in search of the vein it has not opened up any stoping ground.

A crosscut has been driven from No. 2 shaft east, to connect with winze, a distance of 217 feet; also the crosscut from No. 4 shaft towards the "Northwestern" at the 19th level has been extended 596 feet and is now in 948 feet east from No. 4 shaft. According to surface measurements we have yet to extend this crosscut 692 feet to reach the "Northwestern" vein. I have now to put in an air machine and pipes in this crosscut, and then I intend to work it full time and get it through to the vein as rapidly as possible. From all I can learn we ought to cut a good vein in this portion of the company's property, and which will be quite an addition to the vein we are now working.

CONSTRUCTION.

The past year we have spent considerable time and money in improvements of various kinds. The most expensive and beneficial has been the straightening of No. 2 shaft. This shaft has been made perfectly vertical from the surface to the 30th level.

From the surface to the 5th level we had to make a complete new shaft and a new skip road from the top to the bottom has been put in. Now we are using a cage and a dumping skip, which works splendidly. The skip being double the size of the old one, we can now hoist double the amount of rock that we formerly did in the same given time. This work of straightening No. 2 shaft occupied a greater part of our force for about three months, and of course while this work was going on not much work could be done in the mine, which will account for the falling off in our product the past year. Should the 30th level prove good we will be in good shape for a long time to come.

JAMES DUNSTAN, *Agent*.

LAC LA BELLE MINING COMPANY

is the successor to the franchises and to the real and personal estate of the Conglomerate Mining Company, which latter corporation has ceased to exist.

There is nothing new to be said about this mine. There is a fine plant of hoisting machinery, compressor, air drills, new stamp mill, railroad, numerous dwellings—good ones—fine new store, office, etc. In fact, from 1881 to 1884, a period of about three years, the company expended very nearly a million of dollars in preparations to mine, and then finding the mine too poor to pay, it was shut down permanently. It is an old location, near the end of Keweenaw Point, in the south slope of the range, that is south of "the greenstone," and there are several fissure veins that have been mined in the years long gone by, with but poor success. In 1880, the company discovered some rich evidences of copper in the conglomerate belt that underlies the greenstone,

and therefore began to open a mine in it, and to make the most extensive surface outlay. The company holds a large estate, from which it has been cutting the pine timber since the mine ceased to be operated.

What the future plans are I am unable to state.

Tribute copper to the amount of one ton and 1,728 pounds were obtained in 1889. The aggregate yield of all the mines on this property is 2.624 tons, 1,608 pounds.

A. P. Thomas, Resident Agent, Delaware Mine, Mich.; John Hoskins, Secretary, 308 Walnut St., Philadelphia, Pa.

A meeting of the board of directors is called for May 20, to increase the capital stock of the company to $625,000.

THE COPPER FALLS MINING COMPANY

continues to operate moderately under the supervision of Capt. Moyle. The stamp mill has not been running for some time; but the opening work has been pushed along with a view to stoping later on, and to be in shape to keep the mill supplied with better rock than the average. I have described this mine very fully in past reports and it is not necessary to repeat what has been said heretofore. The mine is in the north slope of the range and was originally a fissure vein mine, opened in what was called the Owl Creek vein. The vein crosses the formation at about right angles and dips vertically. The formation lies very flat; that is, it dips to the north under Lake Superior at an angle of 22° to 28°. The apex of the ridge dividing the northerly and southerly slopes is a coarse crystalline trap—called, through the country here, "the greenstone." The mine was formerly entered by shafts high up on the hill; but later an adit was driven from the north, on the horizon of the 9th level, in the Owl Creek vein.

The adit is about three quarters of a mile in length, and is laid with T-rail, on which the rock-cars are run into and out of the mine, drawn by a small locomotive. The formation is made up of succeeding beds of trap, sandstone, amygdaloid, etc., and it is in one of the latter, called the ash-bed, that the mine has for many years been worked. This ash-bed is a dark colored, soft amygdaloid bed, about seven feet wide, that carries, disseminated through it, a small percentage of copper, about 7-10 of one per cent of ingot, so that it is very difficult to make it pay to work it. The difficulties, the advantages of the lode and the methods of working are very fully described in former reports.

They are driving the adit south to the greenstone, exploring the Owl Creek vein; nothing of great importance has been discovered.

Table of Product of Copper Falls Mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
Previous to 1855	158		1872	260	862
1855	100		1873	643	340
1856	104	10	1874	535	320
1857	153	1,305	1875	208	1,587
1858	151	1,852	1876	8	1,488
1859	178	174	1877	5	1,980
1860	255	818	1878	5	1,790
1861	240	11	1879		
1862	299	299	1880	3	645
1863	159	1,348	1881	936	1,121
1864	179	808	1882	293	1,500
1865	235		1883	402	
1866	508	1,160	1884	445	1,168
1867	1,128	1,485	1885	575	538
1868	239	1,384	1886	689	679
1869	345	1,400	1887	270	
1870	386	990	1888	500	
1871	229	881	1889	434	1,136
Total				10,789	1,389

David Nevins, President, Boston, Mass.; Geo. Brooks, Treasurer; J. H. Moyle, Superintendent, Copper Falls, Mich.

THE ONTONAGON COUNTY MINES

are all, except the National, working on tribute. Ontonagon and Rockland have now railroad connection with the D., S. S. & A. line, but still there is no impetus given to its mining interests.

The mining history of the Ontonagon district has for many years been a record of failure, some of the undertakings have been such conspicuous misfortunes that capital has no doubt become weary of investing there. However, there have beep very rich mines at Rockland, and I have faith in the future of some of the locations in that county.

AT THE NATIONAL MINE

all mining work underground except tramming and hoisting rock previously broken ceased before the close of the year 1889. Prior to this, trial was made of the old burrows which it was stated would yield a good percentage of copper.

This was anticipated both of the National and the Minesota rock piles; it also being intended to endeavor to work up the latter. So far, the rock taken from the mine and also that from the burrow, has proved disappointing. It has yielded less than one per cent of copper. Just at present the mill is idle, some jigs are to be added and repairs made and it is said that it will be run on the burrow rock next summer. One thing is shown pretty conclusively, the amygdaloid belt is not a rich one; it can scarcely pay to work now, or in the future. Twelve men are tributing in the south vein.

The product of the National in 1889 was 258 tons 723 pounds, making an aggregate production of 5,712 tons, 487 pounds.

Wm. E. Parnall, Agent, Rockland, Mich.; D. L. Deninion, Secretary and Treasurer, 19 Congress Street, Boston.

THE MASS MINE

is worked on tribute by B. E. Chynoweth. He has fourteen men employed in the mine under James Chynowreth. They get some masses of copper, one recently that weighed 1,200 pounds. The Mass is a small mine, but it is a very good one. It has yielded an aggregate of 2,476 tons and 1,730 pounds of refined copper.

THE RIDGE COPPER COMPANY

keeps its mine at work on a system of tribute. The results of operations in 1889, are as follows:

Product was 31,929 pounds which realized		$2,921 52
Received from sale of treasury stock		5,000 00
Balance of assets, per last report		5,440 63
		$13,362 15
Mine expenses	$3,547 68	
Smelting and other expenses	2,225 00	
		5,782 68
Balance assets Jun. 1, 1889		$7,579 47
The total expenditures to date have been		$1,175,582 92
Total dividends, etc.		99,284 50
Company's stock held		304 50
Cash on hand		7,309 40
Total receipts to date		$1,486,413 32
Capital stock bid in for property		200,000 00
Assessments		219,988 50
Total receipts from sales of copper		1,044,538 80
Sale of treasury stock		5,000 00
Interest acct., collected Jun. 1, 1889		16,735 02
Total receipts		$1,486,413 32
Per cent of copper in mineral in 1889		76,334 00
Total inventory of mine, etc.		17,051 27

There is an accumulation of stamp rock which it is proposed to stock the mill to work up.

The aggregate production is 2,609 tons, 969 lbs.

Philip Highley, Sec'y and Treas., Boston, Mass.; Alfred Meads, Resident Director, Ontonagon, Mich.

THE ADVENTURE

is one of the oldest mines in the country and work done by tributers during the past year on the Knowlton vein, shows that the property has merit. The vein is marked along on the surface by ancient Indian pits and where the tributes have opened on it, it is well defined and shows copper in paying quantity—10 men are working. Thomas F. Mason, Pres't., N. Y.

IN THE HILTON MINE

also, 8 tributers are working on the Knowlton vein and are finding copper enough to pay them well, so they say.

THE EVERGREEN BLUFF MINE

was pumped free of water by Capt. Richard Chynoweth and he mined last year 14 tons and 773 lbs. of copper. Six men are working this winter.

THE KNOWLTON MINE

is also being tributed by Richard Chynoweth & Son. It is reported that an 8 ton mass of pure copper has been found. The Knowlton vein is one of the best on the lake.

THE ISLE ROYAL LAND CORPORATION (LIMITED)

is a company organized to hold a large body of lands in Isle Royal. The island contains, it is said, 110,000 acres of land, of which this new company holds 84,000. They have been prospecting all summer for copper; but aside from the primary object of producing copper, building stone, etc., there is an ulterior purpose of making of the island a great pleasure resort, for which the situation is in many particulars admirably adapted, and for which purpose there is no doubt but it will be, in some degree, ultimately used.

The company is an English one, S. S. Robinson, general manager. Mr. Jacob Houghton, of Detroit, was one of the promoters of the scheme and has much to do with the conduct of the exploration. The island is traversed by the Keweenaw series and contains numerous veins and copper bearing belts in which much ancient mining was done. The mining companies that have operated there were not successful; but there are abundant indications of copper—fissure veins, amygdaloid and conglomerate beds, and it is quite possible that discoveries may be made that will cause Isle Royal to become an active mining district.

THE CALUMET AND HECLA

mine is rapidly recovering from the effects of the fires, which continued so long and destructively.

The entire mine, including the portions where the fire prevailed, will soon be producing copper again.

There is, perhaps, no mining property in which the mineral value is so little a matter of conjecture as this. The territory is so large and has been explored so far in advance of the present opening of the mine, that a reasonable estimate of the great value of the mine can be made.

The deposit is not all equally rich; but its productiveness is found to be the same at the greatest depth that has been reached, that it is nearer the surface, and there is every reason to suppose that this condition of things will continue indefinitely; at least, to as great a depth as can be reached during many years to come.

The thickness of the belt is from eight to twenty-five feet, probably averaging about twelve feet, of productive material.

This would give 2,400 cubic fathoms to the acre; and, since the yield of ingot copper to the cubic fathom is about 1,300 pounds, worth in the market, today, 14½ cents per pound, it is easy to estimate the enormous wealth which the company possesses in its estate of 1,300 acres. The portion of the mine which yields the lowest percentage of copper is the south end, called the South Hecla, or "Black Hills;" but at the same time the deposit here is much thicker than elsewhere, so that, probably, as much copper is obtained from the same

superficial arc as elsewhere in richer portions of the mine.

For the benefit of those who are not familiar with the matter, it may be well to give a brief description of the situation. The mine is in sections 14, 15 and 23, T. 56 N., R. 33 W. Here are the villages of Red Jacket and Calumet (practically one village), which contain the mining population, etc. The deposit is one of the regular belts that make up the formation of the country. It is a conglomerate, through the mass of which the copper is disseminated in native form but seldom in large masses. Occasionally, the round boulders, which are contained in the conglomerate, or part of it, are found to be nearly pure copper. One can find round, smooth masses, which appear to the eye to be cobble-stones, but, taken in the hand, the impression is quite different. There has been a change of the material structure, copper taking the place of the rock material.

The bearing of the formation is about N. 33° E., and the northwesterly dip is 37½° with the horizon. There are 13 shafts, 5 in the north, or Calumet portion of the mine, 4 in the Hecla, and 4 in the South Hecla, all sunk in the conglomerate and thus going down on the incline of the formation. Two of these shafts between the Hecla and the extreme South Hecla shafts are new ones, and have but lately reached paying ground. The main shafts in the Calumet and in the Hecla mines are sunk to the 39th level, 3,750 feet from the surface, measured along the inclination, or a vertical depth of 2,280 feet.

The elevation above Lake Superior is 640 feet.

The conglomerate is all stamp rock and goes to the stamp mills situated at Lake Linden, five miles distant. The mine and mills are connected by a railroad, 4-ft. gauge, owned by the company.

Also contiguous with the stamp mills are the smelting works, which is practically a Calumet and Hecla concern. The capacity is sufficient to smelt all the copper produced by the mine.

The opinion was formerly entertained that the Calumet and Hecla company, in its mining operations, did not keep pace with the times; that many of its methods were obsolete, and that there was less enterprise and economy exercised than were shown by other leading companies. But this charge cannot be properly entertained now. Many and important improvements have been recently made and are still in progress that should place the Calumet and Hecla in the front rank of mining companies as well for the practical character of its equipment and its application of progressive methods, as for the great richness of the mine.

Great improvements have been made in the stamp mill, which have brought the manipulations of the rock to a high degree of perfection. The stamps are all now the Leavitt heads, a machine of great power and effectiveness. Much saving of copper at the mill has been secured by the more careful treatment of the slimes. A great number of slime tables are now employed in the mills. At the stamp mills of other companies the slime table has been a main dependence for many years; it is equally so now at the Calumet and Hecla mills. Also the mineral is only "dressed" to about 65% purity instead of 76% as formerly. The "mineral" thus goes to the smelters containing more impurities than formerly, but it has been subjected to less loss of copper.

The average number of tons of rock now daily treated in mills is about 3,000.

Among the things added at the mill, is the great wheel for elevating the refuse water and sand discharged from the mill. There has been one in use many years, which is 43 feet in diameter, the new one, which is in addition to the former, is 54 feet in diameter, its estimated weight is 200 tons. In 24 hours it will elevate water and sand sufficient to cover an acre of land, one foot deep. On the rim are 432 teeth, 4.71 inches pitch and 18 inches face. The material is of the best gun metal, and the finish is the most perfect. The teeth are polished as smooth as glass.

The wheel is driven by a pinion having 33 teeth and a speed of 600 revolutions per minute. The shaft is also of the best steel, 30 inches diameter, the journals being 22 inches diameter, 3' 4" long. The steel buckets, 448 in number, are 4' 5½" long and 21" deep. The combined capacity, is 3,000,000 gallons of water and 2000 tons of sand every 24 hours. The cost is about $100,000. The purpose of this wheel is to elevate the "tailings" from 11 stamp heads and to discharge them into launders that extend out into the lake, away from the shore. This wheel is illustrative of the magnitude of operations at the Calumet and Hecla—everything is on a stupenduous scale, as it must be, in a measure, to meet the requirements of so great a mine.

At the mine there are many notable matters in progress, the chief of which is the Red Jacket, or the new vertical shaft, that is sinking to the conglomerate. It is now, at this writing, March, 1400 feet deep and descending at the rate of three feet per day.

The rock, passed through, consists of alternating beds of trap approximating to amygdaloid, at intervals. A maximum thickness of 17 feet is all that has been, thus far, encountered.

According to estimate, its depth will be, when the conglomerate is reached, 3,400 feet to the 60th level, and about two years will vet be required to consummate the work. It will be 2,100 feet to the 36th level, and they are driving a crosscut from the mine in this horizon, west, to meet the shaft. The crosscut starts from No. 4 shaft and will be 1,700 feet long.

The plan is to use this crosscut for a tram-way from the mine to the shaft and to begin to use it as soon as they are connected. The shaft is 15½x25 feet, and divided into six compartments, four of them for balance cages, two for timber-way and pump pipes, etc. When the shaft is down to the 36th level, and the crosscut driven to

connect with it, four of the compartments will be fitted up with cages, two of them used for hoisting rock, without interfering with the work of sinking the shaft. This shaft will reach the lode at the 60th level, 21 levels below the present bottom of the mine, so that there will be a vast amount of stoping ground above this line of intersection. In point of fact, the mine has not been much stoped, anywhere, below the 28th level, and that in the stretch from No. 4 Calumet to No. 3 Hecla. Thus there will be not only the levels yet untouched but the pillars of conglomerate yet standing in all the levels up to the surface. These pillars, it seems to me, can be attacked by commencing at the top and removing them in succession, running the copper rock down and out through the crosscut to the vertical shaft. The copper can thus be substantially all removed, and the roof of conglomerate let to fall in.

They are hoisting now, March 1, from seven shafts: 4 and 5, Calumet, 3, Hecla, and 9, 10, 11, 12. No. 6 is now "holed" to the 25th level, is in good copper ground, and will soon be producing. They are repairing No. 2, Hecla, and No. 3, Calumet; but will not restore the man engines, both of which were destroyed by the fires; but they will use seven cars to carry the men. One is now used in the No. 8 shaft, and there are six more. They will be operated by separate machinery than that used in hoisting. These independent hoisting plants are already in readiness to use. At present, the men ride in the skips to considerable extent. The fires did so much damage that there is a world of work to repair the shafts. They did not see the bottom for two years; and, even yet, the water fills the deepest part of the mine.

In the Black Hills mine, No. 12 is to the 16th level, the others to the 18th. 9 and 10 constitute nearly a single shaft. From Nos. 3 to 6, Hecla, the distance is 1,100 feet, and the two short shafts that have been started in this space, Nos. 4 and 5, will be abandoned. It is also 1,100 ft. between Nos. 4 and 5, Calumet, but the good ground in the latter, did not begin until the 33d level was reached, so that no shaft will be sunk between. They are walling up, in masonry, all the levels at the shafts, to prevent any one going through them and to prevent fires. This work of sealing up the levels is proceeding rapidly, already the South Hecla levels are stopped. No. 3. Hecla, is nearest to the Tamarack No. 1. It is to the 34th level and in two levels more will be to the horizon of the upper point of the Tamarack. The 39th level, the deepest opening in the Calumet and Hecla, corresponds in depth with the 5th level of the Tamarack.

In sinking the new vertical shaft, rapid progress is made. In September, 109 feet were sunk. The greatest number of feet made in one month was 126, the timber used in the shaft, is southern yellow pine.

The new hoisting plant that they have been for two years past erecting will operate 2, 3 and 6, Hecla, shafts. The drums are coned 14' and 26' end diameters. This plant in appearance, is by far the finest on the lake. It is said to have cost $750,000, however this may be I do not know. The drums, etc., are named, respectively, Gratiot, Houghton and Seneca.

In extinguishing the fire all sorts of plans were resorted to, among others the surface was kept frozen to stop the leaks, etc. The hot gas was conducted from No. 3 in sheet iron pipes that were kept covered with snow which reduced the temperature to 30° to 40° when it was discharged again as far down in the mine as possible. The fire burned more or less to the 23d level. No trace has been discovered of the bodies of the men who were lost. They were probably utterly destroyed in the man engine shaft.

It has been in contemplation to erect a large rock house at the mine at which the rock from the shaft should be concentrated preparatory to being sent to the stamp mill, but this scheme has been abandoned and I was informed that it is the intention to crush the rock at each shaft.

Some very crude newspaper comment has been indulged in lately regarding the percentage of copper obtained from the Calumet & Hecla mineral, attributing this fact to the falling off in richness of the lode. In fact the mineral is the stamp mill product, the ingot, the smelting mill result. The purity of mineral depends largely on the extent of the manipulation which, if carried too far, results in loss of copper. It has been understood that the loss of copper in the tailings at the mill, has been in the past very considerable, 1½% and upwards. This reduction of the richness of the mineral is an effort to save copper. A test to find if this result is accomplished will be the percentage of copper obtained from the rock treated. But even this test is not fairly applicable just at present since, that for three years past, so large a portion of the rock treated has come from the south end mine, a leaner portion of the lode. When all the mine is producing, the work at the stamp mill will be fairly determined.

The following shows the per cent of copper obtained for all the years given:

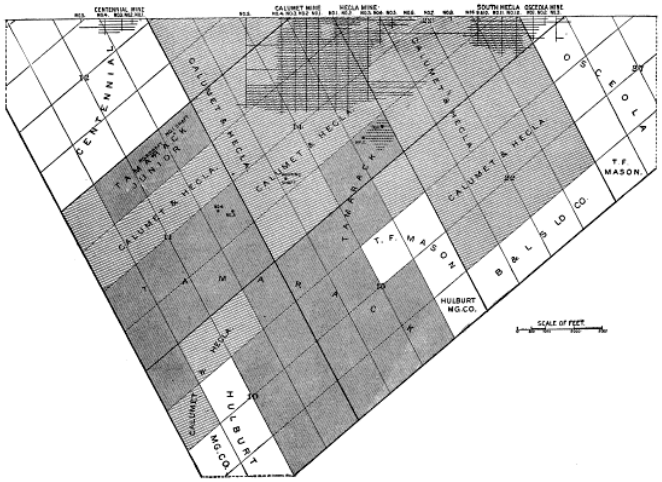
Year.	Tons of rock stamped.	Yield per cent of ingot copper.	Year.	Tons of rock stamped.	Yield per cent of ingot copper.
1875	249,704	4.3	1883	372,320	4.45
1876	279,185	4.37	1884	435,372	4.63
1877	247,925	4.15	1885	535,820	4.32
1878	271,000	4.66	1886	508,522	4.22
1879	284,715	4.61	1887	654,055	3.52
1880	334,343	4.75	1888	763,728	3.29½
1881	340,080	4.61	1889	807,918	3.012
1882	344,134	4.59			

Table of product of Calumet and Hecla mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1867	657	1,173	1879	13,135	943
1868	2,549	275	1880	15,837	1,229
1869	6,157	1,771	1881	15,690	781
1870	7,930	1,584	1882	16,026	1,538
1871	8,111	500	1883	16,562	1,045
1872	8,081	183	1884	20,236	1,585
1873	9,424	265	1885	23,623	1,960
1874	10,062	1,225	1886	25,250	250
1875	10,730	1,954	1887	23,008	123
1876	10,845	732	1888	25,147	1,721
1877	11,284	468	1889	24,334	266
1878	12,656	1,128			
Total				301,388	1,5 77

Number of shares of the company, 100,000; par value per share, $25; market value now $261; dividends paid in 1889, $2,000,000. Total dividends to date, $33,350,000.

LONGITUDINAL SECTION OF A PORTION OF LANDS EMBRACING THE CALUMET AND HECLA CONGLOMERATE, SHOWING THE POSITION OF ALL THE SHAFTS THAT ARE LOCATED IN THIS CONGLOMERATE, JULY 1, 1890.



The monthly statements of results are as follows:

No. of tons stamped each month of year 1889.			No. tons mineral produced in each month of year 1889.		
Month.	Tons.	Pounds.	Month.	Tons.	Pounds.
January	64,889	425	January	2,599	1,030
February	58,351	1,300	February	2,397	755
March	64,947	450	March	2,703	65
April	62,733	1,650	April	2,583	1,500
May	65,161	850	May	2,884	1,000
June	61,560	375	June	2,588	300
July	67,517	1,250	July	2,857	65
August	65,571	975	August	2,755	900
September	65,218	1,000	September	2,932	1,410
October	70,606		October	3,385	1,395
November	78,916	1,000	November	3,266	1,135
December	76,352	140	December	3,245	205
Totals	807,917	1,415	Totals	34,110	1,780

The percentage of copper obtained from the mineral in 1887 was 77.10%, 1888, 73.42%, 1889, 66.00%.

The average force employed is 3,000 men; at the present time the number on the pay roll is 2,700.

The following are officers of the Co.: Alexander Agassiz, President, Boston, Mass.; Chas. W. Seabury, Treasurer, Boston, Mass.; S. B. Whiting, General Manager; J. N. Wright, Superintendent; John Duncan, Assistant Superintendent; John Heebner, Assistant Treasurer and Purchasing Agent; H. Messimer, Superintendent of Motive Power; J. D. Ramsay, Ass't Supt. Motive Power; F. G. Coggin, Supt. Stamp Mills; W. A. Childs, Supt. H. & T. L. E. R; Thomas Hoatson, Chief Mining Capt.; P. C. F. West, Chief Mining Engineer; James N. Cox, Chief Clerk; M. B. Patch, Supt. Smelting Works.

THE TAMARACK MINE

is the Calumet and Hecla's only rival; but only such in the sense of richness, productiveness and value. Thus far the Tamarack has had only one shaft and a small amount of ground opened, but ere long there will be four shafts from which copper will be hoisted, and when such is the situation the Tamarack will rival its great neighbor in the amount of its product.

The Tamarack has an extraordinary record; it was started on a mere probability. Those who inaugurated the enterprise had faith, certainly, but there were many who did not. I was on the ground when the first blow was struck, and assuredly it did seem a vast undertaking to sink to the depth of nearly half a mile before the copper belt sought could be reached. But the great work was pushed steadily forward to its successful termination and all the scoffers were forced to become believers. Through this single shaft has been elevated to the surface, from the seemingly impenetrable depth which it reached, copper enough already to far more than pay for all outlay of the company in sinking to the copper and equipping the mine to the productive point. The mine immediately became a self sustaining institution when the conglomerate was reached. A second shaft has been added to the first. This, No. 2 shaft, was begun in March, 1886, and reached the Calumet and Hecla conglomerate at a depth of 2,575 feet. It is now to the 12th level, 2,818 feet below the surface, and is still descending.

The crosscut to the shaft at the 12th level is 685 feet long.

The two shafts were connected by a crosscut 720 feet long from the 2d level in No. 1. being 2,215 feet from the surface. The shaft is 7'x9' inside the timbers and is divided like No. 1 into three compartments, two for hoisting and one for the men. The air goes down No. 2 and up No. 1. The engine house for No. 2 is 65'x45', placed at 125 feet distant from the shaft. The machinery, which has been two years building, was made by E. P. Allis & Co., of Milwaukee, and comprises two Corliss engines each 42"x64", the drum 30½ feet diameter, 11 feet face. It is estimated that it will raise 4 tons of rock, 2,500 feet per minute.

There are three Reynolds boilers, upright, same as used at No. 2, Tamarack, Jr.

The shaft house, as at No. 1, combines, also, a rock house, and is 110 feet in height. The rock breakers are three in number, 18” x24”, 13” x20” and 8” x14”, with steam hammer. The sinking of the shaft proceeded somewhat slowly until the beginning of 1888, since which time the work has proceeded rapidly. The greatest number of feet attained in one month being in July, 97.3 feet. Among other additions at the mine, is a brick office, supplied with all modern conveniences.

The new shaft house at No. 2. is the best in the upper peninsula.

The engines and drum occupy a floor space of 35x62 feet, and are operated from an elevated platform by four levers, viz.: throttle, cut-off, reverse and steam brake.

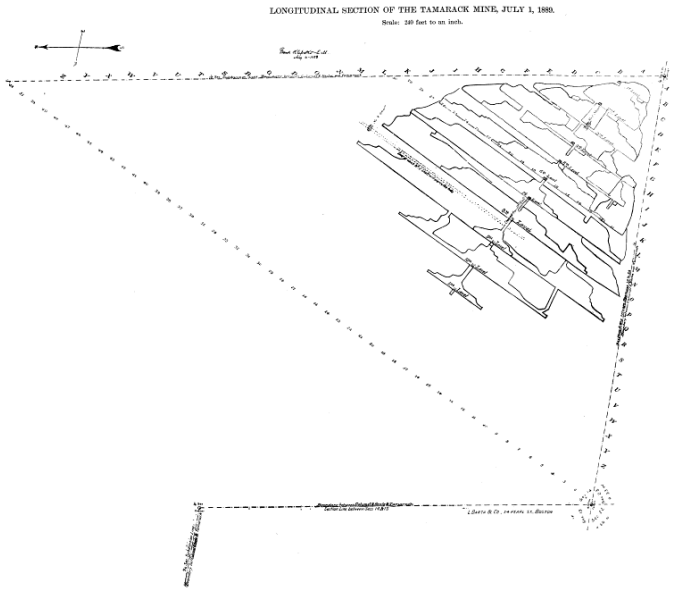
Overwinding is made impossible by a device that shuts off steam and applies steam-brake automatically.

I was down through the mine recently (February), and found it as usual. There is a portion of barren ground in the mine; some, very rich, and still much more that is only medium, rock that carries a low percentage of copper. The barren ground is sandstone, and there is quite a stretch of it in the 10th level, becoming less in the 11th. The sandstone appears as bunches in the conglomerate.

There is a "crossing" south of the crosscuts, where the formation is faulted. North of this and near it, the conglomerate is narrow and poor, but directly south of it the lode is 16 feet wide and rich, this is true in all the levels.

Now that No. 2 shaft is down and the machinery ready to run, it could be used immediately for hoisting copper rock, but Capt. Daniell wishes to do more opening work first. It must be borne in mind that the stoping has been pushed along as rapidly as the mine was opened. Now they will have much greater length of levels, 2,200 feet in the 13th level, so that if they push down to the 14th first, they will be able to produce copper cheaper and more rapidly than if they crowd the stoping now. The hanging wall is about as bad as it can be. It takes a forest of timber to hold it up. Blocks of trap drop out if not held in place by stulls. In going through the crosscuts the drifts in the foot wall from the shaft to the lode, one sees how the foot wall cracks and disintegrates when the pressure is removed.

The Tamarack Company has a model stamp mill. They have now three heads of stamps and the fourth one is ordered. Each stamp will crush 300 tons per day if necessary. The fourth head will be used on the Kearsarge mine rock.



No. 1 head, with its solid iron bottom, now after nearly two years' service is working just as well as on the day it started. The day of spring timbers has gone.

Nos. 3 and 4 shafts, now sinking in Sec. 11, are down to a depth of 300 feet. These shafts have machinery, etc., that was at first employed at Tamarack, Jr., and will suffice until a larger plant is required, which will be when a depth of 700 feet or upwards is reached. Within the coming year the Osceola amygdaloid will be reached in Nos. 1 and 2 shafts. If it prove good it will add to the value and resources of the mine. It will also be of scientific and practical interest otherwise, as determining to some extent whether amygdaloid belts hold copper equally well at great depth.

The Company has built a good many dwelling houses for employés, both at the mine and especially at the stamp mill.

The Company's fiscal year closes June 30, so in copying the following from its report I do not bring the statistics down to the close of the year 1889:

The production of mineral was 14,675,856 pounds, which, at 75.20 per cent, gave 11,036,469 pounds of refined copper, from which has been realized the gross sum of		$1,423,332 98
Interest receipts		6,785 59
		$1,430,118 57
The costs have been:—Running expenses at mine	$509,097 91	
Smelting, transportation and all other expenses of handling copper	180,072 41	
Total running expenses		689,340 32
Showing a mining profit of		$740,778 25
Add balance of assets June 30, 1888	$906,164 12	
Add amount received from sale of treasury stock	400,000 00	
Add balance receivable from sale of treasury stock	600,000 00	1,906,164 12
		$2,346,942 37
Deduct dividends Nos. 2, 3, 4 and 5	$720,000 00	
Deduct amount expended in mine plant during the year	161,178 44	881,178 44
Making the balance of assets		$1,465,763 93

ASSETS AND LIABILITIES.

Assets.

Cash on hand at mine	$309 81
Accounts receivable at Boston	2,366 30
250 shares H. & C. R. R. stock	25,000 00
Accounts receivable at mine	31,395 67
Supplies on hand at mine	47,144 27
Hancock & Calumet R. R. Co. 6 per cent bonds	55,000 00
Wood and timber land, about 30,000 acres	153,944 64
Bills receivable	365,701 32
Copper on hand	227,110 32
Cash in bank at Boston	348,943 17
Treasury stock	623,120 00
Total cash assets	$1,083,143 50

Liabilities.

Unpaid dividends	$348 00	
Drafts outstanding	31,847 54	
Accounts payable at mine	68,417 85	
Accounts payable at Boston	116,709 18	
Total liabilities		215,379 57
Balance of assets July 1, 1889		$1,465,763 93

STATEMENT OF RECEIPTS AND EXPENDITURES OF ALL KINDS, 1882 TO JULY 1, 1889.

Receipts.

From capital stock, 50,000 shares, $13.00 a share, paid in		$650,000 00
Of which 10,000 shares were placed in the treasury and have been sold as follows:		
$20 per share paid Feb. 1, 1889	$200,000 00	
$30 per share paid June 1, 1889	300,000 00	
$30 per share due Oct. 1, 1889	300,000 00	
$20 per share due Feb. 1, 1890	200,000 00	
$20 per share due June 1, 1890	200,000 00	
	$1,000,000 00	
Less $13 per share credited to capital stock in above amount of $650,000.50	130,000 00	
		870,000 00
From 361 lbs. copper, 1882, at $18.00	$65 34	
From 7,435 lbs. copper, 1883, at $14.71	1,093 57	
From 1,979,400 lbs. copper 1885–6, at $10.05	198,944 56	
From 4,036,521 lbs. copper, 1886–7, at $10.24	474,014 68	
From 10,389,867 lbs. copper, 1887–8 at $13.95	1,448,943 88	
From 11,030,402 lbs. copper, 1888–9, at $12.90	1,423,332 98	
From 28,050,055 lbs. copper, total, at $12.65		3,546,994 81
From interest receipts		12,955 09
From 350 shares Hancock & Calumet R. R. Co.'s stock sold and paid for		35,000 00
250 shares Hancock & Calumet R. R. Co.'s stock on hand		25,000 00
Total receipts		$5,139,949 90

Expenditures.

Running expenses prior to July 1, 1888	$1,285,860 84	
Running expenses during 1888–9	689,340 32	
		$1,975,201 16
Construction expense to July 1, 1888	$483,080 97	
Construction expense during 1888–9	85,489 63	
No. 2 shaft	118,844 84	
No. 3 and No. 4 shafts and expenditures on section 11	21,569 35	
		658,984 81
Dividends Nos. 1 to 5, inclusive		840,000 00
Real estate		200,000 00
Total expenditures		$3,674,185 97
Balance of receipts July 1, 1889		$1,465,763 93

DETAILS OF MINING EXPENSE.

Underground Expense.

Shaft-sinking, 145.80 feet at $19.39	$2,828 00	
Winze-sinking, 681.85 feet at $11.96	8,156 83	
Drifts, 3,483.05 feet at $9.55	33,256 00	
Stoping, 6,811.46 fathoms at $10.56	71,925 82	
Trimming	40,991 50	
Timbering, labor, materials and supplies	73,598 74	
Extra work	8,152 85	
Supplies, labor, fuel, etc., for air drills	34,957 62	
Supplies, fuel and labor for engines	56,178 89	
Mining superintendence and Co. acct. labor	33,321 53	
Blacksmith, machinist and carpentar labor	6,378 61	
	$369,100 42	
Less profit on supplies, etc.	20,246 50	
		$348,853 92

Other Expenses.

Rock house	$25,580 39	
Surface labor, supplies, etc.	6,230 61	
Office labor, supplies, etc.	8,071 83	
Transportation	27,963 16	
Stamping	80,378 50	
Incidental expenses	1,496 66	
Taxes less rents collected	10,295 84	
		159,813 99
Total running expense		$508,667 91

Construction Costs.

No. 2 engine and shaft equipment	$18,823 84	
No. 2 rock and shaft house	4,719 60	
Dwelling houses	15,180 40	
Machine shop	2,345 60	
Schoolhouses	1,851 18	
Blacksmith shop	940 90	
Carpenter shop	288 94	
Fire engine	2,980 59	
No. 1 engine and shaft equipment	12,830 86	
Stamp mill, dwellings, etc.	24,284 41	
No. 2 boiler	84 90	
New office	465 32	
New barn	1,012 65	
No. 2 shaft	34,119 44	

Expenditures of Section 11.

Dwelling houses	$7,651 23	
No. 3 shaft	3,454 20	
No. 3 engine and shaft equipment	8,129 27	
No. 4 shaft	887 54	
No. 4 engine and shaft equipment	603 28	
Railroad extension	595 82	
Change house	238 01	
	$21,569 35	
		$161,178 44
Total expended at mine		$669,846 35

Summary.

Rock stamped	169,250 tons.
Product of mineral	14,675,856 lbs.
Product of refined copper	11,036,469 lbs.
Yield of refined copper per cubic fathom of ground broken	1,111 lbs.
Yield of refined copper per ton of stamped rock	65.21 lbs.
Yield of mineral per cubic fathom of ground broken	1,477 lbs.
Percentage of mineral in stamped rock	4.34 per cent.
Percentage of refined copper in stamped rock	3.26 per cent.
Refined copper, cost per pound at mine	4.61 cents.
Cost of smelting, freight, commission and Boston expense	1.64 cents.
Total cost per pound of refined copper laid down in New York and sold	6.25 cents.

Opening work foots up as follows:

No. 1 shaft sunk	145.8 feet.	
No. 2 shaft sunk	1,000.4 "	
		1,146.2 feet.
Winzes, conglomerate	512.0 feet.	
Winzes, country rock	169.9 "	
		681.9 feet.
Levels, conglomerate		3,222.1 "
Crosscuts		1,210.9 "
Total		5,261.1 "

Conglomerate rock broken afforded 1,111 lbs. ingot for each cubic fathom, 117 lbs. less than the previous year.

Cost of stamping for the year was 47.49 cents per ton. Each head stamped 228 tons per day, of running time, without being crowded to its full capacity.

Total mining cost per ton of rock, $3.00.

Rock handled for the year was 196,707 tons; 178,859 tons passed through the rock-house; 9,609 tons were discarded and 169,250 tons sent to the stamps; 17,848 tons were stowed underground, in 4th and 5th levels chiefly. Rock hoisted from conglomerate workings is equal to 9,937 fathoms of ground broken. Mineral produced, 14,675,856 lbs.; of this, 298,346 lbs. were boulders. Ingot obtained, 11,036,469 lbs., the percentage of ingot in mineral being 75.2 per cent. Ingot in stamp rock was equal to 3.26 per cent.

It will be seen that, while the Tamarack mine is in the Black Hills shoot of copper, the percentage is greater than was the Calumet and Hecla last year. This is due, I think, to the fact that the Tamarack Co. takes greater pains in selecting rock than is exercised at the South Hecla. At the latter the rock all goes to the mill, while at the Tamarack it is picked over and a percentage is rejected.

J. W Clark Pres't. A. S. Bigelow, Sec. and Treas., Boston. John Daniell, Agent, Opechee Mine.

Tamarack has produced as follows:

1885	90 tons,	1,669 lbs.
1886	1,823 "	517 "
1887	3,702 "	1,606 "
1888	5,704 "	1,217 "
1889	5,302 "	1,451 "
Totals	16,634 tons,	460 lbs.

On April 21, 1889, the engine house at No. 1 Shaft was burned. No damage further than the value of the building, injury to machinery and the delay in hoisting. I doubt if the latter will prove a loss, since the opening work can now be pushed and in the end the production will be as great as it the tire had not occured.

THE TAMARACK JR. MINING COMPANY.

The out-come of this exploration is still a matter of much speculation. The Company owns the E. ½ of the E. ½, except the N. E. ¼ of N. E. ¼ of Sec. 11, T. 56, N. 33, three forties, 120 acres joining the Centennial. The remainder of the half section, five forties, is owned by the Calumet and Hecla Co. Nos. 3 and 4 shafts of the Tamarack Co. are directly west half a mile from those of the Tamarack, Jr. While it is nearly certain that these Tamarack shafts will intercept the main "shoot of copper" of the Calumet and Hecla mine it is by no means an equally assured fact that the shafts of the Tamarack, Jr., will strike a rich portion of the conglomerate belt. There are important indications, however, that are very favorable. No. 5 shaft of the Calumet and Hecla is 1,100 feet north of No. 4, and for nearly all this distance the lode was poor down to the 33d level in No 5 where it became rich and continues so; they are now to the 36th, and are north of the shaft 250 feet, the belt holding good. No. 5 shaft is about 3,500 feet south of the south line of the Tamarack, Jr., and this ground between has not been explored even along in the outcrop; thus it is quite possible that there is a good shoot of copper in this intervening space, which will be found at greater depth on the Centennial and Tamarack, Jr., lands. In any event it is more than probable that they will have the copper ground found in the Calumet No. 5 shaft. The shafts are located in about the center of each 40, so that it the lode does prove good, the situation will be excellent for taking out copper very rapidly.

No. 1 shaft is about 1,800 feet deep, No. 2, 1,200 feet. At about 2,400 feet in depth the lode should be reached. As they have already attained 1,700 feet and are descending at the rate of about 100 feet per month it follows that long before the close of the year the problem will be solved. At least the lode will be reached and we shall know its character near the points of intersection. If it prove favorable, steps will be immediately taken to

build a stamp mill, probably on Lake Superior, and to make the other suitable preparations for actively producing copper.

The officers of the company are: J. W. Clark, President, Boston, Mass.; A. S. Bigelow, Sec. and Treas., Boston, Mass.; John Daniell, Supt., Opechee.

THE CENTENNIAL MINE.

This mine joining the Calumet and Hecla and the Tamarack, Jr., is another important mining enterprise to which great interest attaches. What I have said in describing the Tamarack, Jr., applies to the Centennial also. They are sinking a deep shaft in the lode to explore it at greater depth, hoping that a "shoot of copper" will be found.

The Centennial is in the northerly extension of the Calumet and Hecla conglomerate. The mine was worked many years ago, but the conglomerate was too poor to pay. At greater depth they hope to find it richer. This new exploratory work was begun a year ago and good progress has been made. They have sunk both No. 3 and No. 4 shafts, the former is now 1,300 feet deep—Feb. 26—on the incline, and is the one that will be continued down. The No. 4 is 900 feet deep, to the 9th level. The strike of the formation is about N. 33° E., and the dip north-westerly 37½°, so that the vertical plane through the south line cuts the lode in such a manner that there must be a continual lengthening of the levels south in the Centennial as they go down. This southerly extension amounts to about 1 in 5, or 20 feet each 100'.

No. 3 has been sunk 812 feet since May, sunk 100 feet in Nov., 90 feet in Dec. The average, per month, has been 81 feet. The mine was 485 feet when the new work was begun.

In the 9th level they are drifting south to connect Nos. 3 and 4 shafts, and to prove the ground. The whole distance is 606 feet, 231 feet of which is already accomplished, and they have drifted north of No. 4, 60 feet.

There is a shoot of copper ground, not rich, that continued all the way down between these shafts as far as the old company worked. It is hoped that at the 9th level this ground will be found richer than it was above. They are already finding fair stamp rock. No. 4 will not be sunk further at present.

The matter that awakens the greatest interest is a new pit started at 1,500 feet north of No. 4, in the continuation of the surface line of the deposit. Capt. Vivian located it and found that immediately on getting through the sand and finding the conglomerate, it proved rich, that is, part of it did. They are now about 40 feet deep, the belt is 8 feet wide and part of it very rich, about 2 feet in width of it, along the foot-wall. They are certainly finding as rich rock in this north shaft as can be obtained anywhere in the Calumet and Hecla lode. Even "nigger heads," small boulders of copper, appear, and these are ever esteemed the best of indications. Thus it certainly looks as if the Centennial Co. were to have a rich mine to reward them, finally, for their perseverance. The old company expended about $865,000.

The financial statement made by the officers one year ago, showed a balance in the treasury of $298,300.07.

The directors are: H. J. Stevens, president; D. L. Demmon, Treasurer and Secretary; S. L. Smith, William J. Rainey and F. E. Robson. The Boston office is at 19 Congress street, and the place of registration the Howard National Bank of Boston.

No. of shares 80,000, of which 40,000 were sold on a basis of $12.50 per share, to obtain the funds to prosecute the work now in progress. The estate is Sec. 12, 56, 33, and the C. and H. conglomerate belt has a mile in length on the property, besides which there are the Osceola amygdaloid and other important lodes.

Capt. Johnson Vivian, the agent and superintendent of the work, is very hopeful of the future. He was the agent here many years ago in the days of the Schoolcraft Co., when the record was failure and ruin. Now, if from that history of disaster he can redeem the property and lead to an abounding success, it will surely be a matter of great gratification to him.

Undoubtedly he has found, in this north shaft a new shoot of copper, one that is not found in the lands to the south.

The above was written in March. I now find, a month later, that the shaft, No. 6, has been sunk 120 feet, and a drift north is in 15 feet. The lode in the drift is 7½' wide and is nearly all stamp rock, so that the theory of their having thus a newly found shoot of copper is greatly strengthened as the work progresses.

THE KEARSARGE MINING CO.

owns the next land on the north crossed by the Calumet and Hecla conglomerate, and in view of the favorable outlook at the Centennial in the new north shaft, it is but natural that the Kearsarge people should be also somewhat elated at such a bright prospect of good fortune approaching their own borders. Exploration was made to a limited extent some years ago in the Calumet and Hecla conglomerate belt on the Kearsarge property but at the point where it was explored it was found to be poor. As soon as the spring opens it is the intention of Capt. Daniell to supplement this work with more thorough exploration.

The present Kearsarge mine is still a somewhat extended exploration in an amygdaloid belt, known as the Kearsarge amygdaloid. It has two shafts—No. 2 to the 10th level, 1,000 feet down on the incline, and No. 1 to the 6th level, 600 feet deep. The mine has been very poor from the 4th level down. Now in the 9th they are finding some good ground and the shaft below the 10th is now in exceptionally good ground. It is thought that

the mine is changing for the better. The formation is less disturbed below. There is still considerable stoping ground above the 4th level that pays well. The mine is making money. The copper has much more than paid for all outgoes. The stamping is done now at the Tamarack mill.

The following are from the books of the Co.:

Mining expense	$96,457 94	per cent of whole cost	.61903
Rock house expense	5,005 76	" " " "	.032089
Transportation expense	11,705 40	" " " "	.08402
Stamping expense	32,395 70	" " " "	.20233
Office and incidentals expense	3,598 91	" " " "	.00250
Surface expense	351 73	" " " "	.01564
Total running expense	$139,503 44	" " " "	1.0000
Constructing account	6,000 00		
Total expenditures	$145,503 85		
Number of fathoms of ground broken			3,518.99
" " of tons of rock hoisted			76,541
" " " " stamped			56,104
" of pounds of mineral produced			2,331,810
" of pounds of mass produced			4,558
Total product			2,388,368
Number of pounds ingot			1,918,849
Rock hoisted, cost per ton			$1 89.694
Rock stamped, cost per ton			$2 48.651
Ingot copper, cost per lb.			$0 07.27
Per cent of mineral in rock hoisted			.07659
Per cent of mineral in rock stamped			.1988
Per cent of mass in rock hoisted			.3349
Per cent ingot copper in rock hoisted			$0 .1304
Per cent ingot copper in rock stamped			.171
Per cent of ingot copper in mineral smelted			.8622
Number men, 124½.			
Number feet shaft sunk—No. 2			229.2
Number feet winzes sunk			490.7
Number feet levels driven			2,191.3
Number feet crosscut			78.3
Number fathoms stoped			3,513.99
Cost of sinking shaft per foot			$13,755 00
Cost of sinking winzes per foot			9 80
Cost of driving levels, etc., per foot			6 95
Cost of stoping per fathom			10 89
Amount paid for shafts			3,142 70
Amount paid for winzes			4,810 40
Amount paid for drifts			15,705 42
Amount paid for stopes			38,284 52
Amount paid for extra work			812 91
Total			$62,315 85
Less supplies			31,662 18
Net amount paid miners			$30,653 67
Amount paid on contract			$62,315 85
Amount paid for tramming			10,704 13
Amount paid for timbering			2,192 54
Amount paid captains			1,600 06
All other accounts—labor			5,853 75
Carpenter, smith, machinist			1,586 20
Hoisting, pumping			4,948 90
Compressor			9,182 03
Supplies and fuel			3,065 39
Total			$101,843 71
Credits			14,885 77
Net total			$86,457 94
Number days credit			1,553
Number of men on contract			59

Rock House Expense.

Number days	1,860
Laborers	$2,719 81
Smith, carpenter	408 39
Steam power	1,438 09
Supplies	439 47
Total	$5,005 76
Tons of rock crushed	74,141
Cost of treatment per ton	.06752

Cost of Air Drills.

Smith, carpenter, machinist	$1,195 02
Steam power	5,309 69
Supplies	2,342 48
Pipe, etc.	335 13
Total	$9,182 03
Days	58

Transportation Cost.

Tons of rock transported	56,304
Paid R. R. Co. 20c per ton	$11,260 80
Loading cars	444 60
Total	$11,705 40
Cost per ton, transportation	.2079

Office Expense.

Agent	$1,000 03
Clerk	899 85
Stationery, etc.	64 18
Postage	1 25
Fuel, oil	32 47
Express, etc.	36 66
Taxes	800 00
Retainer	150 00
Traveling expenses	$65 99
Sundries	390 72
Freight on mineral	331 17
Total	$3,091 39
Total surface expenses	$3,579 38
Credit for rent of houses	$430 50
Sundry credits	1,777 15
Total credits	$3,227 65
Total net surface expense	351 73
Supply account	41,654 03
Fuel	7,222 88
Treasurer	149,478 27
Sundry	210 97
Total receipts	190,251 94
Treasurer	321,511 65
The product of mineral was 2,325,615 pounds, which at 86.21 per cent, gave 1,918,849 pounds of refined copper, for which was realized the gross sum of	$241,691 86
From the sales of silver	400 77
From interest receipts	605 24
Balance assets Jan. 1, 1889	94,340 10
Total receipts	$336,707 47
Running expenses at mine	$139,503 44
Smelting, transportation and other expenses	37,264 02
Expended in mine plant	6,000 39
Total expenses	182,767 85
Balance assets Jan. 1, 1890	$153,939 62

The balance sheet on Jan 1, 1890, shows as follows:

Assets.

Cash in bank at Boston	$87,924 86	
Cash on hand at mine	134 55	
Supplies at mine	2,477 44	
Bills receivable at mine	25,514 18	
250 shares Hancock & Calumet R. R. stock	25,000 00	
Copper on hand, 227,048 pounds	30,629 53	
Accounts receivable at mine	1,206 40	
Total assets		$172,886 96

Liabilities.

Drafts outstanding	$4,984 66	
Accounts payable at mine	13,962 68	
		18,947 34
Balance assets Jan. 1, 1890		$153,939 62

A dividend of $2 per share, calling for $80,000, was paid in January from assets as above, which will be included in the 1890 accounts. The amount of rock stamped during the year was 56,104 tons; yield of refined copper per ton of stamp rock was 34.2 pounds; percentage of mineral in stamp rock, 1.99; percentage of refined copper in stamp rock, 1.71; cost per ton of rock hoisted, $1.90; cost per ton of rock stamped, $2.49; refined copper cost per pound at mine, 7.27 cents; cost of smelting, freight and all other expenses per lb., 1.94 cents; total cost per lb. of refined copper laid down in New York, 9.21 cents. As this is the first report for a full year of production, full comparisons cannot be made; but as a matter of interest, these statistics can be given for three years:

	1889.	1888.	1887.
Fine copper, pounds	1,918,849	829,275	21,237
Per cent copper in material	85.22	86.64	21.237
Received per pound, cents	12.58	16.09	16.05
Cost per pound, cents	9.21	10.03	22.84
Profit per pound, cents	3.37	6.57	.....

This summary may be given of results in the three years:

	1889.	1888.	1887.
Gross receipts	$242,467	$139,038	$45,960
All expenses	182,768	101,398	63,108
Net income, or year's increase of assets	$59,699	$37,769	* $17,148
Balance of assets Jan. 1, succeeding year	153,940	94,240	76,480

* Reduction in balance of assets. In 1887, $40,000 was received from assessment No. 3, and is included in gross receipts above.

THE OSCEOLA CONSOLIDATED MINING CO.

is a corporation that has, ever since it has been under the local management of Capt. Daniell, shown a great deal of enterprise. There have been times when the appearance of the mine was anything but favorable. The mine was first opened on the Calumet and Hecla conglomerate, which belt extends southerly across the Osceola lands. But subsequent work developed the fact that the conglomerate only contained copper for a limited space joining the north line. Fortunately, at this juncture, the amygdaloid belt was found and a new mine was opened and so vigorously worked, that though the belt was not rich, the mine has been made a profitable one. But here again appeared the shadow of misfortune. The amygdaloid belt was found to be best adjoining the Calumet and Hecla line, and as this line cuts under to the south, as explained in the Centennial mine, the levels in the Osceola shortened rapidly and the best "shoot of copper" in the mine became lost to the company.

And here we have another illustration of the value and importance of "push," energy, extensive exploration, properly directed, in operating a mine. They could go no further north, the only hope was to the south where they had abundant length of deposit. It was only to be determined if it is paying ground; fortunately for their interests the usual energy and foresight were applied to the solution of this vital question and happily good fortune has attended the effort. The south end of the belt on the property had been explored heretofore, but not to any great depth; also the mine itself was comparatively poor in that direction. Now, however, that they have sunk deeper in the extreme southerly shaft and that the mine is opened lower down, this south ground is found to be good, paying amygdaloid for a great length. Thus the mine is now nearly sure to be a greater producer than it ever was before. Nearly all the levels going south show improvement in the quality of the rock. There are four shafts, numbered from the north; but a fifth one, the Opechee shaft, was started some years ago at a distance of 1,450 feet southerly from No. 4. The ground proved to be poor, as before stated, and the shaft was abandoned, but under the stress of the necessity to further explore the ground, work in this shaft was resumed and it is now (March 1) to the 16th level, and is proceeding downward at a rapid rate—double skip shaft. The 12th level has been driven all the way through this intervening space and others are well started in the same direction. Thus the ground has been pretty well shown up and there is a good deal of it—all new ground, and sufficient for several years to come. In all, the surface length of the lode from No. 4 to the south line is 2,200 feet.

The Osceola will be more largely opened than ever before and will have a greater amount of paying ground to draw from. It cannot fail to produce more copper and produce it cheaper than at any time heretofore. The product of 1889 was the largest in its history, but it now seems that the past year was but the opening of a new chapter that will record increasing prosperity.

No. tons of rock hoisted during the year		208,299
No. tons of rock discarded during the year		32,712
No. tons of rock sent to mill during the year		75,587
No. lbs. ingot copper obtained		4,734,127
Rock reduced to cubic fathoms		11,373
No. lbs. of copper per cubic fathom		392
Total cost per ton of rock		$2 21
Total cost exclusive of ex. at Opechee slope		$1 74
Total cost per ton of rock stamped		$2 06
No. feet shaft sunk		1,090½
No. feet winzes sunk		711.4
No. feet levels driven		6,108.7
Extra sinking, not included in above		630.9
No. 1 is to 15 level	1,387 feet	below surface
No. 2 is to 23 level	2,073 "	" "
No. 3 is to 24 level	2,162 "	" "
No. 4 is to 22 level	1,973 "	" "
No. 5 is to 16 level	1,480 "	" "

No. 4 shaft has been provided with a pair of hoisting engines with drum, and a pair of the same engines will be put at No. 5, in May next. Additions to boiler capacity, compressor power, etc., have been made in the past year. The intention is to keep all four of the heads at the stamp mill at work on Osceola rock.

The number of pounds of mineral produced was 5,262,997, which yielded 86.15% copper.

Amount received from sales of copper		$541,512 15
Amount received from sales of silver		827 01
Interest		650 68
		$542,990 74
Running expenses at the mine		388,807 59
Smelting, transportation, etc.		67,476 42
		$455,284 01
Mining profit		87,206 73
Balance of assets, Jan. 1, 1889		
Amount expended in plant during year	$304,995 15	
Deduct dividends, March 1, last	32,145 66	
	50,000 00	
	$82,145 66	
Balance assets, January 1, 1890	122,539 49	
	209,745 22	

STATEMENT OF RECEIPTS AND EXPENSES OF ALL KINDS, FROM SEPTEMBER 25, 1873, TO JANUARY 1, 1890.

Receipts.

From capital stock, 50,000 shares, $25 a share full paid			$1,250,000 00
" 995,002 lbs copper, 1874 at 23 37-100			218,796 92
" 1,380,813 "	1875 at 22 77-100		302,902 96
" 1,698,237 "	1876 at 20 53-100		348,333 25
" 2,774,277 "	1877 at 18 19-100		504,686 93
" 3,705,998 "	1878 at 15 53-100		420,340 14
" 3,197,387 "	1879 at 17 79-100		568,699 89
" 3,381,061 "	1880 at 19 15-100		647,487 19
" 4,126,976 "	1881 at 17 77-100		742,585 84
" 4,179,782 "	1882 at 17 70-100		739,458 26
" 4,256,400 "	1883 at 14 90-100		630,846 83
" 4,247,880 "	1884 at 12 82-100		544,051 02
" 1,929,999 "	1885 at 10 75-100		208,558 65
" 3,560,791 "	1886 at 10 51-100		374,144 13
" 3,585,723 "	1887 at 11 86-100		424,991 85
" 4,134,520 "	1888 at 15 3-100		621,375 14
" 4,594,127 "	1889 at 11 94-100		541,512 15
" 50,632,197 "	total at 15 49-100		
" sales of silver to date			$7,845,056 15
" interest receipts to date			33,266 95
" 900 shares Hancock & Calumet R. R. stock sold			87,546 72
" 250 shares Hancock & Calumet R. R. stock on hand			25,000 00
Total receipts			$9,236,869 82

Expenses.

Running expenses prior to 1889		$5,984,946 09	
Running expenses during 1889		435,784 01	
		$6,420,730 10	
Construction expense prior to 1889		737,444 33	
Construction expense during 1889		82,145 66	
		$709,589 99	
Real estate		588,836 70	
Dividends prior to 1889		1,172,500 00	
Dividends during 1889		50,000 00	
		$1,222,500 00	
Exploratory work		15,466 81	
Total expenses			$9,017,123 60
Balance of receipts January 1, 1890			$209,745 22

Details of Mining Expense.

Shaft sinking, 1,091.6 feet at $9 66	$10,541 85	
Winze sinking, 711.4 feet at $10 24	7,357 50	
Drifts, 4,981.6 feet at $6 78	33,356 06	
Stoping 10,888.54 fms. at $11 42	124,150 91	
Tramming	39,274 55	
Supplies, fuel, and labor for engines	37,110 30	
Supplies, labor, fuel, etc., for air drills	28,782 11	
Mining superintendence and Co. account labor	25,008 37	
Timbering, labor materials, and supplies	10,938 75	
Blacksmith, machinist and carpenter labor	3,829 81	
Extra work	1,990 34	
	$328,300 58	
Less profit on supplies	41,671 00	
		$281,629 58

Other Expenses.

Stamping	$47,581 28	
Transportation	27,521 78	
Rockhouse	16,994 63	
Office labor, supplies, etc	5,737 49	
Incidental expenses, including taxes	5,609 50	
Surface, labor, supplies, etc	593 29	
	106,678 01	
Total running expenses		388,807 59

Construction Costs.

New engine at No. 4 shaft	$22,613 21	
New compressor and building	5,982 63	
Dwelling houses at mine	2,882 64	
Stamp mill construction	1,377 96	
New engine and boiler house at Opechee	714 33	
No. 1 pump	575 00	
Total construction costs		32,145 66
Total expended at mine		$420,453 25

Summary.

Rock stamped	175,567 tons.
Product of mineral	5,262,997 lbs.
Product of refined copper	4,584,127 lbs.
Yield of refined copper per ton of stamp rock	25.82 lbs.
Yield of refined copper per cubic fathom of ground broken	392 lbs.
Yield of mineral per cubic fathom of ground broken	455 lbs.
Percentage of mineral in stamp rock	1.50 per cent.
Percentage of refined copper in stamp rock	1.29 per cent.
Cost per ton of rock hoisted	$1 86
Cost per ton of rock stamped	$2 21
Refined copper, cost per pound at mine	8.56 cents.
Cost of smelting, freight and all other expenses	1.49 cents.
Total cost per pound of refined copper laid down in New York	10.05 cents.

Percentage of cost in each department.

Opechee shaft	.06516
Amygdaloid	.09041
Rock house	.05073
Transportation	.07086
Stamping	.02258
Incidentals	.01445
Surface	.00137
Office	.01478
Whole number of men	.475

Details of stamp mill cost.

Superintendent	$1,016 63
Engineers	1,404 10
Firemen	3,428 85
Cooper and carpenter	1,271 30
Watchmen	805 40
Machinist	1,452 10
Smith	685 20
Head runners	1,132 90
Head feeders	4,158 15
Oilers	1,003 90
Sundry labor	1,563 05
Teaming	4,618 45
Overseer of w. house	324 00
Copper washers	1,297 90
Laborers and mechanics	5,070 10
Silver pickers	404 40
Gruter	51 25
Total	$29,782 69

Cords of wood	$10,722	
Tons of coal	4,101	
Cost of fuel		$48,304 19
Illuminating oil		141 60
Lubricating oil		1,284 75
Stamp shoes		640 00
Hardware		267 11
Iron and steel		624 90
Tools, machinery, castings		1,368 19
Waste		155 87
Packing and belting		267 49
All other supplies		2,974 25
Total supplies		$6,918 36
Labor account brought down		$29,782 69
Total		79,906 93
Received stamping Kearsarge rock		32,395 70
Total expenses		$47,581 28

Annual products of the Osceola mine are given in the following table:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1874	408		1882	2,088	782
1875	665	303	1883	782	2,128
1876	846	1,737	1884	2,123	1,640
1877	1,382	177	1885	909	1,169
1878	1,312	1,908	1886	1,780	786
1879	1,589	1,387	1887	1,791	1,728
1880	1,921	1,487	1888	2,067	320
1881	2,099	1,956	1889	2,267	127
Total				25,312	661

J. W. Clark, President, Boston, Mass.; A. S. Bigelow, Sec'y and Treas., Boston, Mass.; John Daniell, Agent, Opechee, Mich.

THE PENINSULA MINING COMPANY,

the successor of an old company (the Albany and Boston), is operating, in a small way, the original mine.

This mine is in a wide belt of coarse conglomerate, identical with that at the Allouez mine, undoubtedly the same belt. It has the same characteristics: comparatively small portions of it are found well charged with copper; but the average of the rock gives a very low percentage of mineral. The whole financial record of the operations of this mine is one of failure. A great deal of money has been expended in the vain effort to secure a paying mine.

In the light of experience, it is perfectly apparent that this result cannot be accomplished, except the mine be opened extensively and operated on a large scale; by so doing, the best ground may be selected and stoped, and the worthless portions of the lode left unmolested. We have learned that some very low deposits may be worked profitably if only worked extensively enough. In copper mining, in low grade rock, it is as it is in wholesale trade or manufacture, the larger the business, other things corresponding, the less the per cent of profit necessary in order to secure a successful enterprise. There is certainly good stoping ground in the Peninsula mine, and there is enough to indicate that if the mine were operated in the manner that its neighbor, the Osceola, for instance, is worked, it would pay. I should say that it is, at least, a good 12 cent mine, that is, a mine in which copper could be made for at least 12 cents per pound. And thus, at the present price of the metal, there should be a profit.

The mine is 600 feet deep; two shafts are at that depth, Nos. 1 and 2, both to 8th level. A much greater percentage of the ground opened has been stoped away than is customary, except in rich mines. The good and poor ground have, evidently, alike been broken. Third, 4th, 5th and 6th levels have been worked south of the shaft, No. 1, 800 feet, thus making a long, and hence expensive, tram of the rock. To obviate this, Capt. Dunn began to sink a shaft, 800 feet to the south; but the Company decided to arrest its progress. The crosscut, driving east from the 4th level, to explore the formation and to reach, ultimately, the Calumet and Hecla conglomerate, is now 1,200 feet in length; it is estimated that it will require 350 feet more to intersect the belt in question.

The policy of the Company is to expend only what the mine will yield. The directors do not propose to advance any money, but let the mine pay its own way. They are stamping 350 tons of rock per day, working the two heads of stamps. They reject 15% of the rock broken and get about 1% of mineral, 72% ingot from the rock treated, a very low percentage to support an industry on. A new compressor has lately been added—Ingersoll—using now seventeen drills. Work 175 men.

W. A. Dunn, Supt.; A. S. Spendlow, Sec'y and Treas.; H. L. Terrel, Pres., New York, 36 Wall St.

The product in 1889 was 368 tons, 507 pounds, making an aggregate of production of 1,911 tons, 1,578 pounds. More recently, the Pewabic lode has been intersected in the crosscut, 475 feet west, and, while I have not seen it, I am informed that it is found to contain a good percentage of copper, showing both stamp rock and coarse copper—"barrel-work."

PONTIAC, MESNARD, ETC., MINES.

From the Osceola to the Franklin, a distance of about 10 miles southerly along the mineral range, there are many old mining locations all of which have been long since abandoned except the Peninsula. The work at these mines consists mainly of explorations along in the Pewabic lode which proved to be narrow and poor so far as it was proved. But what has thus been done by no means settles difinitely the character of the lode or determines what the other well known copper bearing belts may contain. The amygdaloids are notoriously "bunchy" and even if lean at the surf ace may be rich at great depth; as witness the Osceola in the south end and even the Quincy which has been richer in the lower levels than at the surface. This stretch of the mineral range to which I have referred has great possibilities and may in the future be found to contain very rich deposits of copper.

THE FRANKLIN MINING CO.

This Company continues to sustain its excellent record. There is no better example of success than that of the Franklin, under the present management. I have heretofore given a full history of this matter and will not dwell upon it now. It really is always pleasant to visit the Franklin mine and to go about with Capt. Vivian, and to observe how well everything is done; how neat and ship-shape everything is; what economy is practiced. There is everywhere the evidence of skill and intelligence. It is the same old mine; the same old shops and shaft houses; same old stamp mill; same old engines and hoisting machinery that a few years ago were dilapidated, out of repair, antiquated and inadequate. Everything is in good shape now, and the ultimate result shows that whether the machinery is old or new the desired end is reached; the mining is cheaply done and there is, to the stockholders, a gratifying profit on the work. The Franklin mine has been pushed, but it has been cautiously and economically done. There has not much been added but the old machinery has been altered and improved and everything brought up to the requirements of the times. Capt. Vivian has been a miner all his life, and for many years prior to undertaking to revive the Franklin, he had been in the employment of poor companies, working at poor mines where the practice of the greatest economy was a necessity of existence. This atmosphere of economy animating all operations at the Franklin, permeated with superior intelligence, energy and mining skill has prevailed at the Franklin and prosperity has ensued.

Apparently the future of the Franklin depends a good deal on the outcome of the controversy over the possession of the Pewabic. The latter mine lies between the Franklin and the Quincy. All three of the mines are worked close to the boundary lines, both are deeper than the Pewabic, and both being good in the bottom indicates that the Pewabic ground is good also. It so happens that the boundary lines of the Pewabic lands cut off both the Franklin and Quincy mines. The Pewabic gets the lode and they lose it. In the Franklin mine the two southerly shafts have reached, in their descent the Pewabic boundary and of course cannot be sunk further. In the Quincy the levels in the north constantly are shortened as the mine descends. So that the possession of the Pewabic mine, which is to be sold by decision of the court, is a matter of about equal importance to the two companies. The ownership of the Pewabic would make the Franklin a profitable mine for many years to come. In the meantime the stockholders are receiving good dividends from the earnings of the mine, as it is. The mill stamps about 500 tons per day and the reduction of the cost of mining 5 cents per ton in 1889, was an important gain. Total number of men employed 384½ at an average cost each of $70.51 per month.

No. 3 shaft is to the 32d level.

Receipts.

Copper sold, 8,390,667 pounds at 12.055 cents		$397,896 29
Copper on hand, 1,045,395 @ 14c.		146,355 30
Interest received		3,149 21
Silver sold		3,143 10
Total		$548,743 90
(Net income during the year	$139,577 52)	

Expenditures.

Total mining expense	$228,632 25
surface expense	11,615 55
stamp mill expense	64,574 07
tram road expense	8,102 54
rock house expense	15,566 46
general expense	10,575 64
office expense	2,999 65
construction expense	2,879 48
Total	$345,405 99
Other expenses	68,700 89
Total expenditures	$409,106 88

Total expense 1874	$74,449 02
1875	259,921 78
1876	355,611 82
1877	372,990 81
1878	329,974 74
1879	336,934 51
1880	340,596 77
1881	339,623 96
1882	350,350 13
1883	363,544 39
1884	357,294 04
1885	338,995 99
1886	333,102 19
1887	325,107 71
1888	342,377 32
1889	345,405 99
Total	$4,866,104 58

Cash	$181 11
Supply account	17,043 22
Mine wood account	30,000 52
Mill wood account	14,725 72
New machinery account	61,422 56
Balance due company	5,240 68
Stampage account	3,760 00
Coal	5,199 15
Treasury	5,339,112 20
Balance due merchants	14,517 69
Balance due men	14,812 91
Total	$5,349,442 80

Tons of rock hoisted	196,440
Cost per ton	$11 84
Pounds of mineral per ton hoisted	28.26
Pounds of ingot per ton hoisted	23.27
Per cent of mineral in rock hoisted	1.413
Per cent of ingot in rock hoisted	1.163
Tons of rock stamped	141,579
Cost per ton	0.4060
Tons of rock stamped per cord of wood consumed	12.40
Per cent of mineral in rock stamped	1.396
Pounds of mineral in ton of rock stamped	27.94
Pounds of ingot in ton of rock stamped	20.88

Per cent of mineral in rock stamped	1.867
Per cent of ingot in rock stamped	1.134
Cost of mineral per pound at smelting works	6.54 cents.
Cost of ingot per pound at smelting works	7.91 cents.
Per cent of copper in the mineral	80.312

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	3	660	1874	23	1,780
1858	56	1,104	1875	583	800
1859	116	1,231	1876	963	641
1860	157	1,860	1877	1,169	1,817
1861	783	43	1878	1,290	1,526
1862	733	645	1879	1,414	1,703
1863	639	694	1880	1,168	466
1864	905	1,235	1881	1,338	1,993
1865	779	1,481	1882	1,632	120
1866	919	994	1883	1,744	1,308
1867	701	455	1884	1,882	1,097
1868	737	1,326	1885	1,969	1,172
1869	779	970	1886	2,132	297
1870	589		1887	1,975	1,832
1871	300	1,000	1888	1,827	1,751
1872	185		1889	2,173	62
1873	188				
Total				31,741	128

No. shares 40,000; par value $25. Location of mine, Section 24, T. 55, R. 33. Mine office, Hancock, Mich. Boston office, 19 Congress street.

Officers of company: H. J. Stevens, President; D. L. Demmon, Secretary and Treasurer; Johnson Vivian, Superintendent; Thomas Dennis, Mining Captain; Arno Jaehnig, Clerk.

QUINCY MINING CO.

This company has made important changes during the past year that will greatly facilitate its mining operations and enable it to increase its production. No. 4 shaft has been straightened so that the movement of the skips in hoisting can be accelerated. It has also been made a double skip shaft and soon will be in readiness to be so used. The skips will be made to balance one another, the empty one going down as the full one ascends. Skips hold 2½ tons each. The angle of the shaft is now 54° with the horizon down to the 20th level; thence, after, the angle is 51°. The shaft has been sunk to the 39th level, being now 3,070 feet deep on the incline—2,300' vertically. The new level opened continues to show the usual phenomenal excellence of the deposit and there is very much of the deposit yet standing throughont the mine that is rich enongh to pay well to remove; still it may be doubted if the facts regarding all the standing ground in the mine are so well known that it can be said just what is rich and what is poor. A great deal of the lode left in the levels will be mined out, no doubt, but the work of getting it will in a measure partake of the character of a new exploration. Thus far but very little timber has been used in the mine. The method of leaving pillars suffices to hold the hanging in place. Now that the company has the new stamp mill and the railroad built to it from the mine, it will of course be economy to make the greatest production possible; for the expense of operating the road will be nearly as great for a small output as for a large one.

The Quincy has a conspicuous advantage over other amygdaloid mines in the fact that it yields a larger amount of mass and barrel work; that is, perhaps, the most profitable form in which copper occurs. As found in the Quincy, this form of copper requires neither cutting nor stamping; it is ready for the smelter as soon as it comes from the mine; 37½% of the product is A copper.

The new mill is on the margin of Torch Lake, on lot 3, sec. 23. As would of course be expected, the mill and everything pertaining to it are of the best. It is intended to be as well appointed as a mill can be. The mill proper is 198x120 feet, and contains two heads of stamps like those in the Tamarack mill, and there is place for a third head. There are 56 jigs and 8 double locked slime tables. The iron mortar plates weigh 75 tons and rest on heavy oak timbers. The timbers are bedded in cement and are built from the ledge up eight tiers deep, laid crosswise, in cement. The weight of the mortars is 16 tons each. In round numbers each stamp, with mortar plates, weighs 125 tons.

The pump and boiler house stands on the opposite side of the road from the mill on lower ground, nearer the lake. This pump house is connected with the mill by a covered way that inclines up, spanning the highway.

The lower building is of stone, 154'x56' divided into pump and boiler house—in the latter are six boilers with room for two more. The pump is a high duty Worthington, having a capacity of 8,000,000 gallons of water per twenty-four hours. The water is brought to the pump through an adit from the lake. The pipes, etc., pass from the pump house to the mill through the covered way referred to above. Above the mill are two small streams of water that will be used to help supply the stamps or boilers; enough for both, I am told, at certain seasons of the year. There are convenient arrangements for handling coal, etc., at the dock; and, also, the approaches to the mill for bringing the rock are excellent, being after the plan of those at the Tamarack mill.

The product of the mine was 7,820,040 pounds, or 3,910 10-2000 tons of mineral, yielding about 81 9-10 per cent, or 6,405,686 pounds of refined copper, for which has been realized the gross sum of		$766,244 36
Realized from sale of silver		2,195 87
		$768,440 23

The expenses of the year are as follows:

Running expenses at mine	$337,740 72	
Building and construction account	87,097 80	
Quincy and Torch Lake railroad	71,882 63	
Smelting, transportation and all other expenses	102,856 87	
		600,148 02
Leaving as a mining profit		$168,292 21
There has also been realized during the year, from interest on loans		12,568 93
Received from real estate, Hancock		1,800 00
Making the income of the year		$182,661 14

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

January 1, 1889		$562,706 41
Add earnings of 1889		182,661 14
		$745,367 55
Deduct dividend of February 15, 1889	$200,000 00	
Deduct dividend of August 15, 1889	80,000 00	
		280,000 00
Leaving balance of assets Jan. 1, 1890		$465,367 55

A dividend of $3.00 per share, or $120,000, payable February 17, has been declared, which, with dividend of $2.00 per share, paid August 15, last, makes a total for the year, $200,000.

GENERAL SUMMARY OF RECEIPTS AND EXPENDITURES OF THE QUINCY MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1889.

Receipts.

From capital stock paid in	$200,000 00
From proceeds copper and silver (106,627,134 lbs. copper)	19,971,215 06
From interest	149,021 24
From profit on sale P. L. & E. Improvement Company stock, and other investments	79,637 16
From sales of real estate, Hancock, Mich.	60,250 43
	$20,460,123 89

Expenditures.

For expenditure on location previous to 1856	$42,097 98
For expenditure Quincy vein, 1858, not now worked	55,000 00
For openings and explorations on 3,000 feet "east" or Pewabic vein, extending to Portage Lake, preparatory to future work	11,500 00
Real estate and permanent improvements on the same, including dwelling houses, stamp mill, machinery, steam engines, railroad, dock warehouse, and other buildings and roads	1,353,248 48
Mining and surface labor, expenses of smelting and marketing copper, and all incidental expenses	13,282,909 88
Balance carried down	5,715,367 55
	$20,460,123 89
Balance brought down, being receipts over expenditures	$5,715,367 55
Deducting dividends declared, Nos. 1 to 2 inclusive	5,250,000 00
Leaving balance as per statement on next page	$465,367 55

STATEMENT OF ASSETS AND LIABILITIES, EXCLUSIVE OF REAL ESTATE, MINE PLANT AND SUPPLIES IN USE, JANUARY 1, 1890.

Assets.

Cash in New York office, and copper		$361,132 42
Cash on hand at mine		6,231 92
Accounts receivable, since paid		45,333 62
		$412,697 96

Liabilities.

Drafts unpaid	$105 00	
Dividends unpaid	599 00	
Accounts payable in New York	20,529 35	
Accounts payable at mine	38,771 41	60,004 76
		$352,693 20
Add at mine, viz:		
Supplies per inventory on file	$93,851 10	
Farm account (horses, wagons, etc.)	5,004 00	
Accounts receivable	38,589 25	112,534 35
		$465,367 55

Less dividend payable February 17, 1890, $1.00 per share, $120,000.

Summary for Year.

Average force employed	485 men.
" number of miners	145 "
" wages of miners on contract, per month	$49 15
Yield of mineral per fathom of ground broken	842 lbs.
" of refined copper per fathom of ground broken	690 "
Total rock mined	167,077 tons
" " hoisted	123,986 "
" stamp-rock treated	117,285 "
Yield of rock stamped	2.82 per cent. mineral
Product stamped mineral	6,641,785 lbs.
" masses	1,178,225 "
" refined copper	6,405,686 "

AGENT'S REPORT.

QUINCY MINE, LAKE SUPERIOR, MICH.,
January 31, 1890.

The following report of the Quincy mine for the past year is respectfully submitted:

During the year No. 2 shaft was sunk from the thirty-eight to the thirty-ninth level.

The drifting done from this shaft was at the thirty-sixth, thirty-seventh, and thirty-eighth levels north. The thirty-ninth level was drifted north and south of shaft a few feet only. The vein, for the most part, as shown in those drifts, is of good width and full average quality.

At the twenty-fifth level about one hundred and fifty feet south of this shaft a crosscut was driven east fifty-five feet, intersecting at that point a low grade stamp vein.

The stoping done in this part of the mine was at the thirty-eighth and thirty-seventh levels north and south of shaft; at the thirty-sixth, thirty-fifth, thirty-fourth, and thirty-third levels north, and at the the thirty-second, thirty-first, thirtieth, and twenty-ninth levels north and south of shaft. A little profitable stoping was also done at the twenty-eighth level north and at the twenty-fifth level south of shaft.

No. 4 shaft was sunk from the thirty-eight to the thirty-ninth level.

The drifting done from this shaft was at the thirty-ninth and thirty-eight levels, north and south of shaft. At the thirty-seventh, thirty-sixth, and thirty-first levels south, and at the sixteenth level north and south of shaft.

The drifting done at the thirty-ninth level was mostly in low grade stamp vien,— though south of shaft it showed a few bunches of good copper ground. North of shaft, in this level, a crosscut was driven east forty feet, when it intersected an ordinary looking vein, narrow, and carrying only just a little stamp copper.

Drifting at the thirty-eight level, north, was on an east branch of low quality. Drifting south in this level was on the main vien. Much of it was low grade, but several short stretches of rich vein were exposed. The thirty-seventh level opened up some fair stoping ground. The thirty-sixth level was mostly in narrow, low grade vein. At the thirty-first level two hundred and thirty-three feet south of shaft, a crosscut was driven east sixty feet, intersecting a wide good-looking stamp vein, in which a drift was extended south one hundred and fifty feet. Drifting at the sixteenth level exposed some good stoping ground. About one hundred feet north of shaft in this level, a crosscut was driven east sixty feet, exposing a body of fair looking stamp vein.

The stoping done in this part of the mine was at the thirty-seventh level south, at the thirty-sixth, thirty-fifth, and thirty-fourth levels north and south; at the thirty-third, thirty-second, and thirty-first levels south; at the twenty-seventh level north and south; at the twenty-fifth level south, and at the sixteenth level north and south of shaft.

The straightening of No. 4 shaft from the sixth to the eighteenth level was completed in the early part of the year. Later on, in view of the prospective increased demand for stamp rock, it was thought advisable to prepare the shaft for a double skid track. This improvement was accordingly taken up, and all the work necessary, except the timbering, has been nearly finished. To carry out this plan for increased production, it will be necessary to make an addition to No. 4 engine house, and to place another hoisting drum therein. All this will be carried out in due time.

The usual repairs to machinery, dwelling houses, and other buildings were made and everything in and about the mine kept in good working condition.

Work at the new stamp mill site was resumed in May last, though there was not much of importance done until the month following.

In addition to the mill building, pump and boiler house, there were six substantial frame dwelling houses erected for employees, and a small ware house built at the dock. A small stone building was also put up for the storage of oil.

For the unloading of coal from vessels a convenient hoisting apparatus was erected, and an elevated tram railroad built from the dock to the boiler house. By this contrivance coal can be rapidly and cheaply unloaded and taken directly to boiler house or dumped outside.

To utilize the water from the two little creeks near the mill, a run of launders, some eighteen hundred feet in length, altogether, was laid from the creeks to a tank in the mill. The water thus obtained will always be enough to feed the boilers, and during the spring and fall there will probably be sufficient to supply one, if not two heads of stamps. The boilers, pumping engine, pipes and most of the mill machinery are now in working order and we expect to have the mill ready for active service by March 1, next.

The Quincy and Torch Lake railroad was practically finished in October last a small gap only being necessarily left open at the mine end. This road throughout is well built, and is fully equipped to meet all probable requirements for many years to

come. At the mine end of the road a substantial stone locomotive engine house thirty-eight by sixty-four feet was built, and a fifty foot iron turn-table set in masonry near by. At the stamp mill end of road a similar turn-table was placed and a small frame building erected there. This building serves as a depot and also to cover a three thousand gallon water tank.

Maps of the mine, and tabulated statements of work and expense in the different departments have as usual been sent from this office.

S. B. HARRIS, *Agent*.

Table showing yearly product of Quincy mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1856	6	1,462	1873	1,400	
1857	61	762	1874	1,525	654
1858	158	772	1875	1,884	281
1859	178	1,114	1876	1,536	1,171
1860	970	414	1877	1,427	326
1861	1,248	852	1878	1,480	449
1862	1,153	218	1879	1,328	1,458
1863	1,115	1,757	1880	1,848	262
1864	1,251	566	1881	2,753	884
1865	923	1,500	1882	2,882	1,796
1866	1,172	1,000	1883	3,006	239
1867	1,013	1,000	1884	2,825	426
1868	727	1,000	1885	2,924	407
1869	1,208	1,365	1886	2,961	1,529
1870	1,248	1,777	1887	2,804	1,762
1871	1,204	1,591	1888	3,153	1,889
1872	1,334	1,134	1889	3,202	1,086
Total				58,250	1,388

Thomas F. Mason, President; Wm. E. Todd, Treasurer, 52 Broadway,

The quality of the rock that is stamped varies but little in richness. This is shown by the percentage of copper obtained, as given in the following table:

Year.	Per Cent.	Year.	Per Cent.	Year.	Per Cent.
1851	2.55	1871	2.29	1881	2.88
1852	2.03	1872	2.17	1882	2.80
1853	2.75	1873	2.60	1883	2.85
1854	2.96	1874	2.61	1884	
1855	2.60	1875	2.44	1885	2.70
1856	2.63	1876	2.38	1886	2.30
1857	2.74	1877	2.11	1887	2.97
1858	2.25	1878	1.76	1888	2.70
1869	2.48	1879	1.80	1889	2.72
1870	2.61	1880	2.59		

PEWABIC MINE.

I have heretofore in this report, in describing the Franklin, referred to the Pewabic. A recent decision has been rendered in this important case by the supreme court of the U. S., requiring that the mine be sold. Both the Quincy and Franklin companies desire to own it. It would be very valuable to either and could be so divided as to be of equal advantage to both.

THE HURON COPPER CO.

I think that the Huron would be a paying mine if it could be more extensively worked; that is if more rock were mined, a greater extent of openings made and a third stamp head kept running. It is not a rich mine, but then for about the same amount of opening there is a regular supply of copper. The work is done cheaply enough and even as it is the company would have been on a firm basis if it had not been for the great amount of bad luck that has been met with. The Huron is doing well now and it is probable that the company will clear up its indebtedness within the year. Considering the scale of its operations no mine could be better managed. There has been no change about the mine, or in it, except that it is deeper. Matters remain the same.

Tons of rock hoisted	150,333
Cost per ton of rock	$1 69
Tons of rock stamped	112,723
Cost of stamping on ton rock	$0.4722
Number pounds mineral in one ton of rock hoisted	17.37
Number pounds ingot in one ton of rock hoisted	13.92
Number pounds mineral in one ton of rock stamped	24.56
Number pounds ingot in one ton of rock stamped	19.96
Per cent mineral in rock hoisted	.00869
Per cent ingot in rock hoisted	.00696
Per cent mineral in rock stamped	.0123
Per cent ingot in rock stamped	.009845
Number tons stamped per cord of wood	8.57

Memoranda.

Total expenditures	$270,525 07
Pounds of mineral produced	2,766,470
Per cent of ingot in mineral	80.18
Pounds of ingot	2,219,473
Cost of mineral per pound at smelting works	$0.0926
Cost of ingot per pound at smelting works	$0.1213

Expense Account.

Mining expense	$178,391 19
Surface expense	9,239 81
Stamp mill expense	53,227 98
Rock house	15,383 26
Tram road	2,851 81
General expense	5,445 43
Office expense	1,021 24
Construction expense	907 52
Extra pumping expense	84 83
Total	$270,525 07

Total number of men	209
Tram road cost per ton	0.253
Per cent of rock rejected	28.25
Cost of selecting, breaking and delivering one ton of rock to cars	0.0923
Number fathoms of ground broken	8,852
Number feet shafts sunk, 137.8; cost per foot, sinking	$15 36
Number feet winzes sunk, 140; cost per foot, sinking	$11 69
Number miners employed	126
Number feet drifted, 3,339.7; cost per foot	$7 96
Number feet crosscut, 91.2; cost per foot	$8 74
Number fathoms stoped, 75,943.5; cost per fathom	$3 94

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	3		1873	257	1,883
1856	12		1874	125	1,005
1857	35		1875	81	1,269
1858	24		1876	31	1,857
1859	22	1,387	1877	41	161
1860	4	1,000	1878	32	1,100
1861	49		1879	14	1,760
1862	69	1,305	1880	85	285
1863	69	206	1881	127	815
1864	50	1,745	1882	182	579
1865	268	11	1883	300	213
1866			1884	903	1,660
1867	683	1,164	1885	1,135	1,163
1868	740	80	1886	906	995
1869	841	863	1887	742	103
1870	42	183	1888	1,187	1,147
1871	134	1,453	1889	1,109	1,473
1872	276	1,984			
Total				10,652	279

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

THE ISLE ROYAL, GRAND PORTAGE, ETC.,

mines, lying north of the Huron, between it and the lake, remain idle. The owners hold them for sale and sometime, no doubt, they will be again worked with better results than formerly. In this stretch of ground would certainly be a good mine.

Graham Pope, Agent, Houghton, Mich.

THE ATLANTIC MINING CO.

The Atlantic Mining Company continues its record of excellent results. There has been a change in the local management, Mr. Frank Mc M. Stanton, M. E., having assumed the office of agent and discharged its duties. The Atlantic is the best example we have of a mine in very low grade rock operating through a series of years at an annual profit. The Atlantic belt bears N. 50½° E.,

having a northeasterly dip of 45°. It is remarkably uniform in strike, dip, width and composition. It is a soft, dark brown amygdaloid, about 14 feet in width, through which the copper is so generally disseminated that all the deposit is taken and treated at the stamp mill. The latter is on the south side of Portage Lake, 2½ miles from the mine, with which it is connected by a railroad. The mill is supplied with water from sources above, the water being brought in a launder. There are 5 Ball stamps and the mill is well appointed and well conducted. There are four shafts in the mine, numbered from the north. The rock from all of them is run on an elevated trestle, by winding machinery, to the rock house which is situated a short distance south of No. 4 shaft. Thence on the railroad the rock is taken to the stamp mill, thence the "mineral" copper goes to the smelting works, a mile distant. The Atlantic is ever designated as a poor mine, and it is so as to the percentage of copper obtained; but from the above brief statement, it will be seen that it possesses important advantages, which under the exceeding good management which it has fortunately had, account for the success achieved. These are the width of the lode, its angle of dip, its comparative softness and uniform character, and the relief from cost of pumping at the mill. Still there are changed necessary, some are now making, which should still further reduce the cost of production. For instance, I recently watched the ascent of the skip at No. 3 shaft. The movement was so slow that I inquired as to the cause, of Mr. Stanton, who informed me that it was moving at its accustomed rate, that it took 4½ minutes for the skip to come up from the bottom, bringing 1½ tons of rock. One can understand that there is no economy in this. The machinery is so inadequate that were it not for the counter weight car it would not bring up the skip at all. They have a new hoisting plant for this shaft that will soon be in operation. It consists of double Corliss engine 22”x60" double, coned drum, 12' diameter at ends and 21' in center. It is necessary to explain that a new shaft has been made 30 feet north of No. 3, through the old openings. It is north of the shaft pillars, is 9’x16', and thus large enough for two skip roads. The new machinery will operate both this and the old shaft, the new one to be used to hoist the rock in and the old one for car for men to ride in and to send down timber in and for pump rod, etc., three ton skips will be used, weight 5,000 lbs., buffers are added to take up the "chuck" due to inequalities of the track. The new engine house is built of Portage Entry sandstone; it is 49x55', iron roof; light admitted from above. A new 100 horse-power steel boiler has been added to No. 3 steam plant, to suffice for increased demands. Also new half of duplex compressor has been procured. New machinery built by M. Bullock & Co.

It is contemplated to build a new shaft house at No. 2, and to include in the structure a rock house, to take the rock from No. 1 and No. 2 shafts. Rock houses will be put at No. 3 and at No. 4 shafts first. No. 4 shaft house is so old that it must give way to a new one and the rock house will be included. The shafts have all been sunk one level in the past year, and No. 3 is now to the 19th; 1,800 feet in length. No. 4 is to the 17th level, No. 2 to the 13th; 1,275 feet deep, and No. 1 900 feet. The extreme length underground is upwards of 4,000 feet, and nearly 2,000 feet from No. 1 to No. 4 shaft.

The company has purchased 200 acres of land, the northwest corner of which is about 300 feet east of No. 2 shaft.

Annual Report of the Atlantic Mining Company.

The directors present the following report of operations during the year 1889:

The production of mineral was 5,099,504 pounds which yielded 73 83-100 per cent, or 3,698,837 pounds of refined copper, which realized and average price of about 11.09 cents per pound.

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

Production.

3,698,837 lbs. copper at 12.09		$447,291 25
Add balance of interest account		6,023 43
Add dividend received on estate of Thos. J. Pope & Bro.		502 40
		$453,816 07

Costs.

Working expenses at mine, as per clerk's tables		$33,120 17
Freight	$9,264 97	
Smelting	36,510 55	
Expenses	7,308 79	
Brokerage	2,047 36	
Insurance	867 15	
Storage	106 24	
Taxes (City and State of New York)	246 67	
	56,366 73	
		$389,466 90
Showing a mining profit of		$64,349 17
There has been expended for additions to plant, as per detailed statement hereafter		37,309 56
Leaving a net gain for the year of		$26,679 61
The surplus from 1888, after payment of dividend, was	$302,564 80	
Less allowance on inventories of supplies at mine	6,223 48	
		296,341 32
Making the net surplus, Dec. 31, 1889		$323,020 93

as shown in detail in the annexed statement of assets and liabilities and out of which a dividend of one dollar and fifty cents per share ($60,000 was paid Feb. 1, 1890).

Assets and Liabilities, Atlantic Mining Company, December 31, 1889.

Assets.

Cash		$53,057 95
Accounts receivable		7,957 33
Loans		120,344 38
Copper on hand, sold		60,874 17

At Mine.

Cash	$1,877 16	
Coal	14,167 88	
Wood	18,280 60	
Supplies	39,036 48	
Merchandis ein store	38,820 63	
		112,082 75
Total assets		$354,196 58

Liabilities.

Indebtedness at mine	$21,000 50	
Agent's drafts outstanding	2,000 00	
Accounts payable	7,573 15	
		31,175 65
Balance of assets		$323,020 93
(Less dividend payable February 1, 1890	$60,000)	

Summary of Receipts and Expenditures of Atlantic Mining Company, From Date of Organization to December 31, 1889.

Receipts.

Capital stock paid by consolidation	$700,000 00	
Capital stock paid by assessments	280,000 00	
		$980,000 00
Sales of copper		6,104,076 49
Other sources		829 15
		$7,084,929 64

Expenditure.

Real estate ("South Pewabic" and "Adams" mines, buildings, railroad, stamps, etc., as valued at consolidation)	$679,642 11	
Real estate (lands since purchased)	33,464 41	
	$713,106 52	
Net expenditure for additional equipment, mining operations, smelting and marketing copper, taxes and incidentals	6,188,802 19	
		6,901,908 71
Balance of receipts, being net profit to date		$183,020 93
Deduct dividends paid		60,000 00
Net surplus December 31, 1889		$323,020 93
(As shown in detail in preceding statement.)		

(As shown in detail preceding statement.)

STATEMENT OF WORKING EXPENSES AT THE ATLANTIC MINE FOR THE YEAR ENDING DECEMBER 31, 1889.

Underground Expenses.

Sinking 94 feet, average $24.20 net		$2,284 50	
Drifting 3,625.8 feet, average $5.53 net		20,044 41	
Stoping 14,457.5 fathoms, average $4.49 net		65,049 14	
Timbering, tramming and labor		67,741 91	
Timber, materials and supplies		8,644 10	
Pumping and operating air compressors:			
Labor	$8,577 86		
Fuel	17,310 10		
Supplies and materials	4,888 37		
		30,776 33	
			$194,588 99

Surface Expenses.

Superintendence, and labor of all kinds, less sundry credit items		$25,437 18	
Supplies and materials		6,854 32	
Fuel		15,324 40	
Feed for teams, etc.		1,098 77	
Fire insurance		446 00	
Taxes		2,887 30	
Canal tolls on copper		327 93	
Expenses and sundry repairs		1,987 76	
		$54,361 66	
Less amount received for rents		4,015 16	
			50,346 47

Railroad Expenses.

Labor		$5,917 48	
Fuel		2,649 15	
Supplies		2,462 41	
		$11,029 05	
Less received for transportation		213 00	
			10,816 05

Stamp Mill Expenses.

Labor		$28,128 61	
Fuel		45,782 93	
Supplies		11,658 29	
Fire insurance		990 00	
Teaming, mineral, etc.		1,112 24	
		$77,692 29	
Less received for dockage		213 00	
			77,419 29
Total working expenses			$333,120 17

CONSTRUCTION ACCOUNT.

At Mine.

Hand fire engine and hose cart		$600 75	
800 feet fire hose		510 26	
Labor on engine house		450 80	
Supplies and materials		671 09	
			$2,323 28
Labor on wind mill, cistern, piping, etc.		$401 64	
Wind mill, pipes, and fixtures		736 01	
Teaming		33 75	
			1,171 40
Fixtures for heating store with steam and setting same		$344 60	
Fixtures for heating agent's house with steam, and labor		195 01	
Fixtures for heating "dry house" with exhaust steam, piping and labor		687 75	
			1,777 33
Labor on new shaft		$4,946 66	
Rails and other supplies for same		2,706 92	
			7,652 58
Building stone engine house, labor, supplies, etc.			4,865 44
M. C. Bullock Mf'g. Co. on account of hoisting engines			9,000 00
1 single frame house		$275 00	
1 two-story double house		612 84	
1 one and one-half story single house		350 00	
1 two-story double house		1,862 57	
1 double log house		330 29	
			3,131 70
			29,057 76

At Mine.

Materials for 1,000 feet sand launders		$1,756 34	
Labor and teaming on same		510 63	
			$2,266 97
Centrifugal sand pump and engine		$600 00	
Addition to mill building for same		41 10	
			650 10
			$2,917 07

At Dock.

Contract for building new dock		$1,948 71	
Timber, supplies and teaming		2,749 50	
			$4,698 21
Labor moving and repairing ware-house		$356 23	
Lumber and other supplies		346 29	
			702 52
			5,400 73
Total expenditure			$370,789 73

Summary of Results.

Ground broken in openings and stopes	36,125.9 cubic fathoms.
Rock stamped	276,680 tons.
Product of mineral	5,060,504 lbs.
Product of refined copper	3,696,887 lbs.
Yield of refined copper per cubic fathom of ground broken	28.9 lbs.
Yield of rock treated, 13 272-1000 lbs. copper per ton, or	0.933 per cent.
Gross value of product, per ton of rock treated	$1.9050
Cost per ton of mining, selecting and breaking, and all surface expenses, including taxes	.8787
Cost per ton of transportation to mill	.0388
Cost per ton of stamping and separating	.2778
Cost per ton of working expenses at mine	1.1953
Cost per ton of freight, smelting and marketing product, including New York office expenses	.3022
Cost per ton of running expenses	1.4975
Total expenditure per ton of rock treated	1.5827

The agent says: "During the first quarter of the year we treated 960 tons of rock per day, with an average yield of 12,938 lbs. of copper per ton of rock, being lower than has ever been experienced at this mine. This and other results led us to believe that we were crowding the mill and in April the amount of rock treated was reduced to about 875 tons per day. Since that time the average yield has been 13,397 lbs. per ton, giving an average yield for the year of 13,272 lbs., against 13,336 in 1888. There has been no perceptible change in the character of the rock, with the exception of a poor streak in the 19th level, which we are drifting through, and the ground is apparantly improving as the work progresses."

The following table gives the product each year:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
1866			1878	1,132	1,592
1867	6	1,475	1879	1,152	1,822
1868		1,260	1880	1,170	1,195
1869	764	258	1881	1,264	9
1870	823	857	1882	1,315	1,708
1871	186	617	1883	1,341	197
1872			1884	1,566	1,585
1873	491	1,336	1885	1,791	533
1874	686	403	1886	1,751	1,070
1875	783	1,086	1887	1,820	1,865
1876	917	1,041	1888	1,967	972
1877	1,027	304	1889	1,849	837
Total				28,788	1,105

Office, 76 Wall street, N. Y. John Stanton, Secretary and Treasurer; Frank McM. Stanton, Agent. No. shares, 40,000; par value, $25. Dividend paid, 1889, $80,000; total dividends paid, $560,000.

STONE.

LAKE SUPERIOR SANDSTONES.

Lake Superior sandstones continue to meet with general favor wherever they are used. The business of quarrying is increasing and a good deal of attention is given to the discovery of workable deposits of this stone. The largest producers are still Furst & Jacobs, of Marquette, and the Portage Bed Sandstone Co. The former produced in 1889 372,469 cubic feet of block stone, footing stone, 10,058 cubic feet, rubble stone 823 cubic feet.

This firm has produced at Marquette and Portage Entry in

1886	150,000 cubic feet.
1887	300,000 "
1888	300,000 "
1889	383,348 "

The Portage Entry Bed Sandstone Co. produced in

1888	250,000 cubic feet
1889	320,000 "

The companies pay a royalty to the owners of the fee of the lands from four to eight cents per cubic foot of stone produced.

Preparations are making to increase the business the coming year by the further introduction of machinery in the old quarries and the working of new ones. The stone sells from sixty cents to one dollar and twenty-five cents per cubic foot, and the beautiful brown stone at Marquette at even a higher figure.

The stone improves with age; it is quite soft when freshly mined, but becomes hard and impervious with time.

The Portage Entry Bed Sandstone Co. have now one hundred men at work stripping. T he superintendent is P. B. Parker, P. O. Jacobville, Mich.

THE BARAGA GRAPHITE CO.

The Baraga Graphite Company has been engaged in quarrying so-called graphite, near L'Anse, and a quantity has been sent to Detroit for trial. It is to be hoped that a paying industry will develop. A sample that I saw was soft, carbonaceous material that while not, apparently, graphite would still answer some useful purpose. Thus far it is in the experimental stage. Henry Kiesling, Sec'y, Detroit. More recently work has been wholly suspended.

THE MICHIGAN SLATE CO.

at Arvon continues to operate in an exploratory way. There are no other companies working.

C. M. Turner, Supt. of the Mich. Co., Arvon, Mich.

KAOLIN.

The following analysis was made of a sample of a large deposit of clay near Marquette:

Iron oxide	2.00
Silica	54.02
Alumina	12.82
Lime	12.68
Magnesia	4.25
CO^2 and waste	12.01

LAKE SUPERIOR GRANITE CO.

This company is an organization made by F. O. Clark, J. R. Devereaux, and other Marquette gentlemen, to investigate what appears to be a very valuable granite formation. They propose to explore it further and if it proves, on complete investigation, to be as valuable as it now seems, they will quarry the rock systematically. There are several varieties of the stone, some of which cannot be excelled for beauty or texture. It remains to be seen if it can be quarried in large blocks.

SERPENTINE, MARBLE.

I am told that Mr. J. M. Case, of Marquette, who controls large marble deposits which he has explored, has effected an organization of capitalists in London, England, to work the deposits.

The plan is to manufacture the crude material into finished forms, at Marquette, utilizing the water power in that city for the purpose.

Twelve miles east from Trout Lake station and two and one-half miles south, is a bluff of marble, which rises to an extreme height of seventy feet. In fact, there is an extensive deposit of this mineral in that vicinity. It is believed to be valuable.

But the Ishpeming Serpentine at the Ropes mine, and in that range, are certainly very fine. Experts in marble pronounce it to be equal to any other.

GOLD

GOLD EXPLORATIONS.

Gold explorations continue, and, on the whole, the outlook for this mining industry on Lake Superior has improved within the year. Some definite results have been obtained and are favorable. I think that gold mining has come to stay; that, though it may not become a large industry, it will be a permanent one. There is evidently gold enough in the rock to pay for mining it and the veins are persistent.

THE MICHIGAN GOLD COMPANY.

This company having won the suit establishing its claim to the lease of the land, immediately began more definite mining operations. A Huntington mill was procured and the work of treating the accumulated rock was begun. From the first run of twenty-eight tons of rock $8,400 worth of bullion was obtained, an average of $293 to the ton of rock treated. Previous to this, in December, about $3,000 of the metal was derived from several hundred tons of quartz, rich in free gold, by hand manipulation. There are still in the Cleveland office about two tons of exceedingly rich rock, estimated to be worth many thousands of dollars.

The main shaft is now, February 27, 105 feet deep and the vein 8 feet wide in the bottom. However, the best description is the result, and the following is to the point:

ISHPEMING, Mich., March 7, 1890.

Mr. F. P. Mills, Agent Michigan Gold Company:

DEAR SIR—February run of 150 tons of quartz yielded of gold bullion $3,581 90
Silver 30 60

Total $3,612 52

This makes a value per ton recovered of $24.08.

Loss in tailings per ton in gold $3 40
Loss in tailings per ton in silver 12

Total $3 52

Making total value per ton of rock treated $27 60

Days of 24 hours each run by mill is 20, and average tons treated per day 7½.
The loss in tailings seems high. I account for it from the fact that the "deep shaft" rock carries its gold and the mineral (antimonial galena) so very fine, and the fine gold being so intimately associated with it, that it does not all amalgamate. It would concentrate more closely in vanners.

Yours truly,
J. ROPES, *Supt. of Mill.*

Approved:
R. A. TREVARTHEN, *Supt. of Mine.*

There is one thing about the Michigan gold mine, it is self sustaining. They have money in the treasury from the earnings so far.

The mine has yielded more than has been paid out.

The owners, I think, have faith in it and say that the mine will be fully worked for all that it warrants. Its management is in good hands.

The following shows the operation of mill, receipts from specimens sold and amount due us for treating outside quartz, all for the month of March, 1890:

10½ days milling Michigan rock at 7.31 tons per day	75 tons.
Melted pullion obtained	3.562 lbs. adv.
Which assays:	
Gold	82.91 per cent
Silver	17.09 per cent
and gives a value of	
Gold	$800 85
Silver	8 14
Making 75 tons yield $11.06 per ton or $808.99 in all.	
Loss in tailings by assay:	
Gold	$1 00
Silver	04
	$1 04
Making actual value of rock $13.00 per ton.	
Receipt from bullion	$886 99
For specimens sold	265 50
For treating 60 tons of Gold Lake quartz at $5.00	300 00
Total	$1,462 49

Yours truly,

J. ROPES, *Supt. of Mine.*

Approved:

R. A. TREVARTHEN, *Supt. of Mine.*

AT THE GRAYLING

they have been exploring with the diamond drill and the results that are given establish the fact that the vein holds its size and richness down to the depth to which the drill penetrated.

THE GOLD LAKE MINING CO.

This is the name now given to the Lake Superior property joining the Michigan. It was in this property, near the Michigan mine line, where the first extraordinary rich pocket was found. The earliest quartz specimens that started the gold excitement, were found in this shaft. The L. S. Iron Co. owns the land and first explored it quite systematically and afterwards concluded to lease it. The shaft is 87 feet deep, and they are drifting to find the vein which was not followed in sinking the shaft. An average of the rock taken from all parts of the mine is stated to give more than $20 per ton.

W. L. Jones, Supt.

THE PENINSULA.

The Peninsula, which joins the Grayling, has not been much explored during the year.

R. A. Trevarthen, Supt.

THE ROPES.

As the Ropes gold mine has been systematically worked for years and still continues to be so, it is natural that the results obtained at it should be scanned with much interest and should afford an excellent criterion to judge of the future of this industry. Fortunately the company publishes an annual report which gives all the information that is requisite.

March 10, 1890.

To the Stockholders of the Ropes Gold and Silver Co.:

GENTLEMEN:—I submit the following report relative to the operation of mine and mill for the year ending February 28, 1890.

The main shaft has been sunk 110 feet, making present depth of shaft 551 feet, the 11th level. The last 94 feet was in barren rock, the vein having pitched to the north or foot wall side. The skip road is laid to the 10th level.

On the first and second levels no work has been done the past year.

On the third level we have drifted 60 feet to the west, at this point a connection was made with second level by a raise winze of 35 feet, developing a fine body of pay ore, to the east no work has been done the past year, here a large body of pay rock extends to the surface.

The fourth level has been extended 32 feet to the west in low grade rock; to the east nothing but stoping has been done.

On the fifth level, 150 feet west of shaft, a raise winze was made to the fourth level, opening up a good body of ore; to the east nothing but stoping has been done. Here is a body of very good ore.

The sixth level has been extended 88 feet to the west, all in good ore; no drifting has been done to the east.

On the seventh level to the west a raise winze to the sixth level opened a good body of pay rock; sixty feet to the east of shaft a raise of 52 feet shows fine ore; 84 feet further to the east a large body of good ore stands.

On the eighth level the drift has been extended 50 feet to the west, all in good ore, the vien having on average width of about 12 feet. To the east of the shaft the drift has been extended 80 feet, about 20 feet of this in fair ore, at the end of drift a winze was raised to the seventh level; at this point the good ore is 15 to 20 feet in width.

The ninth level has been extended 75 feet to the west, following the same body of ore as in the level above; this has been connected with eighth level by a winze. To the east 94 feet has been drifted all in low grade ore, this can be profitably worked.

On the tenth level the drift of 96 feet to the west is still in the barren rock through which the shaft was sunk, indications lead us to expect good ore in a few more feet; a crosscut from shaft to the north shows 9 feet of good ore.

On the eleventh level a drift has been started to the north to reach the ore body showing on the tenth level.

The surface improvements during the year consist of the addition of two heads of stamps, four Frue vanners, which were placed in the mill building erected in 1888, and were started August 20.

Half of an 18x30 Rand air compressor, the foundation for which was built for a Duplex machine, so that the other half can be added at any time.

A building for compressor and hoisting machinery was erected 26x30 feet with a wing 20x40 feet, a dry house 16x26 feet, a two-story dwelling for superintendent.

The cost of these improvements was $20,113.02. The present hoisting drum being inadequate for greater depth of shaft, we have ordered a six foot Lane band friction drum, to be operated by the 16x30 engine, which formerly furnished power for the first mill.

The number of tons of rock treated during the year was 31,365, the average yield $3.18 per ton. Numerous experiments have been made to treat the concentrates at the mine, but so far without success.

A careful survey of the mine gives the management every assurance of a prosperous future for the property.

J. ROPES, President.

ISHPEMING, MICH., *March 8, 1890.*

SECRETARY'S REPORT FOR YEAR ENDING MARCH 1, 1890, ROPES GOLD AND SILVER CO.

On hand March 1, 1889		$4,788 69
Received for small engine		100 00
" " treating 71/4 tons quartz for Michigan Gold Co.		351 25
" " Bullion 12 mos.		75,927 69
" " concentrates to Feb. 1, 1890		9,540 96
" " supplies		91 27
" " rents		313 25
		$91,118 11

Contra.

Paid out for insurance and taxes		$2,941 81
" " for labor		38,906 12
" " supplies		7,602 10
" " general expenses		3,286 43
" " wood and coal		10,446 52
" " office expenses		634 75
" " new machinery and new buildings		20,118 02
" " freight		738 39
" " machinery repairs		621 38
" " cost of assay office		1,058 95
Cash on hand		4,659 15
	$91,118 11	$91,118 11

Assets—Available.

Cash	$4,659 15	
Supplies at mine	5,779 14	
Horses, sleighs, etc.	1,200 00	
1,344 cords of wood at $2.00	3,088 00	
Accounts receivable	800 00	
Laboratory supplies	434 00	
Office supplies	185 00	
Coal 125 tons at $3.50	437 50	
Concentrates at mine and works	4,038 00	
	$19,409 78	$19,409 78

Unavailable Assets.

Mill machinery and buildings	$95,406 75	
Water works	4,000 00	
Crusher and shaft house	6,000 00	
Dwelling houses and shops and barns	5,300 00	
Supplies in use	7,439 92	
		118,236 67
Total assets exclusive of mine		$137,646 45

Liabilities.

Notes not acceptances not due	$1,881 29	
Accounts payable	5,184 72	
Fuel account, wood not due	1,878 96	
February pay roll	3,883 98	
		$12,778 95
Number tons quartz treated for year		21,265
Average yield per ton		$5 18

Ropes Gold and Silver Co.—Statement of Concentrates for Year Ending Feb. 1, 1890:

Date.	Amount gold.	Amount silver.	Freight and w'k'g charges.	Net proceeds.
From March 1, 1889, to Feb. 1, 1890	$17,218 86	$6,309 48	$13,987 38	$9,540 96

Statement of Bullion for Year ending March 1, 1890.

Date.	Amount gold.	Amount silver.	Mint charges.	Net proceeds.
March, 1889, to March 7, 1890	$72,861 54	$8,345 57	$259 42	$75,927 69
Concentrates	17,218 86	6,309 48	13,987 38	9,540 96
Total	$90,080 40	$9,655 05	$14,246 80	$85,468 65

Recapitulation.

	Amount gold.	Amount silver.	Net proceeds.
Product to March 1, 1889	$152,644 61	$16,135 35	$145,245 17
Product for year to March 1, 1890	90,080 40	9,655 05	85,468 65
Total product	$242,705 01	$25,790 40	$230,713 82
Gross gold			$242,705 01
Gross silver			25,790 40
Total			$268,495 41

J. Ropes, President; C. R. Ely, Secretary; E. W. Hebard, Treasurer; W. H. Rood, General Manager.

The Ropes Co. owns its land in fee—80 acres.

The number of shares is 80,000.

Since the annual meeting a Huntington mill has been ordered, to cost $3,600. It is estimated that it will work up 15 tons of rock per day.

GYPSUM.

GYPSUM PRODUCTION.

Table showing the amount of Land and Calcined Plaster produced in the years given and the aggregate for years previous:

Years.	Land Plaster, tons.	Stucco, bbls. 300 lbs each.	Years.	Land Plaster, tons.	Stucco, bbls. 300 lbs each.
Years previous to 1866	100,000	80,000	1877	40,000	55,000
1866	14,004		1878	40,000	48,346
1867	17,439		1879	43,658	50,800
1868	28,837	34,000	1880	49,570	106,004
1869	29,996	41,187	1881	33,178	112,813
1870	31,437	46,179	1882	37,821	135,655
1871	41,126	8,685	1883	33,225	201,133
1872	43,596	59,768	1884	27,888	156,677
1873	44,972	82,457	1885	28,181	141,575
1874	30,126	82,449	1886	29,398	153,274
1875	37,019	61,120	1887	28,794	170,145
1876	39,131	64,386	1888	22,177	196,698
			1889	19,824	206,380
Totals				880,936	2,259,681

A description of plaster deposit quarries is given in previous reports, particularly in that of 1881.

Table showing the amount of Land Plaster produced by the different Companies in Michigan in the years indicated.

Name of Company.	Number of Tons of Land Plaster produced by Michigan Companies.										
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
Godfrey & Bro.	9,127	9,000	6,422	6,090	5,082	4,598	4,467	4,560	3,697	3,157	3,150
Grand Rapids Plaster Co.	8,970	12,000	6,375	7,512	5,013	3,044	4,143	3,832	4,517	2,745	3,220
Loren Day	7,000	10,000	6,993	6,801	4,400	3,052	4,059	3,714	3,585	2,950	2,999
Union Mills	4,500	7,500	6,736	8,298	5,500	3,185	3,983	3,687	3,102	2,620	3,000
D. Noble & Co.	10,585	9,570	6,572	6,087	4,000	3,302	3,900	1,947	3,106	2,640	2,930
Smith, Bullard & Co.	1,500	1,500	1,000	2,988	4,600	4,122	4,346	6,039	5,589	3,750	1,043
Alabastine Co.					4,032	6,600	3,900	5,008	4,958	4,278	3,630
Geo. H. White & Co.	1,900										
Totals	43,658	49,570	33,178	37,821	33,225	27,888	28,181	29,398	28,794	22,177	19,824

Table showing the amount of Stucco produced by the different Companies in Michigan, in the years indicated.

Name of Company.	Number of Barrels of Stucco produced by Michigan Companies.*										
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
Godfrey & Bro.		28,000	27,500	30,274	37,000	30,433	30,942	28,273	30,284	30,626	36,670
Grand Rapids Plaster Co.		28,500	20,400	32,854	40,000	24,300	26,408	28,627	32,386	34,751	44,175
Loren Day					12,000	13,108	11,193	11,327	15,125	13,967	18,500
Union Mills		33,000	34,943	21,074	30,000	23,176	15,654	18,027	21,979	20,971	21,935
D. Noble & Co.		24,504	20,000	27,006	38,000	30,288	26,344	28,770	34,235	33,121	36,940
Smith, Bullard & Co.				11,817	30,961	23,961	20,797	27,113	21,152	25,686	32,900
Alabastine Co.					13,172	11,321	10,147	11,347	14,984	17,157	24,400
Totals		106,104	112,843	145,025	201,133	156,677	141,575	153,274	170,145	196,989	206,380

* Stucco is now reckoned at seven bbls. to the ton.

COAL.

THE COAL PRODUCTION OF MICHIGAN.

The coal production of Michigan does not increase. New discoveries of coal are made frequently in various localities and some local excitement is occasioned, but no good mines grow out of the discoveries. Recently they were investigating the coal deposits at Sebewaing in Huron county. Mr. W. L. Webber and J. C. Liken were having holes bored to ascertain the extent of the underlying coal bed.

There is some increase of mining at Grand Ledge and a new mine added at Jackson.

The total production of the State for every year given has been as follows:

	Tons.		Tons.
1857	350,000	1883	74,296
1877	68,947	1884	30,712
1878	85,312	1885	58,676
1879	82,013	1886	49,848
1880	128,053	1887	91,545
1881	130,190	1888	59,231
1882	135,229	1889	57,665

The following are the companies that produced coal in Michigan in 1889:

Name of Company.	Product in 1889, Tons.	Aggregate product, Tons.
R. H. Emerson & Co., Jackson, Mich.	17,283	534,216
Standard Mining Co., Jackson, Mich.	9,882	35,622
Bennett Sewer Pipe Co., Jackson, Mich.	5,000	11,980
Poole Mining Co., Jackson, Mich.	10,120	10,120
Corunna Coal Co., Corunna, Mich.	15,000	148,398
Star Coal Co., Grand Ledge, Mich.	325	625
Starke Mine, Grand Ledge, Mich.	30	344
Bereka Coal Co., Grand Ledge, Mich.	100	275
Grand Ledge Coal Mining Co.	300	300

SALT.

There are 122 salt manufacturing companies in the State, 97 of which were in operation in the year 1889, having a capacity of production of 5,950,000 barrels.

The salt-producing territory is divided by the Inspector into 9 districts, consisting of: 1, Saginaw county; 2, Bay; 3, Huron; 4, St. Glair; 5, Iosco; 6, Midland; 7, Manistee; 8, Mason; 9, Gratiot.

The total capital invested in the business of manufacture is $4,700,000 and the number of employés is 3,600.

In 1889 the number of salt wells pumped was 254.

Comparative Table of Yearly Production.

Year.	Fine.	Packers.	Solar.	Second quality.	Common coarse.	Total.
1869	513,908	123,908	15,204	19,177		516,288
1870	568,326	17,289	15,507	19,620		621,352
1871	655,925	14,877	37,645	19,980		728,725
1872	672,034	11,110	31,461	19,876		724,481
1873	745,702	23,071	32,267	20,706		873,246
1874	960,793	20,090	29,391	16,741		1,026,979
1875	1,027,996	10,233	24,326	19,419		1,081,856
1876	1,402,430	14,233	24,233	21,993		1,462,729
1877	1,500,841	20,889	22,538	25,818		1,560,987
1878	1,770,391	19,267	31,541	32,615		1,855,884
1879	1,997,350	15,641	18,020	29,027		2,058,040
1880	2,580,037	16,691	22,237	48,623		2,670,588
1881	2,673,910	13,885	9,683	52,821		2,750,299
1882	2,928,542	17,306	31,335	60,222		3,037,317
1883	2,828,987	15,424	16,735	33,525		2,894,672
1884	3,087,064	19,808	16,957	38,508		3,161,806
1885	3,230,626	15,480	19,849	31,428		3,297,403
1886	3,548,731	22,251	21,177	71,125	3,993	3,677,277
1887	3,198,070	19,385	15,908	74,965	178,328	3,344,909
1888	3,720,319	18,126	26,174	87,894	13,915	3,866,228
1889	3,721,069	19,780	17,617	93,455	4,978	3,846,979
Total						45,753,985
Salt manufactured prior to 1869						3,292,117
Total amount of salt produced in Michigan to date						49,046,102

The following figures show the average net price per barrel received by manufacturers for salt:

Year.	Price.	Year.	Price.
1866	$1 90	1878	$0 85
1867	1 77	1879	1 02
1868	1 85	1880	75
1869	1 58	1881	83½
1870	1 33	1882	70
1871	1 46	1883	81
1873	1 46	1884	75½
1873	1 87	1885	70
1874	1 19	1886	66
1875	1 10	1887	57.4
1876	1 05	1888	58.5
1877	85	1889	54.3

G. W. Hill, State Salt Inspector; W. E. Burt, President State Salt Association.

INSPECTION OF MINES

MINE INSPECTORS' REPORTS.

We have now in Michigan a law which provides for the appointment of an inspector of mines in each county by the board of supervisors of the county. Among his duties it is to investigate all accidents in the mines and to file an annual report of the same with the county clerk each year. The following are thus taken from the reports of the several mine inspectors:

MENOMINEE COUNTY.—J. B. KNIGHT, *Inspector.*

Record of Deaths from Accidents.

Mine.	Date.	Name.	Occupation.	*Cause of Accident.
West Vulcan	Oct. 12, 1888	Antonio Tolamani	Miner	Fell from bucket while ascending winze.
West Vulcan	Nov. 2, 1888	John Anderson	Repeman	Fell 18 feet in shafthouse.
West Vulcan	Dec. 5, 1888	Thomas Beard	Miner	Fell 100 feet in shaft.
West Vulcan	March 6, 1889	Joseph Crissoti	Miner	Fell of rock in drift.
Central Vulcan	Feb. 18, 1889	Richard Bray	Miner	Breaking of lagging and fall of ground in room.
Curry	Aug. 30, 1889	Samuel George	Timberman	Fall of ground while timbering level.
Curry	Sept. 14, 1889	Adolph Anderson	Miner	Premature discharge of hole in drift.
Powahie	Aug. 16, 1889	Wm. Gustafson	Miner	Fell of ground from back of room after blasting.
Chapin	Oct. 1, 1888	Karl Erick Karlson	Miner	Tried to get on cage after it was rung up.
Chapin	Dec. 8, 1888	Peter A. Johnson	Miner	Explosion of dynamite in thawer on surface.
Cyclops	May 16, 1889	Wm. H. Stanton	Miner	Fall of rock in drift.
Walpole	May 16, 1889	Zanella Marcellio	Miner	Fell 100 feet in shaft.
New Ludington	Jan. 14, 1890	John Pengson	Timberman	Fell into winze.
" "	May 17, 1889	John Polenski	Timberman	Fell of ground while timbering room.
" "	Sept. 18, 1889	Matthew Knaack	Pumpman	Struck by cage while crossing shaft, fell 400 feet.

* In each case the verdict of the jury was "Accidental death."

Record of Accidents.

Name of Mine.	No. men employed.	No. fatal accidents.	No. non-fatal accidents.	No. persons killed by fatal accidents.	No. persons injured by non-fatal accidents.	No. men employed to each man killed.	No. men employed to each man injured.
East Vulcan	204		3		3		68
Central Vulcan	21	1	1	1	1	21	21
West Vulcan	380	4	9	4	9	98	43
Curry	84	2	1	2	1	42	84
Aragon	68						
Perkins	36						
Norway	192		3		3		64
Cyclops	21	1		1		21	
Powahie	41	1		1		41	
Walpole	39	1		1		39	
Millie	94		2		2		47
Chapin	1,165	2	56	2	56	582	20
Old Ludington	15						
New Ludington	380	3	3	3	3	87	87
Hamilton	67						
Smaller Mines	75						
Totals	3,792	15	78	15	78	183	85

MARQUETTE COUNTY.—ANTHONY BROAD, *Inspector.*

Annual Report of Men Killed and Permanently Disabled in the Mines of Marquette County.

Mine.	Number of men employed.	Number of men killed.	Number men permanently disabled.	Mine.	Number of men employed.	Number of men killed.	Number men permanently disabled.
Queen	366	3	1	Republic	843	5	
Champion	775	6		North Champion	80		
Lucy	87	1		Sampson	60		
Cleveland	736	2		Northwest Republic	42		
Cleveland Hamatite	150	1		Riverside	70	1	
				Standard	152		
Salisbury	202	1		The Hank Shouldice	27		
Wheat	85			Humboldt	140	5	
East Jackson	34			Negaunee	240	1	
Furst, Jacobs & Co., Sandstone Quarry	902			Lilley	190	1	
				Cambria	386	1	
Gillet's Sandstone Quarry	105			East New York	105		
Prince of Wales	42			Exploration	200		
Milwaukee	167			Jackson	575	3	
Buffalo	156			Hartford	85		
Volunteer	242			Detroit	70		
Foster	40			Lake Angeline	350		
South Buffalo	175			West Rolling Mill	16		
Lake Superior	725	5		Wick	14		
Mitchell	84			West Republic	20		
Barnum	325			Powell Exploration	9		
Winthrop	450						
				Gold Mines and Explorations:			
Saginaw	26						
Merrywaather	16			Ropes	120	1	
Dexter	55			Superior, Michigan, Gitche-Gumme, Finn & Case, Peninsular, Grummet, Grayling, Grand Rapids, Ishpeming	150	1	
American	120						
Bessie	14						
Michigamme	240						

In summarizing the accompanying report, it will be found that of the forty-seven iron mines, eight gold mines and two stone quarries, employing 10,047 men, there were but thirty fatal accidents, which shows a gratifying decrease in the fatality as compared with the report of last year, being but about one-half the per cent.

Mr. Broad states as follows: I have attended all inquests held, and from a careful consideration of the evidence adduced, have coincided with verdicts which have, in every instance, exonerated the mining companies from all blame.

KEWEENAW COUNTY.—JOSEPH RICKARD, *Inspector.*

List of Fatal Accidents During year 1889.

Date.	Name of mine.	Name of person.	Cause of death.	Remarks.
Jan. 9	Copper Falls	John Balm	Struck by skip	Company exonerated.
March 30	Copper Falls	Peter Johnson	Killed by a blast	He tamped the blast.
April 30	Allouez	John Palomicini	Riding in skip	Company exonerated.
June 19	Copper Falls	Eric Bokkala	Killed by a blast	Company exonerated.
Sept. 21	Allouez	Hans Eriandson	Riding in skip	Company exonerated.

LIST OF FATAL ACCIDENTS AT THE MINES IN HOUGHTON COUNTY.

JOSIAH HULL, *Inspector*.

From September 30, 1888, to September 30, 1889, giving date, person's name, his occupation, place employed and manner of accident.

Date.	Name of person.	Occupation.	Name of mine.	Cause of death.	Nationality.
Oct. 19, 1888	Thomas Eagger	Laborer	Franklin	Running mill	Irish.
Nov. 29,	Mike Keejan	Miner	Calumet	Hanging trap fell	Finlander.
Feb. 4, 1889	B. Leahy	Miner	Quincy	Fell from stage into shaft	Irish.
Feb. 7,	C. Abramson	Miner	Tamarack	Fell out of bucket into winze	Swede.
Feb. 10,	P. Jarney	Trammer	Tamarack	Walked into shaft	Finlander.
Feb. 16,	F. Hawes	Miner	Osceola	Suffocated	English.
March 18,	Jacob Karlo	Laborer	S. Hecla	Fall of rock	Polander.
March 19,	William James	Miner	Calumet	Blasting	English.
April 2,	Thomas Lake	Miner	Tamarack, Jr.	Fall of cross-head	English.
April 18,	Erick Rijula	Miner	Kearsarge	Drilling old hole	Friedlander.
May 1,	A. Pehlaponna	Boy	Osceola	Blasting, holing pillar	Friedlander.
May 11,	A. Ponzetto	Trammer	Huron	Hanging rock	Italian.
May 14,	John Turk	Trammer	Osceola	Blast, holing winze	Austrian.
May 17,	John Hastala	Trammer	Franklin	Fell in shaft	Finlander.
June 19,	Frank Butcher	Trammer	Osceola	Fell off road	Austrian.
June 24,	James Chellew	Laborer	Hecla	Fell into shaft	English.
July 10,	John Miller	Laborer	S. Hecla	Hanging-wall rock	Polander.
Aug. 13,	Henry Hohner	Trammer	S. Hecla	Prying down rock	German.
Sept. 23,	Mike Carno	Laborer	Calumet	Rock down shaft	Italian.
Sept. 28,	Frank Donald	Laborer	Osceola	Riding in skip	English.

Total number of men employed in the mines of Houghton county, working twenty-six days per month, 6,480.

IRON.

THE IRON MINING INDUSTRY IN MICHIGAN, IN 1889 AND FIRST HALF OF 1890.

It is pleasant to note the greatly improved condition of the iron ore market in the past few months, or during the latter half of the year 1889, and to further observe the signs that seem to insure the indefinite continuance of the present activity. There has been no such favorable outlook for the iron mining interests of Lake Superior, for several years, as now exists. It is the first time for a long period when the contracts for ore have been made with the mining companies, so soon as at the close of the year preceding the one in which the deliveries are to be made.

It is reported that even now, Dec. 1889, the contracts for the coming year's product of Bessemer ore, are all made; at a price fully one dollar in advance of that realized the past season. Usually, at this season of the year, after the time when shipping has ceased, there is a comparative cessation of activity; the larger mines get ready for winter and moderately push the work of opening up the mines in readiness for the ensuing year.

The lesser companies not infrequently shut down entirely, or at best, work but little during the winter. They wait to see what the next year will bring forth in the way of business, what the demand for ore will be, how much they can sell, and at what price, before venturing to do much mining. For a number of years past there has been, every winter, an uncertainty regarding the succeeding year. Furnace men have held to a hand to mouth system of buying; that is, they only bought to supply immediate want, and not at all for the future. And even in 1889, there existed during the winter and early spring months, the usual depressed condition. Not much ore had been sold up to the time of the opening of navigation, and for some time afterward the stock piles of ore at the mines, in most cases, lessened very slowly. The mines having Bessemer ore, held for a greater price than furnace men were willing to give, and thus until early summer, there was somewhat of a dead-lock. Finally, however, later in the season, in August, and thereafter, the aspect of the market had entirely changed and there was the most active demand for every ton of ore that could be produced. As a result it has been one of the most active seasons of mining in the iron districts that has ever been experienced. The activity thus inaugurated gives every indication of continuance, certainly through 1890. All the mines are working to their utmost capacity, and every effort will be made to get out all the ore possible during the present winter, in readiness for shipment at the opening of navigation. The product of 1889 was in excess of that of any

previous year and will be much exceeded in 1890. How much ore will be produced the coming year it is impossible to predict; but if all is accomplished that is now declared in the way of production, the total output will be enormous; probably between eight and ten million tons.

In 1889 the first sales of ore for future delivery took place in March, to Chicago consumers, at prices about the same as prevailed during the previous year. At the opening of navigation charters were made with the vessel men for the season's carrying of ore at 90 cents to $1.00, from Escanaba; $1.10 to $1.15 from Marquette and $1.25 from Ashland. In the fall, these rates, as usual, were advanced: in September to $1.05, $1.20 and $1.40; in October and later, to $1.25, $1.50 and $1.90. As early as November, furnace companies in Ohio and Pennsylvania purchased all the Bessemer ore that they could contract for for 1890 at $1.00 to $1.25 advance above the prices of 1889.

These contracts for future delivery of ore thus early made are not confined to ores suitable for steel making but include the non-Bessemer ores as well, which have been largely contracted for at an advance over previous year's prices very nearly the same as for Bessemer ores or at about $1.00 per ton advance for good ores.

Ore sold in 1889—delivered in lower lake ports at about as follows: Republic $5.50 to $6.00; Lake Angeline, hard ore, at $6.25; possibly Champion first class, at $6.25 also; Chapin $450 to $5.00; Cleveland No. 1—non Bessemer—at $5.00; 62 to 63% ores, non Bessemer, at $4.50; 60% hematites sold at about $3.75.

The sales for delivery in 1890 are at $1.00 advance over these prices. No doubt there will also be an advance in Lake freights and on this subject there exists some apprehension, notwithstanding that the year closes with the most confident feeling among the mining men as to the probable general result.

Some vessel contracts have been made at $1.10 from Escanaba, $1.25 from Marquette, $1.40 from Ashland and Two Harbors. It is feared that rates will be in excess of these figures when the season opens. They are sure to do so unless there shall be a large increase of vessel capacity. There is considerable talk of tonnage construction the present winter and it is important that it should equal at least the increased demand that is sure to occur next season. The carrying problem may be an embarrassing one; if the increased production of ore shall amount to 2,000,000 tons, the disposition of it will test the capacity of the railroads to the utmost, also of the ore docks, of the vessels and of the facilities for handling at the lower lake ports. Very fortunately the railroad companies are preparing for the emergency in the matter of ore docks. The C. & N. W. Co. has built a 4th one at Escanaba which is said to be the largest in the world. One has been built at the new village of Gladstone on Bay de Noquette, while at Marquette the D., S. S. & A. R. R. Co. has completed an extension of 300 feet to No. 3 dock and has contracted for the construction of a 4th dock to be done in June next. This dock will have 200 pockets and a loading length of 1,200 feet; its total length to be 1,760 feet. Altogether these additions will double the capacity for handling ore at Marquette.

A great stimulus has been given to exploration as well as to mining and some valuable “finds" of ore have been made, notably in the Saginaw range west of Ishpeming. East of Negaunee and in the Crystal Falls district, seldom, or never before, has there been so great a degree of activity in exploring for ore as at present prevails. The winter is favorable for such work in an unusual degree, and where delayed or held in abeyance on account of the weather, the work will be pushed forward with increased vigor in the spring.

Every year the area of the iron producing portion of the peninsula is enlarged, that is, discoveries of ore are made and mines opened in localities where previously the ore was not known to exist. It is seen that conditions that apply in one place may be greatly modified in another, but still the only proper indications to study are the rocks themselves and where the rocks are apparently all right is the proper place to look for ore.

A few years ago and the working mines were confined to the vicinity of Negaunee and Ishpeming. Then the producing section was extended west to Champion, to Michigamme and southwest to Republic.; and soon after the Menominee region was opened and has been rapidly and greatly extended; and later still the Gogebic range has astonished the country by the extraordinary quantity and quality of the ore which it was found to contain. It is likely that discoveries will be made during the coming year, new mines will be opened and railroad branches built to them and ore sent out.

An important change of ownership of iron mines has been made in the past year, being a syndicate represented by Ferdinand Schlesinger, of Milwaukee, Wis. Mr. Schlesinger has purchased several mines, all were Bessemer hematites, and is pushing the mining work vigorously. He now controls the Chapin, Dunn, Armenia, Florence, Iron River, Youngstown, Queen, Buffalo, South Buffalo, Prince of Wales, and several new properties west of Michigamme lake, in sections 22 and 23, T. 46, R. 33, known as the Ohio, Norwood, Fowle, and Stewart. They are all leased mines held by the several companies on royalties; being from 25 cents to 50 cents per ton for the ore mined. The change in ownership has made no difference in the local management of the mines, the instructions are to get out all the ore possible.

The prices paid for these several leases is reported to be: Dunn, $100,000; Armenia, $40,000; Florence, $350,000; Iron River, $250,000; Youngstown, $125,000; Chapin, $2,000,000; Queen, Buffalo, South Buffalo and Prince of Wales, $850,000. The Michigamme group were got of Mr. J. C. Fowle at a mere nominal figure.

Other mines have changed owners within the past year, as the Aurora, Palms, Pabst, Michigamme and Palmer—

all important mines, to which, more recently, may be added the Wetmore.

Through these sales, particularly of those mines at Negaunee—the Queen, etc.—a number of men in that city have realized considerable fortunes. They were all, previously, comparatively poor men, but the fortunate discoveries of ore which they have made has brought them wealth.

In seeking for other minerals besides iron ore there has been considerable activity. Explorers for gold have not been idle, and while their efforts have not been crowned with any conspicuous success, the results are of an encouraging character.

The Michigan affords so much rich rock that it seems probable that when it comes to be worked for a mine sufficient good rock will be found to make the enterprise a profitable one. The Michigan is the most promising of the new gold mines.

An increased value attaches to the sandstone quarrying industry. The production of sandstone in the upper peninsula is but in its infancy and is already a permanent and important business.

Effort is making to awaken interest in the Serpentine deposits near Ishpeming and the marble in Felch Mountain. The deposits of both these minerals in the localities mentioned are extensive and valuable.

The following table shows the shipments of iron ore from the several Lake Superior ports in 1889:

Recapitulation.

Shipments for season from	Marquette	1,876,335
" " "	Escanaba	3,068,632
" " "	St. Ignace	51,853
" " "	Ashland	1,484,902
" " "	Two Harbors	819,639
" " "	Gladstone	73,847
Grand total of lake Shipments		6,810,108

THE MENOMINEE RANGE MINES.

The Menominee Range Mines, it is needless to say, are in a prosperous condition. They have all of them, produced more ore the past year than was expected, and are in shape to duplicate or even exceed the like amount, another year. Some of the mines in the Menominee district have never been pushed to the utmost limit of their capacity. These have yielded larger this year, 1889, than ever before; but they could have furnished much more if steps to accomplish such a result had been earlier begun. Now they are preparing for a maximum product, and in some of them one is astonished at the great amount of ore in sight.

The Menominee range affords one of the best fields for exploration of any portion of the peninsula, the indications prevail so extensively; there is such a wide field for investigation and good results are of so frequent occurrence that the field is a safe one. There are several notable examples of important success that has attended exploration in the Menominee range recently, among which may be mentioned the Aragon, Harrison, Caledonia (or Mansfield), Hemlock River, etc. I look to see further important finds the coming year, particularly in the vicinity of Norway and of Crystal Falls. Exploration is continued at Waucedah, at the east end of the Menominee range. Nothing new of value has been developed in this late exploratory work. It is proposed now to use a diamond drill.

THE PENN IRON MINING CO.

The mines of this company are the first at the east end of the range, and constitute the East Vulcan, West Vulcan, Curry, Briar Hill, Norway and Cyclops mines, with the Harrison, recently added. The mines are really owned by the Cambria Iron Co., of Johnstown, Pa., where the ore is sent to be smelted. The great flood which destroyed the Cambria works in June last, had the effect also to cripple the mines, somewhat abridging the work for a brief time. However, they were soon in full operation, only all explorations were cut off and such other work dispensed with as could be deferred to a more convenient season.

The Penn Co. is a well conducted corporation, its mines are well managed and well worked. There are seldom any changes in any department. The mining captains are efficient and remain at their posts year after year. The laborers are contented and rarely go elsewhere. I am pretty familiar with the people and with the mines of the Penn Co., and I esteem the former highly and regard the latter as valuable.

I have so fully described these mines in former reports that I do not deem it necessary to be otherwise than brief at this time. Commencing with

THE EAST VULCAN,

which is now, perhaps, the company's most important mine although there is nothing new to chronicle, no discoveries of ore beyond what was known to exist, yet the course of preparation has been so long in making, has been so costly and complete—all done with reference to known conditions, that the mine is in condition to accomplish a good deal now. They can secure, now, a good deal of ore at a comparatively low cost. The mine has been an expensive one to the company. The ore has cost more than it was worth, but that matter is no one's fault. The work has all been cheaply and well done; it simply happens that there was a good deal to do. The ore is of the very best; in No. 1 shaft it is the finest Bessemer ore, that is not easy to obtain in the market. It could not be expected that a strong company like the Cambria needing Bessemer ore would give up a mine like the East Vulcan that gave such an excellent quality of that article and afforded so many indications of ultimate improvement in quantity. The formation is made up of clay slates and jasper slates and hard jasper that stand up at a high angle, dipping south and striking east and west. The ore occurs in irregular pockets in the jasper.

The new No. 1 shaft has been completed to the 6th level, 600 feet vertical, and the drift opened east to the

ore, also 600 feet in length. There are two ore bodies east of the shaft; the first one is a chimney of ore that, in the 6th level, is near the shaft and takes an irregular course upward, getting 500 feet away in the first level. Old No. 1 shaft is 500 feet deep, but the ore, which in the second and third levels was east of the shaft, was found to be in the fifth level upwards of 200 feet west of it and running very flat to the west. It was for this reason that the new shaft was sunk 800 feet west of No. 1.

A fair body of ore was found west of the new shaft in the fifth and sixth levels, in the latter of which it has been worked west 400 feet.

They have the main body of ore now opened to, and assuming that it continues as large as it was in the fifth level, this body alone from the fifth to the sixth level will give 40,000 tons of the best of ore. The other pits, No. 2 and No. 3, show about as they were last year, as particularly described in the report of 1888. They furnish non-Bessemer ore, otherwise high grade. Altogether the East Vulcan will yield, it is estimated, 75,000 tons in 1889.

Capt. John U. Curnow, who for ten years has been superindent of the mine, is one of the most faithful and capable mining captains in the country and his superior officers fully appreciate his value.

Going west, the explorations that were in progress in the spring on section ten were discontinued after the Johnstown disaster that so seriously affected the company, but have again within a few days been renewed. There is every seeming probability that deposits of ore will be found, ultimately, in this ground west from the East Vulcan. The sand is deep over the rocks, making it slow exploring.

There is no ore mined now before

THE WEST VULCAN

is reached, which, until within a year or two past, has been one of the best lenses of ore in the Menominee range. The main deposit—the south one—has averaged for ten years past about 600 feet in length and twenty to thirty feet in width of fine Bessemer ore. The mine has been all right down to the tenth level, when the ore body narrowed up greatly and portions of it were found to be mixed with limestone.

It is 1,000 feet deep now to the eleventh level. I descended to the bottom a few days ago. The eleventh level was not sufficiently opened so that it could be determined whether it would be better than the tenth or not. At the west end, near the new shaft, the ore is good. They had some trouble in finding it. They drifted along what they took to be the junction of the hanging and foot walls, but finally crosscutted west into the foot wall and found the ore, five to fifteen feet wide. There are two shafts. No. 2, double skip incline, is in the foot wall north of the ore, and the downright cage shaft sunk in the hanging wall.

The latter shaft, as explained in my last report, has given much trouble, by reason of the settling of the ground, crushing in the shaft and making it necessary to retimber it or to abandon it. The former plan has been pursued and the work is well under way now. They commenced twenty-five feet below the eighth level and retimber up, 600 feet, using the best pine timbers 16"x16", placed at 6” apart. The cost of this work is $5,000 per 100 feet, $30,000—a great expense coming when the mine is at its poorest. No. 2 shaft also had to be retimbered from the ninth level up, 125 feet, where it caved in by reason of the taking away of the pillars. 2,000 feet of drifting have been done in the mine in the year past, 595' of winzes sunk and 324 feet in rises made. The ore pillars, with the exception of those at the new shaft, have been nearly all removed, and the mine is filled with rock. The rock for filling, all that is required beyond what is obtained in the mine, is run down from the surface through a rock shaft made in the foot wall. There is some ground to stope below the ninth level yet and all the ore above the eleventh to the tenth that is now opened. They are already sinking below the eleventh level.

Since the above was written I have again been at the Vulcan mine and find that the work on the downright shaft is completed and that it is in fine working order. Also that the eleventh level is much better than the tenth and that the shaft is well on its way to the twelfth.

Still later, March 15, the shaft has just been greatly damaged by fire, which extended also to the timbers in the mine, a most unfortunate occurence. No lives were lost, though some of the men were in great danger. The fire destroyed the shaft house and burned the timbers in the shaft so that it was found that away down from the surface the ground was caving in. Mr. Hagey, being apprehensive that the "caving" would, if allowed to proceed, unsettle the foundations of the machinery near by, has ordered the shaft to be filled with sand. I have been at the mine several times since the fire, and on April 11, the fire was still burning in the mine and the work of filling up the shaft was proceeding. This fire has thus caused a great loss to this company.

It is not likely that the shaft will be restored. It is in the hanging wall and the rock is very soft and unstable. Their experience with it thus far is that it is a very expensive and difficult matter to keep it in place. No. 2 shaft, which is to the ninth level, and is double skip, could be sunk and made to do the hoisting but there is no room in it for plunger or pipes. What will be done has not yet, May 1, been decided.

THE CURRY MINE.

bids fairly to take precedence of all other mines possessed by the Penn Company, in quantity, as it certainly does in quality of ore. This mine was given up a few years ago by its lessees on the supposition that it was of too little value to pay for working. The only stope of ore that they then had was a long way from the

bottom of the shaft and so near to the west line of the property that it was not thought worth while to sink a new shaft. The Penn Company not only acquired possession of the Curry, but of the Briar Hill, the property adjoining on the west; and into this latter the ore has already been followed. The company is sinking a shaft to the west that will be more suitably placed for mining this ore. The new discovery—the body of ore near the highway at the foot of the hill south of the former company's workings, which promised so well from the first—two years ago, continues to sustain the high hopes entertained regarding it. The ore body is now 300 feet long and 10 to 38 feet wide, and constantly increasing in length, to the west. This shaft is in the south vien ore and analyses at .008% phos, average 63% iron. The north vein ore goes at .030% phos.

The indications here, and results obtained at the Aragon, and the Harrison have led the Penn Company people to set a very high value on the Curry and Briar Hill properties. Mr. Hagey thinks them to be the most promising of any portion of the company's estate. The new shaft to work the old deposit—No. 2 mine—is located 150 feet west of the Curry line on the Briar Hill property. They are now, December, stoping 60 feet west of the line in the old mine. The shaft is sinking to reach the ore further west.

THE NORWAY MINE

affords no new features. They are simply working to get all the ore that there is left, in the cheapest manner they can. They know just where it all is and possess all the skill and experience to successfully solve the problem of extracting it.

The system they are following is to mine out the pillars, etc., and let in the surface. There are many thousand tons of ore yet in the mine that will be saved, but there is not likely to be any new finds. They are on the limestone bottom everywhere in the mine, and all the ore that remains is above in pillars and roof. The Norway mine has been a pretty profitable 40 acres.

Some exploring with the diamond drill is in progress.

THE CYCLOPS MINE

comprises the 40 acre lot lying next west from the Norway. They are mining in the same pocket of ore described in my last report and it is now the only point on the property where ore is obtained.

The company has done some exploring, and the work will be continued further west and near the south line of the land. They have sunk 50 feet in what seems to be foot wall slates or north deposit slates, just south of this point, across the railroad track, on the flat, Messrs. Colwell and others of Norway, are boring with diamond drill.

The Penn company, I believe, will do considerable exploring the coming year. They have secured the option of a portion of Sec. 6, west of Norway, which has been explored a good deal, but the Penn company will make a further try. Also on section 10 between East and West Vulcan, exploration will be pushed.

The products of the several mines of the Penn Iron Co. in 1889, were as follows:

East Vulcan	45,568 tons.
West Vulcan	103,373 "
Central Vulcan	2,970 "
Curry	28,722 "
Norway	68,044 "
Cyclops	6,101 "
Total	256,773 tons

The Vulcan mines are the oldest mines on the range and have sent out annually as follows:

Year.	Tons.	Year.	Tons.
1877	4,548	1884	101,722
1878	31,239	1885	124,120
1879	57,350	1886	143,980
1880	72,405	1887	205,127
1881	85,671	1888	128,832
1882	94,042	1889	*182,628
1883	76,874		
Total			1,311,488

*This includes the Curry product.

The product of the Norway for each year is as follows:

Year.	Tons.	Year.	Tons.
1878	7,538	1884	71,515
1879	73,540	1885	57,741
1880	108,705	1886	93,818
1881	187,558	1887	95,558
1882	165,184	1888	87,104
1883	114,830	1889	*74,628
Total			1,136,970

*This includes the Cyclops' product.

The officers are J. E. Hagey, General Manager, Penn Iron Co.; Wm. Kelly, Gen'l Sup't.; George Warren, Purchasing Agent; James Hoskins, Mining Capt., Norway; John U. Curnow, Mining Capl, East Vulcan; Tom. Oliver, Mining Capt., Curry; Frank A. Jansen, Mining Engineer; Frank Copeland, Cashier; Wm. Bond, Mining Capt., West Vulcan.

THE PERKINS MINE

still affords some ore, but it is nearly exhausted; 12,302 tons were mined last year, making a total of 388,602 tons.

The mine adjoins the Norway on the east and the workings of the two mines run into each other. The Norway being the deeper, drains the Perkins.

Capt. Perkins expects to mine 16,000 tons in 1890.

THE ARAGON MINE

lying in the group, west of the Briar Hill and south of the Norway, is turning out well in one respect, it gives the best of ore. There is a body of hard ore in the mine that contains 70% iron and .028% phos. The ore of the mine averages 65% metallic iron and about .030% phos.

Now that the shaft is down, there is not an excessive amount of water.

The shaft is 230 feet deep, 60 feet below the 2d level, that is, it was at the time I went down into it, about Dec.

1. The mine is not largely opened yet. The work has been mainly preparatory. They have drifted in ore 50 or 60 feet, west, and crosscutted 30 feet. The ore is cut off in the mine, on the west, by a fault in the formation which has thrown the ore to the north. That is, this is the way matters look now. Sanguine stockholders of the Aragon estimate the next year's product at 100,000 tons. If that amount is obtained there will be a large profit.

The company employs 100 men and the management of the mine is in skillful hands. Mr. Larsson has demonstrated his ability to overcome difficulties by sinking No. 1 shaft after others had failed to accomplish it. I have described all this in my last report. There are some diamond drill borings, which insure a considerable extension of the ore when they get the mine opened to it. The stock is held by a few men and they are not disposed to sell it. Probably none could be bought for less than the par value. Thus far there has been shipped from the mine 1,747 tons of ore.

The officers are Augus Smith, President and Treasurer, Milwaukee, 71 New Insurance Building; A. H. Wilkins, Secretary, Milwaukee, 71 New Insurance Building; Per Larsson, Superintendent, Norway, Mich.

The estate comprises N. ½ of N. E. ¼ of Sec. 8 and N. ½ of N. W. ¼ of Sec. 9, T. 39, R. 29.

Thus far the mine is a small one, but the ore is of extraordinary excellence and of course will sell for a large price.

THE HARRISON

is the name given to a valuable exploration just south of the Aragon. In fact it is probable that the Aragon is in the north vein vulcan ore and the Harrison is in the south vein. In these mines there seems to be two sets of lenses of ore parallel with each other. The south vein is, so far as observed, the largest. The Harrison, has only been tested with the diamond drill, three borings have been made inclining down to the north, the first hole is 269 ft. in length and cuts 35 ft. of ore, the second boring is 270 ft. long and cuts 51 ft. of ore, the No. 3 hole is still boring. Analysis of the drill core, soft dirt, some sand in the ore, it could not be got perfectly clean ore, gave 57% metallic iron, .0012% phos. The description is the S. ½, N. E. ¼, Sec. 8, and the borings are made near the N. and E. lines. The lease is owned by J. G. Butler, Jr., J. N. Porter and J. G. Hagey. Mr. Butler owns one-half, each of the others one-fourth.

Since the above was written the option for the lease of the 12 forties of land on Sec. 8, T. 39, R. 29, held by the gentlemen above mentioned, has been transferred to the Penn Iron Mining Co. The company will at once proceed to sink a shaft to mine the ore.

There are several other explorations in progress at Norway, mainly with diamond drill, south and west of the village. Byron N. White has started a drill for Angus Smith et al in N. E. ¼, N. W. ¼, Sec. 8. Situation is favorable for finding ore.

Also Messrs. H. J. Colwell & Co., of Norway, are operating a drill in the N. W. ¼, N. W. ¼, Sec. 8, under the superintendence of Isaac Wilkinson. One hole has been bored at an angle of 70° N., 400 feet deep, located at the center of the 40. It is all in slates. The last time I visited the place they were boring the 2d hole, 600 feet north from the first one, and were then in slates.

The Penn Co.'s exploration on Sec. 5, Cyclops land, is just north of this of Colwell's.

When the spring opens, considerable exploring will be done west of Norway. In fact, every portion of the range from Norway to Iron Mountain is under option and will be explored for ore during the coming summer.

THE SMITH-WHITE

exploration adjoining the Aragon on the west, being the N. E. ¼ of the N., W. ¼, Sec. 8, 39, 29, previously mentioned, is proving a fortunate enterprise. I learn that ore has been found with the drill at a depth of 460 feet. The drill continued in ore for 10 feet when the hole caved in so much as to fasten the rods so that they cannot revolve them or draw them out. The drill, just before reaching the ore passed through 10 feet of jasper.

THE CHAPIN MINE

with the exception of the Norrie, is the largest producing mine in the State. It is a matter of much conjecture among interested parties, which mine will make the greatest output in 1890. Neither will fall short of producing 800,000 tons and even a million tons is talked of as the possible yield of either of these mines.

The Chapin could easily send out a million tons this year if the shafts were all ready, but the new shafts in the west part of the mine are not completed yet. Nearly all the ore comes up through B. and C. the downright, hanging wall shafts. And of these much the greater portion is hoisted in C. the westerly shaft, nearly all from the sixth level. The ore is trammed and hoisted very rapidly at the Chapin. No other mine is so well equipped for expeditious work in handling the ore after it is broken in the mine. Underground in the sixth level, at C shaft, the tram cars are run to and from the shaft by an endless cable moving perpetually in the track. The cages go up and down with great rapidity. The transfer of cars is made expeditionary and the run of the cars to the stock pile or ore pocket and the discharge of its contents and return to the shaft is accomplished with marvellous celerity.

B shaft is sunk to the eighth level and C is nearly there also. A crosscut at B in the seventh level was 60 feet in ore, but 3 feet east of it was rock; the east side of the lease as it underlies to the northwest. In the eighth level the ore has gone west of the crosscut, south. In the seventh level at C shaft the ore is 100 feet in width and so continues to be so, or nearly that for many hundred feet each way. C shaft is 1,700 feet from the west line and B shaft is 775 feet further east, No. 2 foot wall shaft

is 700 feet west of C, and D shaft is 1,100 feet west of C or 600 feet east from the west line. There is another shaft at which they are now working, which is only 150 feet from the west line and is designated as E. At the east end of the mine away up on the hill are A shaft and others; here the deposit is split into what are called the north and south viens; besides which there are outlying pockets of ore. In this part of the mine is found what is termed the crescent ore, a high grade article that yields 67.50 to 68.50 per cent metallic iron and .003 per cent phos.

No. 2 foot wall shaft will be the first important addition. It is a five compartment shaft, four for cages and one for pipes and ladder way. It is now to the fifth level and will soon be used for hoisting and timber. The underground work in the mine already extends west of this shaft and to send the tram cars 700 or 800 feet to C shaft, is a long distance.

D shaft has been sunk from the surface to the ledge and a winze carried down in one corner to the fifth level. In another year the shaft will be ready to use. They are laying the foundations for the huge pumping plant that, at this shaft, will raise all the water of the mine. As preliminary to the foundations a heavy thickness of concrete and broken stone was laid last fall and heavily covered with dirt suitable to protect it from freezing during the winter. This covering has been removed and the great dressed blocks of sandstone are on the ground ready to be laid. Further west, E shaft was begun years ago but the ground was too wet to succeed with it. Now the swamp has been made dry and the shaft can be sunk. No doubt a large amount of ore will be taken out at the west end of the mine against the Ludington mine arid possibly also the Hamilton mine this season. The Ludington mine has had the greatest width of ore along adjacent to its east line and in mining it they have even, inadvertently, crossed the line on the Chapin side, so it is certain that the Chapin Co. has a body of ore against its west line. This they propose to attack now and make it add to the season's product. They may strip the surface and mine it in open pit.

They mine in the sixth level by cutting out rooms 20 feet wide in the ore, leaving pillars of ore between, 18 feet wide. They cut out the full width of the room 7 or 8 feet high and fill up as they rise. The "mills" for running down the ore are carried up through the filling and the winzes for bringing the rock down are first made through the ore. The ore is so firm that no timber is required in the rooms. It is not the purpose to disturb the seventh level to a great extent. At first the plan was to leave it intact,—100 feet in width and depth, of pillar to preserve the mine, keep it unmoved; but it is now thought that this stability can be secured by judiciously leaving the greater portion of the ore and allowing some of it to be taken.

B and C shafts are in the hanging wall. In the eighth level at B shaft, it is 50 feet to the ore from the shaft. The plan is to run ropes down B shaft to operate the underground tram cable in the levels below the 6th. The machinery will be in the engine house instead of down in the mine as at C shaft in the sixth level.

Another feature of the underground work is that there are two intermediate shafts, one between B and C, and another west of C. They are used to hoist the ore, cut in the drifts, in the seventh level. Each of these shafts has a hoisting plant placed underground to operate it. They work with skip, and dump the ore into a pocket from which it is drawn out into a car that takes it to the main hoisting shaft.

They are stoping ore in every level in the mine, all the way from the first down. In the upper levels, above the fourth, it is mainly in pillars that they are working. Gradually they are taking out the old pillars and probably will save nearly all the ore. There is ultimate danger that the hanging wall side of the mine will settle to such an extent as to disturb the foundations of the machinery and the shafts. Nothing of this kind has appeared as yet; but in the nature of things, when the hanging wall all becomes undercut, it must give way to some extent. It is hoped that the fact of the mine being kept filled will prevent this disturbance from affecting the work.

There are, I am told, 1,700 names on the pay roll, and about 1,200 men regularly employed.

The annual product of the Chapin has been as follows:

Year.	Tons.	Year.	Tons.
1880	84,556	1885	177,987
1881	134,717	1886	198,871
1882	247,595	1887	334,026
1883	265,939	1888	290,872
1884	220,985	1889	518,900
Total			2,494,210

The capital stock is $2,000,000, divided into 80,000 shares, and the recent purchasers took the stock at its par value, $25 per share.

C. H. Cady, Agent, Iron Mountain, Mich.; Wm. Oliver, Mining Capt., Iron Mountain, Mich.; Ferdinand Schlesinger, President, Milwaukee, Wis.

THE LUDINGTON MINE,

which joins the Chapin on the west, has undergone some notable changes in the past year. Mr. Banks, the new Superintendent, has accomplished quite a little in the way of surface improvement, much to the advantage of the location. A large space of ground on the foot wall side has been cleared off and made smooth for ore, stocking timber, yard for storing unused material, etc. Also in same side, and conveniently located, a new machine and blacksmith shop has been built, having brick walls and an iron roof. It is 120'x30' in size.

Mr. Banks is also making a new shaft in the foot wall, south of A shaft. The inclination is 75° to the north. The shaft is to the ninth level, where it is 100 feet south of the ore. It will come down under A shaft at the thirteenth level. This new shaft will be used mainly, at present, to take out the pillars of ore, which are nearly the only available resource for ore until the mine is opened

further down, in A shaft. A shaft is 60 feet below the twelfth level now, April 9; 1,100 feet vertically down from the surface. It being in the hanging wall, gives a good deal of trouble through the settling of the ground. It is proposed to substitute skips for the cages that are now used. Why this shaft was ever located in the hanging wall and why the engine house was similarly placed, it is now difficult to imagine. The company has abundant room on the foot wall side, and the surface there is much smoother. No. 5 shaft was 13½ feet out of plumb; it has been straightened for 400 feet in length. It is sinking and the west end of the mine is looking as well as usual; but what was once the large body of ore in the east end of the mine, is practically gone. In the tenth and eleventh levels, under the ore, above, is now nearly all rock. Mr. Banks confidently expects to find an abundance of ore north of A shaft, the ore that the Hamilton Ore Company has reached. The Ludington Company is sure to get some ore west of the Hamilton line; but how much, future developments will determine. A shaft and the Hamilton shaft are 250 feet apart, and in the 1,225 foot level they are now drifting each way to connect. The drift west from the Hamilton is in ore, and is in the Ludington property. The Chapin ore underlies to the northwest; if the ore in the Hamilton shaft does also, and continues to do so to much greater depth, it will be altogether to the advantage of the Ludington. It is the purpose to work a diamond drill down in the bottom of the Hamilton and explore the Ludington ground west of their line and north of the foot wall.

Mr. Banks is anxious to get A shaft down as soon as possible, to reach this ore that comes into their land from the Hamilton, when he hopes for good results. The C. & N. W. and the M. and N. R. R. Cos., are building a joint bridge over the mine to the foot wall side, where the ore will be mainly sent hereafter. Mr. Banks speaks very hopefully of the future of the mine, based mainly on the Hamilton ore lense. They designate the shafts now, as A, the new one B, No. 5 as C, and old No. 1, D.

Last year, Mr. Banks says, was a successful year for the company. Better wages were paid to the men and more money was made by the company. The ore was mined cheaper than ever before. The main deposit has been getting smaller from the eighth level down. The new shaft is two compartment, double-balance skip and pipe, ladder way, etc. It is in contemplation to get a new plant of machinery for B shaft—two 18 ft. drums. Mr. Banks estimates the product for 1890, at 150,000 tons of ore.

The Ludington mine has annually produced as follows:

Year.	Tons.	Year.	Tons.
1880	8,876	1885	124,194
1881	8,305	1886	76,933
1882	52,519	1887	104,299
1883	102,632	1888	61,883
1884	101,105	1889	116,300
Total			732,306

The mine is in the northeast corner of the S. ½, S. E. ¼, S. 25, T. 40, R. 31. Robt. Banks, General Manager, Iron Mountain, Mich. Of the Chicago office, 59 Dearborn St., A. A. Carpenter, President.

THE HAMILTON ORE COMPANY

has one of the most remarkable undertakings in the whole mining region. Already it has one shaft down to a vertical depth of 1,325 feet, and has begun to sink another 825 feet easterly from No. 1 that it is estimated must penetrate vertically down 2,000 feet before the ore is reached. This new shaft is 7x24 feet, in size, inside the timbers. It is sinking now in limestone and was lowered 60 feet in March, which is rapid sinking. The mine is in the N. W. ¼, S. W. ¼, Sec. 31, T. 40, R. 30, and No. 1 shaft is right in the S. W. corner of the land. The strike of the ore formation is about N. 60° W. and the sides of the shaft were made, as near as might be, at right angles and parallel with the formation.

As this corner of the shaft is on the north and south boundary line, the company can have but little extent of ore west even at great depth.

Mr. Jones is confident that the ore extends east and that it continues down to great depth.

He also thinks that the dip of the formation continues to the north and that it runs very flat. The dip, in the shaft, of the formation has continued at about 63°; but at the 1,325 feet level he opened a crosscut to the hanging wall and bored a vertical hole to the foot, from which data he figures the angle of depression to be 45°. At the 1,225 feet level the width of ore was found to be 155 feet; and at the 1,325 feet level it is 110 feet wide, the diminution in width being due, Mr. Jones states, to the flattening of the foot wall. Ore was reached in this shaft at about 800 feet from the surface, and continued in ore for about 500 feet further before the foot wall was reached.

Mr. Jones estimates that he has 2,000,000 tons of ore "in sight." The water is raised by the Ludington costing $25 per day. As soon as connection is made with the Ludington much less apprehension will be felt. One cannot escape an uneasy feeling for men who are down 1,325 feet below the surface, with only one avenue of escape. A fire that should burn the large shaft house would probably smother them as well as cut off all means of egress from out of the mine. A great deal of faith and courage is shown in the undertaking of sinking the No. 2 shaft. Mr. Jones estimates that lie will produce 35,000 tons of ore in 1890.

The officers are Norman Hall, President, Sharon, Pa.; P. L. Kimberly, V. P., Cleveland, Ohio; O. K. Williamson, Secretary and Treasurer, Chicago, Ill.; J. T. Jones, Superintendent; Frank Corbis, Mining Captain, Iron Mountain, Mich.

The yearly production has been as follows:

1886	872 tons of ore
1887	514 tons of ore
1888	8,301 tons of ore
1889	8,868 tons of ore
Total	18,555

The mine, like the Chapin and Ludington, is in the city of Iron Mountain.

THE WALPOLE MINE.

This mine is just east of the Chapin in the same vein of ore. The work has been carried on for several years under the direction of Capt. C. H. Cady for Pickands, Mather & Co., of Cleveland, Ohio, in an exploratory way rather than as a mine. The equipment is adequate for the work that is doing and the ore is so valuable that the exploration is persisted in. The shaft is 390 feet deep and they have mixed ore 50 feet in width—10 feet wide clean ore—so that it is considered that the outlook for a mine has improved.

Product, 1889, 9,614 tons; total product, 12,224.

Location, E. ½, N. E. ¼, Sec. 31; and S. E. ¼, Sec. 30; S. W. ¼, Sec. 29; T. 40, E. 30.

Quality of ore, .66% iron; .010% phos.

THE MILLIE MINE.

This mine is situated just south of the east end of the Chapin, that is, it is in the east end of the Chapin foot wall.

It has always been a small mine, having one or more lenses of excellent ore. It was formerly operated by the Hewett Mining Company, named after the owner of the fee of the land. This Company, however, believing to have exhausted the mine, relinquished the lease a few years ago and the property was taken by the present company, that has succeeded admirably, considering that it was an abandoned mine.

The mine is in the N. W. ¼, N. E. ¼, Sec. 31, 40, 30, and it is looking better than it has at almost any period in its history. Mr. C. W. Kennedy, the superintendent, declares that he will be able to produce 30,000 tons of ore in 1890, nearly double the amount that was obtained in 1888. It is the best of Bessemer ore.

The greatest depth is 250 feet.

D. G. Dessau, Pres't, New York; C. W. Kennedy, Gen'l Manager, Iron Mountain, Mich.

The production in 1889 was 18,916, and total is, 70,408 tons.

THE PEWABIC COMPANY

is the name of an organization engaged in opening a mine in the N. W. ¼ of Sec. 32, east of the Millie. The management is the same as that known as the Menominee Mining Co., that formerly held the Chapin, etc. The Pewabic is now all in readiness for shipping the ore. The C. & N. W. Co. has built a track to the mine or through the valley south of the shaft, and the mining company has made a long, high trestle extending from the mine to it. This track will be operated with rope and winding machinery. At the extremity of the elevated trestle, over the railroad is a double ore pocket to receive the contents of the tram cars and to discharge into those on the railroad.

The shaft is in the side hill which rises above it to the north and descends to the railroad on the south. It is sunk vertically 500 feet, is double cage like those at the East Vulcan. At 350 feet in depth, a drift was made accross the formation northeast to the limestone 881 feet from the shaft. At about 800 feet in the crosscut a drift was made west and a body of ore 9 feet wide was found in which a winze has been sunk to the next level.

Two hundred and nine feet in from the shaft a drift east, 190 feet long, came into a fine body of ore, which has been worked out up to the sandstone, 20 to 50 feet high. A winze has been sunk in the ore and from the bottom of the shaft, 500 feet level, a drift was started to reach this ore, but a stream of water was cut that flows nearly all that the pumps can master, so that they are delaying the drift until they have in a larger pump.

They have 10,000 tons of ore in stock now and ship, probably 30,000 tons. The ore contains 65% metallic iron, .009% phos. So that it is gilt edge.

Geo. H. VanDyke, Sec'y and Treas., Milwaukee; N. B. Hulst, Gen'l Manager, Milwaukee; E. F. Brown, Supt., Iron Mountain, Mich.

THE COMMONWEALTH MINE

situated about a mile east of of Florence in Wisconsin, has much improved in the past year. There is now far more ore in sight than has appeared for several years. Supt. Davidson has been very successful in his efforts. The new body of ore is not a recent discovery. It was found several years ago, but in the past year the company has undertaken to develop it. The shipments for the year just closing, amount, 102.871 tons, making a total for all the years, 595,665 tons.

O. C. Davidson, Supt.

Products of Commonwealth Mine:

Year.	Tons.	Year.	Tons.
1881	97,410	1886	51,189
1882	115,865	1887	35,000
1883	21,943	1888	61,819
1884	34,622	1889	102,865
1885	42,967		
Total			595,665

THE FLORENCE MINE

is now one of the Schlesinger group. It was purchased last summer with the Iron River and Youngstown mines, and the three are now designated as the mines of the Florence Iron River Company. In the transfer the owner conveyed three-quarters interest in the fee, the remaining quarter interest being owned by H. D. Fisher, of Florence. The consideration was $350,000 cash. The Florence mine is proving to be a very valuable one; all developments made tend to enhance its value and very recently there has been much shown up in its favor, which, with the fact of the increase of price of iron ore and the increased demand for it, have augmented the value of the mine to such an extent that if it were to be

sold now the price would be a much higher figure. The Florence is an off ore. The best is good ore of the kind—62% in iron, but having a high percentage of phosphorus.

The extreme length of the mine from the east end to No. 7 shaft is 1,920 ft. No. 7 is 330 ft. west of No. 5. No. 5 shaft is sunk to the third level, 230 ft deep. The ore has a maximum width of 100 ft., and is thus far opened in the second level 230 ft., and in the third 197 ft.

In the old mine, east of the shafts above mentioned, they are preparing to take out the ore pillars above the old bottom. They are stripping the ore, that is, running the sand that overlies it down to the second level, 153 ft., after which they will "rise up" on the sand filling and take out the "ore backs" in the levels above. No. 4 shaft is to sixth level 350 ft. deep. The ore is 50 ft. wide. There is a great deal of ore in sight in the old mine— the east end—and it can be cheaply mined, but it is not a good hard times ore. It is the company's Eagle ore. Mr. Porter has instructions to get out all the ore he can, and he is just the man to do it. He will get out 350,000 tons in 1890, and will have 100,000 tons in stock by spring.

Year.	Tons.	Year.	Tons.
1880	14,148	1887	79,399
1881	100,501	1888	142,586
1883	100,125	1889	171,862
1886	840		
Total			710,718

Ferdinand Schlesinger, President; J. N. Porter, General Manager, Stambaugh, Mich.; S. T. Beattie, Superintendent, Florence, Wis.; Edward Ball, Mining Captain.

THE IRON RIVER MINE

has yielded an unprecedented product in the last year. A good deal of effort has been required to get it, owing to the fact that the preliminary work for so great a product was not done during the winter, or before the opening of navigation. The company did not expect to mine so much ore and had not made the openings for it. Later in the season it became necessary to push things, to mine all the ore that they finally sold.

The north end of the mine has greatly improved of late. No. 3 shaft is at the north end, and at 200 feet north of the shaft a crosscut shows the ore to be 60 feet in width, and the drift 100 feet further north is all in ore, 30 feet wide at the end. This is the west lense of ore, parallel with the old Corbett lense, at the north end. It was discovered, as described in my last Report, in driving the crosscut in the second level east from No. 3 shaft. This new ore body has since opened finely. It is the best Iron River ore.

The company had no trouble in filling its contracts for Iron River ore; the difficulty experienced was to secure enough Corbett ore to fill out their sales before navigation closed. Of course the Iron River ore could have been substituted, but it is better quality and worth more and it was not desirable to make it take the place of lower grade ore at a correspondingly less price. The Iron River mine has never been extensively worked. There has always been ore enough in sight, with the limited amount of opening work done, to fill the small sales that were annually made. The mine is in the strong ore formation and all that one can observe indicates well for the future of the mine. Considerable difficulty was experienced this season from lack of steam. The increase in the work of hoisting taxed the limited boiler capacity at the north end of the mine to its utmost. The proper remedy has been applied; a new boiler house has been built on the river bank, just west of No. 3 shaft, supplied with two fine steel boilers. No. 2 shaft is sunk to the 300 foot level, but the ore had not been reached the last time I was down in the mine, December. The Isabella pit, a mile further south, continues to hold its own in the matter of production, and in the prospect which it affords for the future. It is 280 feet deep and will produce 100,000 tons in 1890.

The Iron River mine is well managed and well worked. It has the best of superintendence. The ore is cheaply mined.

Since the foregoing was written I have again been at the Iron River mine, and find that they have 90,000 tons of ore in stock, April 1, and the body of ore at the north end has been opened 600 feet in length. The north extremity is now underneath the river and still going on, 30 feet wide. Have begun to sink No. 4 shaft, between the north line of the property and No. 3. Also are preparing for the foundations of a new engine house, for Nos. 3 and 4 shafts.

The annual product has been as follows:

Year.	Tons.	Year.	Tons.
1882	29,115	1886	78,991
1883	100,369	1887	82,404
1884	92,584	1888	100,952
1885	55,693	1889	179,288
Total			668,006

The Iron River ore averages 60 to 61 per cent—the new ore. The new ore and the south end, or Isabella ore, averaged 60 per cent iron; phos., .33 per cent.

J. N. Porter, General Manager; Otto Riebel, Superintendent.

The Iron River mine is at Stambaugh, Mich., in Sections 35 and 36, T. 43, R. 35, Mich.

THE SELDEN MINE

comprising the N. E. ¼, S. E. ¼, S. 35, T. 43, R. 35, near the Isabella pit of the Iron River mine, is now held and worked by the Iron River Co. The St. Clair Bros, operated it in 1886, but it has not since been mined. The fee belongs to the Messrs. Selden, of Stambaugh. The ore thus far found is of poor quality. Mr. Porter is pushing the exploring work in this 40.

THE NANAIMO MINE,

situated across the river from Stambaugh, within the precincts of Iron River village, in Sec. 26, N. W. ¼, S. W. ¼, T. 43, R. 35 W., is idle and has remained so since it was shut down in the summer of 1888. There is still ore in the bottom and perhaps under the improved condition of the iron ore market, the mine could be worked to better advantage now than heretofore. The ore runs about 58% in metallic iron and .25% to .33% phos., with a large percentage of lime also of water.

The fee simple is owned by the McKibbon Bros., of Iron River, Mich. In all, the mine company has produced, since 1882, 110,915 tons of ore.

The lease has been surrendered to the fee owners, and since writing the above the mine has recently (March 10) been again leased, together with the Beta, which joins it and is also owned by the McKibbon Bros., to H. Neunamacher, of Milwaukee, and others, of Escanaba. The lease runs 20 years. They will put in machinery and proceed to pump out the water and sink the shaft, etc.

Joshua May appears as Mining Captain; E. H. Jones, Supt.

THE SHERIDAN MINE,

also situated in Iron River village, lying southeast of the Nanaimo, between it and the Iron River mine, is, apparently, improving. I saw a small stock pile of first-class ore when I last went to the mine.

The Chicago & Northwestern R. R. Co. has built a spur to the mine, so that Mr. Sheridan is now in shape to ship all the ore he can find and mine out. The ore is, when clean, identical with Iron River ore. The shipment for 1889 was 504 tons. The land is owned by McKibbon Bros., Iron River. Mr. Peter Sheridan held the lease and has made the development. He is now sinking a shaft and is already 100 feet deep. The indications are sufficiently favorable to warrant further work.

In fact I see no reason why, in this stretch of ground, from the river to the Nanaimo, there should not be workable deposits of ore. I understand that the mine is controlled by an organized company, composed of Escanaba men, with Peter Sheridan, President.

OTHER EXPLORATIONS AT IRON RIVER.

Just north of the Iron River mine, over the line on the next section, S. W. ¼, Sec. 25, 43, 35, locally known as the Fred Miller homestead, parties, of whom Mr. J. N. Porter is one, are exploring by sinking a shaft, which is 90 feet deep, and the drift from it is in ore.

Also further west, bordering the village, in Sec. 26, in the J. B. Weimer homestead, parties have taken an option to explore.

In Sec, 35, west of the Iron River mine, on the Selden homestead, Mr. Cornelius Palmer has been exploring. The Brule River Mining and Exploring Co. is preparing to operate on S. ½, N. E. ¼, Sec. 20, 42, 35. F. A. Morrison, Iron River, President.

THE CHICAGON LAKE MINE,

in Sec. 26, 43, 34, is now being further examined. There is likely to be a new railroad near it. It is reported that Geo. M. Wakefield, of Milwaukee, has purchased the mine of Mr. N. Boardman. Capt. Alexander Wood is now in charge of the work. Ore was found here, and considerable work done; but the ore was of poor quality.

IN THE CRYSTAL FALLS DISTRICT

the rocks present the uniform characteristics, identical with those at Iron River—a wide belt of dioritric, slaty schists—with jaspery schists in which ore occurs.

The area in which ore is found is many miles wide north and south while the general trend through east and west varies greatly, locally; the ore formation, seemingly lying in many localities north and south following the long outcrops of diorite, which control the local trend of the slates. The lines of magnetic attraction are more generally north and south, or northwest and southeast than otherwise.

An unusual degree of activity prevails in the region, of which Crystal Falls is the initial point, in the work of exploring; and this activity is likely to continue and increase as the new year advances.

One of the best things in the way of discovery of ore was recently made in Sec. 11, T. 43, R. 31, being the land held on a lease by the Caledonia Mining Company, but since the late discovery of ore at this place

THE MANSFIELD IRON MINING COMPANY

has been organized to open and operate the new mine where the ore is found in the west bank of the Michigamme river. Some exploring, done here six years ago, led to the discovery of what was claimed to be a deposit of Bessemer ore. Since then other parties have taken an option on the property and pumped the water out of the shaft, which was 100 feet deep, and have further explored it. But actual inspection of the shaft and crosscut did not confirm the reports of the value of the mine, and all who undertook to explore the mine gave it up, until last fall, in October, Mr. W. S. Calhoun, a veteran explorer, well known in the region, undertook, in behalf of the owners of the lease, or a portion of them, to examine the property, and his efforts have been crowned with the most gratifying success.

Relinquishing further effort at the shaft, Mr. Calhoun sunk a pit 500 feet south from the old workings; also on the east bank of the river. Going through 8 feet of earth stripping, ore was encountered in which the shaft has since continued to the present depth of 105 feet. They have shown a width of ore of 30 feet, and have drifted 100 feet north and 100 feet south, all in ore. The work of examination will be still continued. The outlook is

exceedingly promising. The ore is a rich, soft, brown hematite, the quality of which is shown by the following analyses of samples taken at different points in the shaft: 65.20% metallic iron, .028% phos.; 6400% iron, .025% phos., 3.90% silica; 64.00% iron, .019% phos.

The mine is in the south 40 of lot 8, Sec. 20, 43, 31, owned in part, I believe, by the estate of the late Geo. Wilson, of Republic, and held on a lease by the Caledonia Iron Mining Company, which has sub-leased to the Mansfield Iron Mining Company.

The C. & N. W. R. R. Company will extend its spur from the Armenia to the Mansfield.

The company is now making all preparations to mine, erecting the necessary buildings, machinery, etc.

Probably 50,000 tons and upwards of ore will be shipped from the mine in 1890. Capt. Edward Ball, formerly of the Florence mine, superintends matters.

THE BOHEMIA

is the name given to an exploration for iron ore, conducted close to the Michigamme River, on the east bank, opposite the Caledonia. It is in lot 1, Sec. 20, 43, 31. Messrs Guensburg, Lustfield, Moore and others are the parties interested. They hope to find the Mansfield deposit. The land is owned by the Canal Company. Also a better prospect is that of

THE MAMMOTH,

the name given to an exploration conducted by B. N. White for Angus Smith *et al.*, of Milwaukee, on Sec. 17, N. W. ¼, S. W. ¼, T. 43, R. 31. Just north of the Caledonia, some parties are working also in S. W. ¼, N. W. ¼, Sec. 20; both adjoin the Mansfield.

Capt. Morrison, an old explorer, is attending to the work. Are 40 feet deep now and have many test pits, showing well.

THE HEMLOCK RIVER MINING COMPANY

is second only in importance of the new developments that are reached from Crystal Falls that have been made up to this time—December. The ore is found in the S. W. ¼ of Sec. 4, T. 44 N., R. 33 W.

Land owned by Peter Pascoe, Mat Gibson, the estate of Geo. Wilson and others, who having done all the work so far, have, within a few weeks past, given a lease to Pickands, Mather & Co., of Cleveland, Ohio. The consideration paid being $40,000 with a fixed royalty on all ore that shall be mined. Mr. Henry Warner, of Marquette, late Superintendent of the Grand Rapids mine, now supervises matters at the Hemlock. The exploring work was done under the superintendency of Capt. E. S. Roberts, now at the Mastodon.

The ore is crossed by the north and south eighth line, it is near the Hemlock river, which runs southwesterly, diagonally across the quarter section. The trend of the ore is in the same direction. The location is rather low ground bordering the river. The general elevation being about 12 ft. above it.

Up to this time—December—they have developed a length of ore of 250 ft., leaving a width at the north shaft of about 45 ft. at right angles to the long axis of the ore. At the south end the ore is 30 ft. wide. The shafts are 260 ft. apart and 60 ft. deep. The ore is non-Bessemer, hematite averages 60% or upward in metallic iron. It was first found in the river. The place is reached by a wagon road from Crystal Falls, from which it is thus distant about 16 miles. Probably a railroad will be made to it the coining year, in time to send away ore before the close of navigation. The new company is engaged in erecting buildings, preparing the surface, getting in machinery and placing it, etc.

JAMES PICKANDS, *Treasurer*,
Cleveland, Ohio.

THE OTHER EXPLORATIONS

in this locality have not shown up very much as yet except perhaps one eight miles north of the Hemlock mine, in the E. ½, S. E. ¼, Sec. 28, T. 46, R. 33, made two years ago by Mr. J. C. Fowle and others and which I described in my report of 1887.

Possibly a shipping mine could be opened here as soon as railroad facilities were provided. Exploring work is now in progress at this location. Mr. J. G. Butler has the option.

Hon. George Wagner of Marquette, with others interested, is exploring for ore, east of the Shafer. They hold the S. E. ¼, Sec. 30, and S. W. ¼, Sec. 29, 43, 32. They are in a good ore formation.

East of the Great Western mine in the E. ½, N. E. ¼, Sec. 4, 43, 31, Mr. B. N. White, Superintendent Florada and others interested, are conducting an exploration for ore. They have sunk 70 feet and are already in ore. Also in the S. E. ¼, S. E. ¼, Sec. 25, 43, 32, just west of the Shafer mine, Mr. J. G. Butler, Jr., is exploring for ore. C. L. Lawton directs the work.

THE NIGHT HAWK

is the name given to an exploration in the N. W. ¼, N. W. ¼, Sec. 18, 42, 32, near the Mastodon mine. 50 feet of ore has been sunk in, in a shaft which is now, March 1, 63 feet deep. The proprietors now propose to crosscut and drift in the ore. The ore is similar to Mastodon ore.

THE MASTODON MINE

lying four miles south of Crystal Falls, in the northeast ¼ of Sec. 13, S. ½, 42, 31, has been so fully described in former reports, that it requires no extended mention-here. It has proved to be a valuable mine, a fine lease of excellent non-Bessemer ore that has been cheaply mined and readily sold. The method of working the mine

has been peculiar. The stability of the inclosing rock formation is remarkable; allowing very large chambers to be formed by removing the ore, the roof holding its place without requiring any timbers to support it.

Not much exploring work has been done, as the main deposit has given ore enough to meet the sales.

So far it seems to be a lense of ore inclining down to the northwest; its horizontal section being about 200x300 feet. The shaft is now, March, 340 feet deep, and will soon reach the body of ore that was found with the diamond drill a few years ago. It is situated north of the open pit. They will sink in the ore to the 300 foot level and open south in the ore. The ore also will be found north and east of the shaft. The intention is to open well by navigation time and be prepared to mine and ship 100,000 tons next year. Capt. C. T. Roberts continues to operate the mine on contract, that is, he mines the ore at a certain price per ton. The mine is kept in good shape and the location has much improved of late years. New machinery has been added, new buildings erected, etc.

C. T. Roberts, Agent, Crystal Falls, Mich.; Joseph Austrian, Secretary and Treasurer, 7 Rush St., Chicago. The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1882	3,477	1886	41,640
1883	18,157	1887	49,115
1884	18,020	1888	51,293
1885	11,773	1889	62,696
Total			256,945

The company is exploring in the W. ½, N. E. ¼, Sec. 13, 43, 32, north of the mine.

There are 25,000 tons of ore in stock.

THE SOUTH MASTODON MINE

lying immediately south of the Mastodon is a promising property. It is separated from its neighbor by the rock that underlies the Mastodon lense. Undoubtedly they must look for another lense of ore than the Mastodon. Possibly conditions might be found similar to those at the Dunn where the ore body is divided by a crossing of rock. The mine is about 250 feet deep. The shaft is in a strong ore formation that affords the best of indications for ore but while there is good ore found there has as yet been no large body of entirely clean ore encountered. There are drifts in various directions—all of them showing more or less ore. Mr. Edward Blake, the manager, and the parties interested with him, have shown a good deal of persistence in the work at the South Mastodon. The indications are all favorable; but still no considerable body of ore entirely free of rock is found.

	Tons.
The product in 1888 was	2,732
The product in 1889 was	4,006
Total	6,748

Edward Blake, Superintendent, Mastodon, Mich.

The description is N. ½, S. E. ¼, Sec. 13, 42, 32.

THE ALPHA MINE,

in the S. W. ¼, S. W. ¼, Sec. 12, 42, 33, a short distance northwest from the Mastodon, is now working. Frank Brotherton is operating it. He has a deposit of hematite ore, 10 feet wide, which he is working, and is, at the same time, further exploring for more ore. The shaft is about 85 feet deep; at further depth they will crosscut the formation.

THE DELPHIC MINE,

in the N. E ¼, S. W. ¼, Sec. 24, 42, 33, which has been idle for several years, has been freed of water and they are sinking to greater depth and purpose to more thoroughly explore the property. It is a fine location, with suitable buildings, machinery, spur from the Mastodon Branch Railroad, etc.

When worked, the ore deposits were never large, and, finally, nearly disappeared altogether. Subsequent efforts, made with a diamond drill by the Whittlesey Bros., failed to discover much ore. The purpose now is to sink and crosscut, etc.

The mine was opened in 1882 and worked down to 1887, during which time it furnished 33,246 tons of ore.

THE ATLAS,

so-called, is an exploration that Capt. C. T. Roberts is conducting near Mastodon.

THE DUNN MINE

is a property that has turned out exceedingly well; when it was purchased by Mr. Schlesinger, three years ago, there was not much to indicate that there existed so great a body of ore as has since been developed. It has proved to be a large deposit of good non-Bessemer, hematite ore, that, thus it, has been cheaply mined. The ore exists, apparently, in two lenses separated by a thin barrier of rock, which may prove to be only a "horse" or pillar of rock and thus the ore be found to be continuous beneath it. However the two deposits lie north and south of each other, the north deposit having been worked in open pit so that now it is a great uncovered chasm, 160 feet deep, 200 feet long, and 150 feet wide. The formation is ferruginous schist, which strikes north and south and dips vertically. The body of ore is simply a great pocket or lense existing in the schist with its long axis inclining to the north. There is a skip road, which goes down the wall at the northeast corner of the pit and further north is a shaft passing through rock at first but reaching into ore further down. The intention now is to work the mine underground, taking out rooms and leaving pillars. The south lense is covered over yet but it has been roomed out beneath; the purpose is to mine the pillars and let the surface in, this has riot been practicable so far owing to the position of engine house.

The company is now building a new engine house on the high ridge over to the west of the mine. It will contain four 10 ft. drums, hoisting engine, boilers and compressor, etc. I was told at the mine that the company expected to get out 200,000 tons of ore in 1890.

The mine is close to the east line of the property. The description is the W. ½, N. E. ¼, Sec. 1, 42, 33. The Dunn is one of the Schlesinger group of mines, operated by the York Iron Co.

	Tons.
Product 1887	15,470
" 1888	118,091
" 1889	151,828
Total	285,389

Ferdinand Schlesinger, President, Milwaukee; E. Florada, Supt.; F. C. Bennett, Mining Cap't, Crystal Falls, Mich,

There are now, March 1, 27,000 tons of ore in stock. The mine is about 250 feet deep, 80 feet below the bottom of the open pit.

THE SHAFER MINE

is located a mile north of the Dunn, in the N. W. ¼ of the N. W. ¼, Sec. 31, 43, 32. The mine is 500 paces from the N. W. corner of the section. There has been a great change here within the past year for the better. The mine from being one of doubtful value, is now in a fair way to be one of the best in the district. The land consisting of the west half of section 31, was owned by J. F. Shafer, of Iron Mountain, and Carl Shelden, of Houghton, who gave an option to Chicago parties for the purchase of Mr. Shafer's half of the estate for $80,000, and the lease of the other half at 12½ cents per ton royalty for the ore. The results of the examination, which was made, was so favorable that the purchase, etc., was consummated, and Mr. E. P. Jennings, Chemist and Engineer for the Florence Iron River Co., was appointed Superintendent, and the work at the mine has been pushed remarkably well ever since. Already there are now, March 1, 20,000 tons of ore in stock.

The ore occurs in the ferruginous slate or schist which constitutes the chief rock formation of this section of country. The trend is here about N. 60° W. and dipping slightly N. E., that is the formation stands nearly vertical. The foot and hanging walls of the ore are the same. The mine was originally a narrow open cut, about 200 feet in length and 80 feet deep; but the ore was too much mixed with rock. At greater depth it has proved to be cleaner, but more particularly so to the east and north of the open pit. Apparently the ore is very wide and there is a good deal of it. A shaft has been started at 250 feet north and east of the open pit shaft. It was supposed that it would be in rock all the way, that ore was south of it, but at 75 feet in depth the shaft came into ore. The deposit was thus found to be much wider than was expected.

There is some Bessemer ore in the west end of the mine, but whether they will save out a Bessemer product I do not know. The ore is not high in phosphorus and contains upwards of 60% metallic iron, and is just above the Bessemer limit. The shaft in the pit is 85 feet below the open bottom, and the No. 2 shaft will be sunk to a depth of 200 feet, when the two will be connected at the bottom. A compressor has been added to the machinery. There are two five-foot hoisting drums. Sixty men are employed.

Kirke Himrod, President Shafer Iron Co., 517 Rookery Building, Chicago; E. P. Jennings, Superintendent; Capt. Jones, Mining Captain. There were shipped from the mine in 1889, 11,166 tons of ore, making a total to date of 65,818 gross tons.

THE JUNIATA MINE

situated in Crystal Falls in the E. ½, S. E. ¼, Sec. 29, 43, 32, has been resurrected by Mr. C. M. Wheeler of Marquette, who has had the water pumped out of the mine and is now engaged in sinking the shaft and otherwise exploring the mine. I described the mine in 1887; nothing has since been done until now. It is a good ore formation but thus far no considerable body of clean ore has been encountered. In April, I learned, when at Crystal Falls that all work at the mine had been suspended.

THE YOUNGSTOWN MINE

which had been idle for two years, has been partially worked during the latter part of 1889.

The mine is situated about a mile northwest from the village of Crystal Falls in the N. W. ¼, Sec. 20, 43, 32.

The mine is close to the west line of the section. The mine was held on a lease by the Briar Hill Iron and Coal Company of Youngstown, Ohio, that last spring relinquished the lease on the section 19 portion of leasehold which the company also held till then. It is rather poor ore, unsaleable in dull times, and the company thought that section, 20, gave them all of this quality of ore that they cared for. Subsequently, during the year, the mine was sold to Ferdinand Schlesinger.

Capt. C. T. Roberts took the contract to mine 80,000 tons of ore in section 20, and is now engaged in this work. Mr. C. L. Lawton represents the company at the mine to see that the terms of the contract are observed.

The mine was fully opened; no sinking was necessary.

The ore runs about 54½% in iron, 30% and upwards in phos. and 4½% to 30% in manganese. It is now operated by the Florence Iron River Company, J. N. Porter, General Manager.

The product in 1889 was 7,470 tons, making a total of 110,057 tons. It might be valuable if ore with a certain percentage, sufficiently high, of maganese could be obtained. But the percentage of this element in the ore varies exceedingly. They are putting in a new hoisting plant.

THE CLARE IRON COMPANY

is an organization recently made to operate the section 19 mine, joining the Youngstown on the west. The lease was secured by Mr. Schlesinger and ultimately, no doubt, the two will be worked under one superintendence. Mr. E. S. Gilbert, late of the Florence mine, is now Superintendent of the Clare and is rapidly getting matters into shape to mine out ore. J. N. Porter, General Manager.

THE MONITOR MINE,

situated in lot 6, Sec. 20, east of the falls in the Paint river has turned out very well indeed so far as the quantity of ore is concerned. There is a large body of ore which is now quite fully opened up. The ore was first found by the Paint River Co., having been worked into west of the line from the east. After the Monitor Iron Co. was formed, a shaft was made from the surface just west of the boundary and the ore was hoisted through it. During the past year another shaft has been sunk away to the west and north of the ore and the engine house and machinery placed north of it on the higher ground. The formation is iron schist, standing about vertical, with a strike nearly east and west. The surface arrangements have been much improved in the past year and the mine seems to be fairly well equipped now, new machinery has been supplied, which includes a compressor. The shaft has reached a depth of nearly 200 ft.

The ore is about 50% iron, and 35 to 80% phos.

Product 1889, 21,620 tons; total 14,533.

W. S. Coffman, President, 185 Dearborn St., Chicago, Ill.

THE PAINT RIVER MINE

is close to the west line of the land adjoining the Monitor; both are in the same deposit of ore—the one east and the other west of the line separating the properties. The Paint River mine has two shafts, A and B the latter being very near the Monitor line. It is upwards of 200 feet-deep, vertically down. The ore is from 20 to 60 feet in width for a length of more than 200 feet. The mine has good machinery and can produce a much larger product of ore than has ever been sent out from it, if there is demand for it; but the ore is of a quality that must sell at a low price and thus cannot always, probably, be produced at a profit.

The mine is now worked on company account.

Frank Scadden, Superintendent; Robt. Phillips, Mining Capt.; Madison La Monte, President, Chicago.

Three thousand tons of ore in stock and many thousands of tons are broken and ready to hoist, underground.

The annual production has been as follows:

Year.	Tons.	Year.	Tons.
1882	4,615	1886	13,933
1883	5,971	1887	10,240
1884	11,546	1888	12,506
1885	2,574	1889	32,161
Total			103,346

THE LINCOLN MINING CO.

is a recent organization formed to explore and operate the Fairbanks mine, situated between the Paint River and the Great Western mines, being in the west half of the S. W. ¼ of Sec. 21, T. 43, R. 32. The headquarters of the new company is at Escanaba. H. A. Barr, President; F. H. Brotherton, Secretary and Treasurer.

Mr. J. B. Swartz has been exploring lately to find the continuation of the ore and has sunk a shaft 65 feet in depth, which he states is in ore of good quality.

Capt. Swartz will continue as Superintendent and is now engaged in overhauling the old machinery and getting matters into readiness to prosecute systematic mining work. The Fairbanks mine was opened in 1882 and soon worked out; that is, the ore which was at first found was soon exhausted. The present find is further north and east; the old mine was on the section line, 80 rods north of the section corner.

THE GREAT WESTERN MINE

in the E½, S. W. ¼, Sec. 21, 43, 32, holds its own remarkably well. The owners have the advantage in the fact that this mine affords some of the best of ore. It is a pretty wet mine and has been an expensive one to work, owing to the fact that the ore has occurred in distinct pockets, that required considerable rock drifting to reach. The pockets have not proved to be persistent, they disappeared after a level or two and ore had to be found in some other place.

A year ago when I was at the mine it was nearly full of water, but the water was finally got rid of and a product of 37,855 tons of ore mined and shipped away. The mine is to the sixth level, 315 feet deep. That is No. 1 shaft has been sunk 60 feet, to the sixth level; in the fifth level the main body of ore, at No. 1, was 100 feet wide, and Capt. Hooper finds so far as he has opened in the sixth, that it will be equally as large. The Great Western is a better mine than it has had credit of being. The work has been slow and expensive owing to the want of adequate pumping plant and of a compressor, both of which machines have been lately supplied. The water is much less troublesome now that there is a large pump, new Worthington, to take care of it; and the walls of hard rock and of hard ore are far less a barrier now that they can use power drills to demolish them.

Analysis of the ore in the bottom at No. 1 shaft show 65 per cent iron; .196 per cent phos., and 64.60 percent iron, .22 per cent phos., thus showing it to be high grade non-Bessemer ore. The mine is in low ground and gets a good deal of surface water, but Capt. Hooper has,

supplied a launder that carries it away nicely. The compressor is a duplex Rand, long stroke; also two new boilers, all in a new building. The mine will give a larger product; in 1890 than ever before.

J. M. Turner, Lansing, President; Wm. Hooper, Superintendent, Crystal Falls, Mich.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1882	587	1887	23,239
1883	22,825	1888	21,861
1884	20,722	1889	37,555
1886	25,725		
Total			152,813

The location is about a mile in direct line from the village of Crystal.

The corporation is now the Iron Star Mining Co.

Since writing the above, on April 11, a sad accident occurred in the mine causing the death of the Superintendent, Capt. Wm. Hooper, and injuring several others, two of them seriously. Capt. Hooper was esteemed a good miner and a very intelligent, reliable man.

THE ARMENIA

is another of the so-called Schlesinger mines. It is a new mine, having been opened in the beginning of 1889. It has done very well for the first year, having produced 44,670 tons of ore. The company expects to greatly increase this amount in 1890, but to what extent they may succeed in doing so it is difficult to judge. It needs further work to determine the extent of the ore; even in a comparative limited degree. The mine is in the center of the E. ½, S. E. ¼, Sec. 23, 43, 32, three miles east of Crystal Falls. It is directly east from the Youngstown, Paint River, and Great Western mines. But here in this locality the trend of the ore is north and south or nearly so, corresponding with the direction of the diorite outcrops, which occur also.

Considerable interest attaches to the Armenia, as there are other incipient mines in the vicinity, having the same kind of ore and having the same characteristics of formation, etc., which will be valued somewhat by the outcome at the Armenia. The ore is about 60% iron, slightly non-Bessemer; thus a good saleable hematite. The mine is well equipped with machinery, etc. An extension east of the Great Western mine railroad branch, reaches the mine, the corporate title is the Armenia Mining Co.

Ed. Florada, Supt.; A. J. Carlin, Mining Capt.; Ferdinand Schlesinger, President.

Product, 1889, 47,775 tons.

THE HOLLISTER MINE

is directly north of the Armenia one mile, being in the W. ½, S. W. ¼, Sec. 13, 43, 32; it is evidently in the same "run of ore." Some mining was done at the Hollister last season and a few hundred tons of ore put in stock on the surface, but as there is no railroad at the mine it could not be shipped away.

There are two parallel deposits of ore, one, however, is of poor quality, the other, an excellent dark brown hematite, probably non-Bessemer, though it seems to be only about at the limit in phos. This deposit is 10 ft. and upwards in width for a length of 200 ft. so far as developed. The other deposit of poorer ore is much larger. Work was discontinued in September last, so that at the time I was at the mine the pits were full of water. I am informed that a company has been formed in Milwaukee to work the mine and that operations will begin about the first of March. Heretofore it has been operated by S. D. Hollister, who held the lease, explored the land, etc.

THE BLANEY MINE,

more recently the Wauneta, is in the N. W. ¼, S. E. ¼, Sec. 27, 43, 32, the estate comprising the entire ¼ section. I have fully described all that has been done here and the results, so far as finding ore mattered, in previous reports—1886-1887, nothing has since been done. I think those who did the work, finding it unsatisfactory, surrendered the lease to the canal company who owns the fee.

A shaft was sunk on this property 110 ft. deep, much drifting done and some good ore found. It is reported that Mr. H. J. Benjamin and other Milwaukee parties, have taken an option of the Wauneta and will further explore it.

THE LEE PECK MINE

is about half a mile northeast from the Blaney, in the W. ½, N. E. ¼, Sec. 26, 43, 32, not far from the center of the section. Under the recent stimulus in mining and exploring work in this locality the Lee Peck is undergoing further examination. Some systematic work was done prior to 1888, that is the exploratory work was discontinued in the beginning of 1888. Some very good ore was found, but not in large quantity. Further exploration may give better results. The ore is about 80 rods west of an out crop of diorite, which extends north and south.

JOHN L. BUELL

is exploring in this vicinity—reexamining some old explorations, among others, the James-Rahrer option in Sec. 28, 43, 32.

It would be needless to indicate all the exploration in progress in the Menominee region, there is so much of it.

THE ESCANABA RIVER LAND & IRON COMPANY

has been organized and will examine the Cheshire and Swanzey mines that have been idle for a year or two past. The company also contemplates making exploration of some lands in the vicinity.

Frank Brotherton, one of the company, an able explorer, will do the examining work.

THE MINES OF THE MARQUETTE RANGE.

with, scarcely an exception, have furnished as much ore in 1889, as ever before, some of them even a greater product; and they afford the evidence necessary to give assurance that they will not fall short in 1890.

OF THE JACKSON MINE

there is nothing new to add. It is an old mine; the ground, to a limited depth, has been pretty well perforated with shafts, tunnels, drifts, crosscuts, chambers and drill borings.

For several years past there has been no large body of ore anywhere to work upon. The product has been kept up, but the ore has been obtained from a good many places.

I have described, in the last report, the hard ore deposit, which had been opened into northwest of the old north pit. At the time I saw it a year ago, it was looking very favorable. It did not, however, hold out. The ore deposit, instead of proving to be what was expected, wedged out. The incline shaft that was so troublesome to sink, and which ended, as it seemed, against this same fold of ore that they were mining in further north, is now all in rock at the bottom; the ore has disappeared.

It is a very curious formation. It is full of pockets of ore but they work out. It did seem from all the data, that they were in a fold of ore lying in jasper and under the quartzite that possessed permanence and magnitude. Still further on to the west, if the old borings are to be trusted, they are sure to find a big deposit of ore.

This north pit, working still, gives a good deal of ore, as is seen by the large stock pile, which is daily increasing.

The company is also tramming in the old Pioneer pit, in fact almost everywhere in the old mine. No. 8 pit has been extended nearly to the east line, and a rise made up to the surface has been turned into a shaft through which ore is now hoisted. Borings made in several places develop the existence of underlying deposits of ore; alternating jasper, soap rock and ore.

The company owns the mining right under a portion of the city—the N. E. part of Sec. 1 and drill borings show that ore exists there which it is contemplated to sink a shaft to reach.

In the South Jackson, the Moyle is the main pit still. It is sunk 200 feet below the tunnel. The ore is 7' to 20' wide and 200 feet long. The ore averages about 55% iron and .080% phos.

The east end pit contains a manganiferous ore that goes 7% manganese, which with the iron, goes 61% iron and .048% phos. The deposit is 10 feet wide 225 to 200 feet long. They make a separate product of this manganese ore. Jackson mine is in the City of Negaunee.

Annual products of the Jackson mine are given in the following table:

Year.	Tons.	Year.	Tons.
Previous to 1856 (estimated)	25,000	1873	130,131
1856	417	1874	94,708
1857	12,442	1875	87,283
1858	10,909	1876	98,480
1859	28,377	1877	80,840
1860	41,295	1878	83,120
1861	12,919	1879	113,921
1862	46,046	1880	120,633
1863	77,337	1881	118,989
1864	83,005	1882	93,670
1865	65,505	1883	71,278
1866	92,287	1884	70,826
1867	127,491	1885	67,657
1868	130,524	1886	89,525
1869	125,008	1887	109,947
1870	127,842	1888	101,710
1871	133,397	1889	124,982
1872	114,910		
Total			2,925,451

Samuel Mitchell, President and General Manager, Negaunee, Mich.

THE CLEVELAND IRON COMPANY.

If the certainty of possessing a vast quantity of ore, enough to keep up a great product through many years to come, suffices to assure a long lease of life, then the Cleveland mine is only in the zenith of its career. Its owners can look forward to as many years of prosperity as are embraced in the history of its past. There is nothing new or important developed in the old mine, the Incline, the Moro, the No. 3, etc., pits, these all show the customary features and look neither better nor worse than they have for several years past. But the new mine under Lake Angeline is proving far better than was hoped for. Apparently this is one of the largest deposits of hematite that has ever been found on Lake Superior.

A brief description of the situation may be necessary to fully understand the matter.

The Cleveland mine, in the city of Ishpeming, is in a broad fold of the formation, running east and west, which contains the Cleveland, New York, Cliff, Barnum and Lake Superior hard ore mines. This one main synclinal embraces several minor folds, which contain the different pits of the several mines. The Cleveland mine is at the east end of this basin, where on the south, east and north the jasper underlying the ore comes to the surface and protrudes above it, in places, to a high elevation.

South of the jasper, at the Cleveland mine, is a steep, narrow bluff of diorite which, on the south side, drops abruptly to the surface of Lake Angeline. This basin of water is in section 10, and is a mile in length east and west and about half a mile across at the widest place, where the north and south center line crosses it. It

contains a depth of water in the center of 30' to 37 ft., and for several years, until within a few weeks, it has been the source of supply of the city for water.

The diorite again out crops to a considerable height south of the lake and forms a synclinal beneath it but far down under the ore, which rests on it. The trend of the axis of the trough or basin, under the lake is slightly north of west and southeast, extending beyond the west end of the lake where it is the ore basin of the Lake Superior hematite mine. Thus we have here in this synclinal trough a deposit of ore a mile in length, across Sec, 10, one half mile in the Cleveland Cos'. land, and an equal distance in the lands of the Lake Superior Iron Co.

Three years ago the Cleveland Company thinking that the Lake Superior Cos'. hematite basin of ore must continue easterly under the lake, decided to test the matter, borings were made through the ice, as explained in the Report for 1887. The result verified all that had been conjectured regarding the existence of ore and since that time preparations have been making to develop a mine under the lake. In fact the mine is opened, not extensively as yet, but a great deal has been done beneath the surface and above it; and all in a most systematic manner. On the north side of the lake, the narrow margin between the high diorite bluff and the water has been widened and graded for railroad tracks, ground for stocking ore, timber, etc., shaft house, ore pockets, etc., erected. All is compact and convenient.

They are now putting up a mill near the shaft to be provided with all the machinery for framing the mine timbers. Such a mill has for some time been used in the Gogebic range and does this work admirably. It costs now $1.80 to $2.00 per set to frame the mine timbers, the same result will be accomplished by machinery for 18 cents per set. The cost of the mill is $15,000. The shaft is in the north margin of the lake, dipping to the south at an angle of 50°, double track, ladder way, etc. The skips will be operated to balance one another; that is the empty car descending as the loaded one goes up; also a tail rope will be added.

Rock for filling the mine, will be brought from the waste dumps from the old mine, north of the bluff. A convenient rock pocket has been made into which the cars, loaded with rock will discharge their contents automatically. The rock in this pocket may be run into a chute, that extends down into the mine, or may be drawn into cars and run down on a track to the first level, thence to the place to be filled. All spaces that are made by the removal of ore will be first held with timbers and then filled, with rock.

So far, the work below has been to sink the shaft, crosscut to the ore in the first and second levels, and drift on the deposit to mark off the rooms.

It is 240 feet along the line of the shaft to the first level. Thence south to the ore, 58'. Width of ore in this north fold is 71 feet; through dead ground 405 feet. Then south branch of the fold of ore, 75', thus making this crosscut in the first level 609 feet in length. At the center there are 71 feet of earth and rock between the drift and the water. The vertical distance below the collar of the shaft is 157 feet. At half-way of the crosscut, three borings were made: one to the north, depressed 45°, passed through 135 feet of earth, etc., then 70 feet of ore to the diorite. A vertical hole found also 135 feet of intervening material and then 170 feet of ore. A boring to the south, 45° down, first cut 225 feet of overlying material and then 136 feet of ore.

Thus we have a section of the ore at this place which pretty fully shows the dimensions of the fold. At the end of the crosscut in the first level, they have bored a horizontal hole to the south, 900 feet, to the Lake Angeline mine deposit. This boring cut four points of diorite, separated by soap rock; but no ore was found.

This and further borings and, also, test pits show that the Lake Angeline mine deposit, lying south of the lake, is shallow at the east end. The pitch of these folds is to the west; starting from the surface at the east, they increase in depth and magnitude to the west. The shaft of the Cleveland Co. will be 500 feet long to the bottom of the fold; 135 feet below the first level the crosscut will be all in ore—a body of ore 400 feet-wide north and south. In the first level they have opened thus far, March 1, 400 feet east and 400 feet west of the crosscut. In the second level, the crosscut is in the ore in north branch 80 feet; will be 100 feet wide, probably; 380 feet through rock to south lense. The levels are 130 feet apart, measured on the incline. The outcrop of the ore is found on the south margin of the lake at the east end under the soil. Mr. Mills now has a drill working over on the south side and also has some men sinking test pits to find the ore. It is the intention to drain the lake before doing any work underground beyond drifting and exploration. The water will be pumped out, possibly, during the present year, 1890. Also, another shaft will be sunk towards the west, in place to properly divide the ground between the present shaft and the west line. The ore is identical with that of the Cleveland hematite, about 62% iron, and slightly non-Bessemer. The underground tramming will be by cable, as at the Chapin.

The Moro Pit is down to the twelfth level, about 800 feet deep. It is producing 10,000 tons of ore per month. It presents the same features as heretofore, a very good hard ore mine. The "back" in the Saw Mill pit has not been taken yet but they are prepared to do so soon.

The Incline is about as it has been for several years. It is an immense pit that has given a great many thousand tons of ore; now it is only a Scram. Still the diamond drill is at work, and there are late developments, which lead to the inference that the end of the Incline mine is not yet. No. 3 mine has much ore of a low grade and some good ore. It is the greatest producer, next to the Moro, of hard ore. A drill hole, just bored, in No. 3, dipping to southwest, cut 53 feet of ore, a fact that is looked upon as very encouraging.

The Cleveland Hematite, located about a mile to the north, has somewhat improved. The mine is 725 feet deep vertically down and a winze in the ore is still below this bottom.

The shaft will probably be sunk another hundred of feet and the drift made to the ore. The ore deposit is found to be larger now than it was.

Mr. Mills is exploring it to be satisfied that the ore holds out to fully pay for the sinking and drifting to get it.

It will be remembered that the ore body has, for the last several hundred feet down, inclined away from the shaft which is vertical, so that it is now as far from the bottom of the shaft to the ore as it is to the surface; and it is hard jasper, very expensive ground to sink or to drive in.

The Cleveland company holds here in one body about 2,000 acres of land, a very valuable estate.

The Cleveland mine produced in 1889	215,829 gross tons
The Cleveland Hematite mine produced in 1889	49,987 gross tons
The Lake mine produced in 1889	9,232 gross tons
Total	274,048 gross tons

The following shows the annual shipments:

Year.	Tons.	Year.	Tons.
1854	3,000	1872	151,724
1855	1,444	1873	193,365
1856	6,343	1874	165,855
1857	13,201	1875	139,881
1858	7,909	1876	145,091
1859	15,787	1877	151,304
1860	40,041	1878	143,320
1861	11,794	1879	133,108
1862	40,264	1880	197,234
1863	46,842	1881	197,848
1864	49,164	1882	204,341
1865	33,355	1883	218,219
1866	42,680	1884	224,479
1867	75,864	1885	248,622
1868	102,112	1886	203,896
1869	106,133	1887	204,838
1870	133,884	1888	182,788
1871	142,658	1889	274,048
Total			3,156,681

Samuel L. Mather, President and Treasurer, Cleveland, Ohio; Fred A. Morse, Secretary, Cleveland; F. P. Mills, Superintendent, Ishpeming, Mich.

THE LAKE SUPERIOR IRON CO.

has made but little new development within the past year. The company is constantly exploring with the diamond drill, and otherwise in the mine and wherever ore is found. Before deciding to sink or drift to it to mine it, it is first determined that there is enough to, at least, pay the cost of getting it and a safe margin in favor of profit. The policy of the company has ever been both conservative and progressive, an admirably managed corporation, that for many years has been uniformly prosperous. Like the Cleveland, it is an old company, one of the largest producers of ore, and its mines also within the city of Ishpeming.

The several mines or pits of this company that are now producing ore are No. 2, No. 7, A shaft, Sec. 16 mines, and the Hematite. The No. 2 has been the largest producing hard ore mine. It was a lense of ore in a fold of the formation, between the Jasper and the quartzite, which was opened down to a depth of 725 feet, and has not since been deepened, having reached, it is believed, not the bottom of the fold, but as far as it will pay to go. Jasper had taken the place of the ore. There is a little stoping done in the mine aside from the floors and pillars. About 40% of the ore remained in these and the work of removing them has begun. They work up from the bottom level, having taken out of the floors of the three lower levels and filled the space with rock. The rock is run down from the surface and the work progresses satisfactorily, though, of necessity, not rapidly. The pillars at No. 2 shaft have not been disturbed yet.

No. 7 the most westerly mine, has been sunk 60 feet, they have found that there is yet a deposit of good 65% hard ore. The pumps had been pulled out of this mine intending to run the water through a long drift at the bottom to No. 2, but it has been decided to restore the pumps, and a new Worthington is now going in.

A shaft has become a deep open pit, close to the highway. They have worked west under the road; but are leaving pillars so that the ground is well supported. The deposit is apparently a fish-bellied basin that is nearly worked out. There ought to be ore deeper down and further east, since ore was found in the Union drill hole bored on the line, on the flat ground, by the Lake Superior and Cleveland companies, several years ago.

Section 16 mine is, thus far, not a large mine; it is close to the Pittsburgh and Lake Angeline mine, joining it on the west. The mine is 430 feet deep and the winze at the shaft is sunk 100 feet more, from the bottom of which they will rise up in the shaft and thus extend it down. The ore is mostly Bessemer, though there is a percentage of the product that is not. An imaginary vertical plane, east and west, through the mine divides the two grades. Some borings to the west discovered excellent ore and a shaft has been started 400 feet northwest of No. 1 to reach it. The shaft is now, March 1, 100 feet deep.

The following are several results of analyses of drill cores, which show the valuable quality of this ore: Iron 68.88%, phos. .070%; iron 67.78%, phos. .016%; iron 66.25%, phos. .014%.

The Lake Superior hematite, which lies west of Lake Angeline, has gradually been extended east until it is now under the margin of the lake. This is undoubtedly the same fold of ore in which the Cleveland company is opening further east. In a few years more this deposit will be mined beneath the whole length of the lake. The prospect is a very favorable one for both companies.

Another level has been opened in the east end 513 feet below datum or 70 feet lower than the general bottom of the mine. They had supposed that they were at the bottom of the ore. The fold in which it lies runs tolerably uniform the whole length of the mine. At the east end the ore gets thin in the main deposit, and the ore of this new level is separated from that above by 70 feet in thickness of intervening rock. The ore has a width of 50 or 60 feet. They have started to sink a shaft, located at

600 feet east of the cage shaft, this being not far from the lake margin.

Some analyses of the cores of ore obtained by boring east from the east end of the mine, gave—iron, 64.98 per cent, phos. .032 per cent; iron, 63.60 per cent, .032 per cent phos.

The company mined and sold in 1889 as follows:

Hard ore of all grades except Sec. 16 mine	140,453 gross tons
Hematite	127,802 gross tons
Sec. 16 mine	30,529 gross tons
Total product	288,784 gross tons

Year.	Tons.	Year.	Tons.
1858	4,658	1874	104,311
1859	24,668	1875	119,205
1860	33,015	1876	130,570
1861	25,145	1877	127,849
1862	37,704	1878	104,674
1863	78,926	1879	174,747
1864	90,778	1880	204,664
1865	50,301	1881	252,285
1866	68,002	1882	291,504
1867	114,935	1883	300,799
1868	105,745	1884	304,796
1869	125,560	1885	326,040
1870	166,562	1886	368,035
1871	158,074	1887	362,959
1872	145,070	1888	240,225
1873	158,428	1889	288,784
Total			4,618,005

Jos. L. Fay, Treas.; G. W. E. Matteson, Pres't; A. C. Tenney, Sec'y; office, 28 State St., Boston, Mass.; C. H. Hall, Agt.; W. H. Johnson, Supt.; H. B. Sturtevant, Engineer and Chemist; John McEnroe and James Trebilcock, Mining Captains, Ishpeming, Mich.

THE PITTSBURGH AND LAKE ANGELINE MINE,

it is unnecessary to say, is one of the best iron mines in the State. There is no better ore than that found in this mine and consequently it sells at the highest price. It is not an expensive mine to operate. There is, comparatively to some mines, very little dead work to do.

The mine is about 400 feet deep, to the sixth level, to which it was sunk several years ago, but the sixth level was not opened; more than half of the original amount of ore yet remained in the levels above and the product has, for three years, been derived from the upper levels of the soft ore portion of the mine and from the west end hard ore deposit. The levels are fifty feet apart and the openings in the ore were "rooms," eighteen feet wide across the deposit, leaving pillars of ore 18' wide between the rooms. The rooms were timbered well, after the usual manner, in "sets." In addition to the pillars, floors of ore were left, ten or twelve feet thick, forming arches between the pillars. The ore is so soft that, with other causes, the ground has settled and tended to fill the rooms by the coming together of the pillars and floors. By judicious skill Capt. Walters is able to obtain the ore with little loss. He says that he gets 90% of the ore. They allow the surface to settle and fill the space as the ore is removed.

They hoist ore in all four of the shafts, but by far the most from C, which is sunk in the rock in the southwest part of the mine.

There is a good deal of ore in the Lake Angeline mine, but one cannot reckon to a certainty upon its production for many years ahead. The lenses of ore pitch down to the west and the company is mining to the west line where its workings and those of the Lake Superior Co. are close together. But there is far more ore east of the line at the west end, apparently, than there is west of it. At the west end they are stoping in all the levels from the second to the fifth and have five shafts. This part of the mine is now more fully opened and shows to better advantage than ever before. This hard ore deposit is a chimney or lense; its axis inclining down to the west at a high angle.

The width is, approximately, 200 feet and the varying length of the horizontal section extends to the west line. Of course the width is not uniform, neither the length. The maximum length of the mine is about 2,200 feet, and it is opened the entire distance. There is ore all the way except that the successive lenses, lying the one over the other, towards the west, are separated by a few feet of rock. All this has been fully dwelt on in former reports, particularly in those for 1885 and 1886.

No. 1 hard, C shaft ore, averages above 67% in iron and below .010% in phosphorus.

The averages of the shipments to lower lake ports for the whole season 1889, are as follows:

No. 1 hard ore	66.44%	iron,	.011%	phosphorus
Sheffield ore	61.7%	"	.033%	"
Hematite ore	65.68%	"	.035%	"
South Angeline ore	62.19%	"	.120%	"
Columbia ore	57.10%	"	.0186	"

The two last brands of ore represent but a small portion of the total out put.

The following table shows the year's production of the several kinds:

Lake Angeline Hematite	82,099 tons
South Angeline ore	20,020 "
No. 1 hard ore	80,655 "
No. 2 hard ore	43,901 "
Columbia ore	2,395 "
Total	229,070

General Office, 105 Superior street, Cleveland, Ohio. W. J. Pollock, Secretary; A. Kidder, General Agent, Marquette, Mich.; Thomas Walters, Superintendent, Ishpeming; E. F. Bradt, Mining Engineer and Chemist.

Annual Products, Pittsburgh and Lake Angeline Mine.

Year.	Tons.	Year.	Tons.
1864	19,500	1877	10,113
1865	20,151	1878	28,101
1866	24,073	1879	25,420
1867	46,007	1880	14,794
1868	26,651	1881	18,000
1869	39,644	1882	14,518
1870	58,407	1883	27,250
1871	33,645	1884	87,018
1872	35,221	1885	111,051
1873	48,883	1886	181,384
1874	30,460	1887	191,121
1875	30,281	1888	220,000
1876	22,589	1889	229,070
Total			1,543,881

Within fifteen months the company has declared $35.50 dividends per share, making $710,000. The capital stock is 20,000 shares: market value, $175 each; par value, $25 each.

IRON CLIFF COMPANY.

The estate and franchises of this important mining corporation have passed to the control of new owners.

By the purchase of 14,000 shares of the stock at $125 per share, according to the information which I have received, by capitalists in Cleveland, the controlling interest is now held in that city. At the price at which the controlling interest was secured, the total value of the company's property would be about $2,500,000. There are upwards of 50,000 acres of land held in fee simple by the Iron Cliff Co., much of which is well situated with reference to the occurrence of ore. There are several mines already worked in the property, and more may be found. To those conversant in the matter, the sale is a surprise; that is, people think that the price paid is a very low one. The gentlemen making the purchase are well known in Cleveland iron circles—S. L. and W. L. Montrose, J. H. Wade, Selah Chamberlain, George Howe, *et al.*

Generally also there is an expression of satisfaction that the sale has been made. The policy of the Iron Cliff Co. has been considered as an illiberal one in the matter of leasing its lands. I think that it is not until recently that leases for mining would be given at all. They would pay a reward for the discovery of ore, so much per ton on all the ore the company would mine, to the party making the discovery. I have heard it frequently said for many years, by explorers, that they would not look for ore on the Iron Cliff Co's. lands. Any way it is very seldom that discoveries are made on the lands of this company, and they are certainly favorably situated for the occurrence of ore. It is no doubt far better for the country that a company holding a large tract of lands, lying idle, should be willing to lease them on suitable terms to persons or companies who wish to explore them for ore or to mine it. Tieing up lands by an illiberal policy may retard the development of the country. So it is that one hears it said that the change of owners of the Iron Cliff will be, undoubtedly, of advantage to the country and to individuals. What effect the change will have, if any, in the local management of the company or of its mines does not appear. No one desires any change to be made, so far as I have heard, of local officers, they are all well liked. The policy of the company, shaped by the President and Directors is beyond the local agent and his subordinates, and it is this that people seem glad to have changed.

The mines of the company are the Cliff, Barnum, Salisbury, and Foster, all of which except the latter, are within the city of Ishpeming.

THE CLIFF is a valuable hard ore mine, in the northwest part of the city. The ore is a fold of the formation between jasper and quartzite. The shafts are two, A and B, of which the former is the furthest east, but both are to the same depth, 472 feet, and are 835 feet apart. They are vertical cage shafts, and if the hoisting machinery will equal to the wants of the mine these two shafts could send up a great deal of ore. The mine could produce 200,000 tons in 1890, may be it will any way; but the hoisting machinery, both engines and drums are inferior to the necessities of the mine. No doubt the new company will displace it with something better. They can break more ore now than they can hoist. The mine has not been greatly explored. The company does not seem to have been able or to have cared to sell much ore and so the mining work has not been pushed.

The stoping is mainly above the bottom of the mine in the north branch of the fold where it goes off quite flat to the north. The Cliff is an interesting mine, a pleasant one to examine; it is easy to get into and out of and to traverse through. The roll of the formation is so distinct, the walls, in places so smooth, the separation of the ore belt from the quartzite so entirely complete that one thus finds many things of interest to note. In parts of the mine there is too much jasper; it comes in too freely to take the place of the ore. At the east end the formation is broken up, and work in that direction has not proved very satisfactory. Not much has been done west of B shaft, but borings, etc., show that ore exists in that ground in quantity. I have described the mine so fully in past reports that I find nothing new to add.

THE BARNUM has the advantage of being drained by the Lake Superior mine, which it joins, and being supplied with air, for the drills, from the compressor at the Cliff, so that the cost of the ore is thus reduced to a point that the company can afford to mine it. Were it not for these advantages the Barnum would be an abandoned mine.

	Tons.
The product of the Cliff mine in 1889 was	134,616
The product of the Barnum mine in 1889 was	12,834
Total	147,450

These mines have together produced annually as follows:

Year.	Tons.	Year.	Tons.
1868	14,396	1879	34,911
1869	37,703	1880	34,921
1870	44,793	1881	27,281
1871	45,169	1882	41,426
1872	38,881	1883	62,752
1873	44,366	1884	67,262
1874	40,255	1885	47,458
1875	40,914	1886	82,086
1876	37,770	1887	95,586
1877	38,314	1888	88,731
1878	28,680	1889	147,450
Total			1,120,510

Wm. Sedgwick, Superintendent, Ishpeming, Mich.; Tom Barge, Clerk, Ishpeming, Mich.; Alex. Maitland, General Manager, Negaunee, Mich.

THE SALISBURY MINE,

situated south of the diorite bluff, which separates it from Lake Angeline is also owned and operated by the Iron Cliff Co. It is a hematite mine that has always been, I should judge, a profitable one. It is good ore and has been cheaply mined. Formerly the ore was close to the diorite and was mined out, leaving a great open pit. But following the diorite it has gone away off to the south, and the shaft, which starts from the surface at the southeast corner of the open pit, has been constantly

inclined more and more to the south, to reach the ore which at each successive level has dipped away further to the south. A downright shaft was finally started, 600 feet south of the old one, and is now about ready to operate. It is 485 feet deep, 85 feet below the lowest level of the mine. It is 9'x20' outside measurement. A large, substantial shaft house has been erected over it. A new engine house built, supplied with two Corliss engines, 18"x48" each, and two hoisting drums, 10' diameter. Also a new pumping plant, made by Allis & Co., consisting of two 14 inch plunger pumps. So far, they have operated with the old machinery. It will be seen that the Salisbury is now well equipped and can be operated more largely than heretofore. It is not a large deposit of ore so far, but holds its own admirably.

Alex. Maitland, General Manager; Thomas Buzzo, Superintendent and Mining Captain.

The following table shows the yearly product:

Year.	Tons.	Year.	Tons.
1872	545	1883	41,888
1873	11,023	1882	42,019
1874	6,730	1883	17,028
1875	4,571	1884	23,171
1876	20,510	1885	29,503
1877	37,868	1886	51,231
1878	52,155	1887	49,329
1879	39,770	1888	74,896
1880	22,387	1889	72,900
Total			600,349

THE FOSTER

is an old hematite mine, owned and operated by the Iron Cliff Co. It is in sections 22, 23, 47, 27. It produced in 1889, 13,238 tons, making a total to date of 188,554 tons.

THE BRAASTED

is the new appellation given to two old mines, the Winthrop and the Mitchell. These mines have quite recently passed to the ownership of Mark Hanna, of Cleveland, Ohio, and of Mr. Fred Braasted, of Ishpeming. The latter gentleman has controlled the mines for the past year and a half and the effect of his proprietorship became quickly apparent to the advantage of the mines.

Capt. W. J. Officer was placed in charge as superintendent and he rapidly made needed changes that greatly improved matters. He completed the sinking of the downright shaft that was started eight years ago and systematically opened up the ore deposit to the southwest, where it proved to be large and of excellent quality. He moved the engine house over on the foot wall side, did away with the unwieldy and inadequate pumping plant by substituting a large Worthington in its stead. This easily raises all the water in the mine. He has turned the stone pumping engine building into a compressor house, added steam power, put up a machine shop, and in all ways the mine has been put on a thorough going basis.

The Winthrop is an old mine and a good one. It should have always been a profitable one, because there was always the ore in sight and it was of a quality to be salable, when properly got out. But owing to the unfortunate method of working followed by the late owners, it has of late years been unduly expensive. The mine was worked as an open pit, it had become very deep, the surface caved in onto the ore and this dirt mixed with ore to the amount of many thousands of tons was hoisted and dumped on the surface south of the mine. All this was costly work and it also caused great delay just in the opening of the season. Then the pump was a wonder. The ropes reached from the pumping house the length of both mines—half a mile—and some part of the togglement was constantly giving out. The situation of the mines is admirable for catching all the water on the surface in time of heavy rain or melting snow. Hereafter this source of trouble is not likely to be serious. Capt. Officer has made a long launder, which conducts the water when once out of the mine far away from it. A second Worthington pump has recently been procured to be placed in a shaft in the Mitchell end of the mine. The new pump has a capacity, so stated, of 800 gallons of water raised 800 feet per minute, with a reserve power of 50 per cent addition to be applied in any case of emergency. These two pumps Will very easily raise all the water from both mines. The water is no longer the *bête noire* as in former times.

The weight of the Worthington for the Mitchell is 50,522 lbs. It is the Lehigh pattern, having two 19¼-inch high-pressure steam cylinders, two 33⅜-inch low pressure, four 10-inch plungers, all 24-inch stroke; has a No. 7 independent condenser, two steam cylinders 7½ inch diameter, two water cylinders 10¼-inch diameter, 10-inch stroke. The engine is supplied with Corliss dash relief valves, the Corliss valve motion, by the use of which attachment it is said that there is but one per cent lost motion. Both high and low-pressure cylinders are steam jacketed.

The product, 155,342 tons mined in 1889, was all from the Winthrop mine, the work in the Mitchell having only recently begun. There are four shafts, the extreme ones A and D, only, are now used.

The mine, underground, was in bad shape but this is being rapidly rectified and as at the Winthrop end it will be systematically worked. The surface arrangements have been changed to great advantage. It looks quite different and much improved.

The ore in both mines, is very soft, averages about 62% in iron and is slightly non-Bessemer.

Table Showing Combined Annual Product.

Year.	Tons.	Year.	Tons.
1870	2,469	1880	57,997
1871	7,314	1881	64,864
1872	14,436	1882	56,833
1873	39,702	1883	50,143
1874	47,950	1884	82,999
1875	8,642	1885	71,620
1876	32,852	1886	86,518
1877	16,446	1887	98,078
1878	27,999	1888	88,688
1879	58,300	1889	155,342
Total			1,017,499

The Winthrop is the S. W. ¼, Sec. 21; the Mitchell, the N. W. ¼, S. E. ¼, Sec. 21, and the mine is close to the north line of the property, each way from the center line of the section.

Fred Braasted, General Manager; W. J. Officer, Superintendent, Ishpeming, Mich.

THE FITCH IRON CO.

is a corporation lately organized to operate a newly discovered mine, known as the Merrywether exploration, situated about two and one-half miles west of the Braasted, and one mile from the Saginaw mine, in the S. W. ¼, N. E. ¼, Sec. 24, T. 47, R. 28; belonging in fee to the Iron Cliff Co., but held on a lease by the Fitch Iron Co., the royalty being 40 cents per ton for the ore. The company was organized in January last with capital stock of $1,100,000, divided into 40,000 shares.

Exploration was begun in April last, by Mr. C. Merrywether, John Jochim and others, of Ishpeming, and was so far successful that a deposit of the best hard specular ore has been found, which appears to be in sufficient quantity to insure the having of a working mine. Preparations are making to be in first-class condition for operating. Buildings are going up for holding the necessary machinery and for other purposes, so that the company will be early in the field in shipping ore, the ensuing season.

The location of the shaft is 300 feet from the east line of the property, and 500 feet from the north line. The ground is dry so no pump has been required in the work of exploration. The formation dips north and the strike is east and west.

This is a range in which are many abandoned mines. The New England, Lowthian, Saginaw, Sec. 19 mine, Goodrich and Albion. It is a strong ore formation giving a foot wall of banded jasper and hanging of quartzite. In places, as the Sec, 19 mine, the hanging is a quartzite conglomerate. The ore is remarkably good working ore in the furnace, as it contains a percentage of silicate of alumina, a very necessary ingredient of furnace slag.

At the Fitch the ore is slate and black granular. The shaft, 8'x12' inside, is 85 feet deep, first passing through 16 feet of drift. At 55 feet in depth a crosscut found the ore 26 feet wide. The slate ore is along the foot. They had drifted along the foot about 30 feet in ore. Test pits on the surface, further east, discover the continuance of the ore. Analyses of samples of the ore result as follows: Slate ore, iron 68.96%, phos. .012%; iron 66.42%, phos. .063%; granular ore, iron 65.80%, phos. .100%.

The track from the Goodrich mine, which is but half a mile distant, will be extended to the Fitch. The chief stockholders are Pickands, Mather & Co., Cleveland; W. F. Fitch, Marquette; Louis Stegmiller, Escanaba; A. B. Eldrige, Ishpeming. Sixty men are employed.

Mr. J. F. Armstrong, late of the Cleveland Iron Mining Co. is Superintendent.

THE GOODRICH MINE

is located in the N. W. ¼, N. W. ¼, Sec. 19, and is the next east of the Fitch. It was operated from 1873 to 1882 by Capt. Goodrich of the Goodrich line of steamers. The total production was 51,479 tons of ore.

The formation is very irregular, and I suppose that the financial result was not satisfactory, still, I think, it is a good mine to explore; the indications are good. I described the mine in a former report, 1881 I think.

THE SAGINAW MINE

is again undergoing examination. Mr. Lee Peck has pumped out the water and is exploring the mine. The Saginaw was opened in 1871, by Messrs. Sam. Mitchell, Lonstorf and Maas, of Negaunee, who sold to the Cleveland Boiling Mill Co., for $300,000, in the fall of 1872, and soon after the Saginaw Mining Co. was organized to operate the mine. The mine has been fully described in earlier reports.

It was closed down and abandoned in 1884, up to which time it had produced 439,328 tons of ore. It is proper for those to note who are re-examining this mine, that Capt. Mitchell explored it, as he thought, thoroughly, with a diamond drill, and that the result of all that he did was, such as to cause him to abandon the property.

The mine is in the N. W. ¼, N. E. ¼, Sec. 19, 47, 27.

THE ALBION MINE

is situated between the Saginaw and the Goodrich mines. It was opened in 1871 by the St. Clair Bros., who leased the land of Messrs. Ed. Breitung and S. L. Smith. 4,592 tons of ore were mined and shipped.

THE SECTION NINETEEN MINE

was owned and operated by the Lake Superior Iron Company, having been first opened in 1871 and was worked ten years. There were two shafts: No. 1, near the boundary line of the Saginaw, was 100 feet deep, dipping to the north 45°. No. 2 shaft, 480 feet east of No. 1, was 200 feet deep. The extent of underground opening when I was last in the mine, ten years ago, 450 feet east and west. West of the shaft the ore averaged ten feet wide; and east, 16 feet. The average dip was about 50°—jasper foot and quartzite conglomerate hanging. The ore was chiefly granular, rich in iron, with a percentage of alumina that was disseminated through it as a soft, whitish, greasy feeling mineral. The mine attained a depth of 300 feet, when the ore gave out and the mine was abandoned. Capt. P. T. Tracy, superintendent of the work.

I have thus briefly described these old mines for the reason that the discovery at the Fitch has awakened

renewed interest in the range and it is probable that considerable exploring work will be done.

THE CAMBRIA

and Lillie mines are contiguous, and have the same owners and have had the same general manager. So that it would seem to be a good plan to consolidate them and operate them under one corporation.

The Cambria was started in 1876, the land being leased from the Teal Lake Iron Co. It lies west of Teal lake and the workings are now close to the margin, probably the ore extends under the lake.

The Cambria has been a good mine, and still continues to be. It has not been a large mine but a profitable one to its owners. Until within a few years the mine was further west and south, the workings joined those of the Lillie and extended by a series of pockets directly east. This deposit of ore has been exhausted and the mine is now in a belt of ore further north, where the ore deposit holds in magnitude and in quality now, as well as it has at any time since it was opened. The ore body has a length of 300 ft. and a width of 40 ft. In fact the company expects to got out 100,000 tons in 1890. There are now 17,000 tons in stock.

They are down to the fifth level, 350 ft. deep. The location is a mile northwest of Negaunee.

Analysis of the average of the ore gives 61% in iron, .032% phos.

Alex. Maitland, General Manager; Charles Koch, Superintendent.

Table Showing Yearly Product of the Cambria Mine.

Year.	Tons.	Year.	Tons.
1876	6,324	1883	47,508
1877	10,082	1884	59,740
1878	3,754	1885	50,706
1879	6,860	1886	59,406
1880	7,232	1887	41,138
1881	18,887	1888	59,009
1882	47,345	1889	72,280
Total			491,075

THE LILLIE MINE

formerly the Bessemer, was also opened in 1876. The land consists of 70 acres located in S. E. ¼ of Sec. 35, T. 48, R. 27, being fractional on Teal lake. The land is also owned by the Teal Lake Iron Co., but held on a lease given to C. M. Wheeler and others who first worked the mine and assigned to Win. H. Barnum and others, who organized the Lillie Mining Co.

The ore body that was originally mined was worked down to a considerable depth, leaving a large open pit. The ore now is south of the open pit under the hanging wall. The strike of this range is about east and west, dipping south at about 45°.

The body of ore has lateral dimension of about 275 feet each way. The shaft is in the ore and it requires too much ore to be left in pillars to support it so that a new shaft will be started in the foot wall, they purpose to rise and sink in the shaft.

The ore averages 61% iron and .070% phos.

Statement of Annual Product.

Year.	Tons.	Year.	Tons.
1875	144	1883	2,472
1876	6,801	1884	2,083
1877	10,127	1885	708
1878	3,586	1886	3,957
1879	21,681	1887	28,041
1880	18,347	1888	32,602
1881	16,718	1889	33,916
1882	28,221		
Total			212,156

A. Maitland, Gren'l Agent; Charles Koch, Supt.

Passing the Cleveland Hematite, which has been previously mentioned the next mine west is

THE DETROIT

of which there is not much to be said at present. The company is exploring for more ore, also sinking the shaft that was started a few years ago south of the mine, some ore was found at this point by boring with a diamond drill. So far as I know, no new body of ore has been found on the property the past year.

I have described the mine heretofore, and no important change has occurred in the past year. The product in 1889, was 10,113½ tons, making a total to date of 132,070 tons.

Jas. McMiller, President; W. K. Anderson, Sec'y and Treas., Detroit, Mich.

THE HARTFORD MINE

joins the Cambria on the east, and while work continues on this property not much progress is made towards making it into an ore producer. It is in the Teal lake range, affords good indications of ore, and there is more than half a mile of the formation. I have described it with sufficient fullness heretofore, especially in reports 1886-7.

Product 1889, 566 tons.

Ben. Neely, Proprietor, Negaunee, Mich.

THE LAKESIDE IRON CO.

is an organization made at Negaunee to explore east of the Hartford, in the northwest part of the city of Negaunee.

THE ELBA MINING CO,

is exploring in the City of Negaunee, north of the office of Iron Cliff Co. They have, March 1, a shaft down 60 feet deep in an ore formation. John Rowe, Superintends the work, Mr. A. Maitland and others are footing the bill.

THE NEGAUNEE MINE,

a mile east of the city, is a flat deposit of ore, dipping northwest at an angle of about 24° with the horizon; the upper edge of the ore is about 260 feet below the surface. The shaft is 438 feet from the surface down to foot wall of ore. The ore deposit has a maximum width, east and west, of 350 feet; it narrows somewhat suddenly at about half way up, so that it will only average 150 feet wide the rest of the way up. The length of the foot wall is about 500 feet. The thickness of the ore, perpendicular from foot to hanging, is from 16 feet to 35 feet, banded ore, having the exact resemblance to banded schist. I described the method of working the deposit in my last report. There is no change; they are extracting the pillars above the shaft and also now mining below the level of the point where the shaft intersected the ore. The same method is pursued as heretofore; the shaft has been sunk deeper and the ore is run to it through a crosscut in the foot. No timbers are used. In mining out the pillars they work from the upper end towards the shaft and thus remove all the ore. It is mostly soft hematite, 60 per cent and upwards in iron and all within the Bessemer limit. The product was:

1887	5,859 tons
1888	45,304 tons
1889	78,318 tons
Total	128,981 tons

Samuel Mitchell, Manager, etc.; Albert Newcome, Superintendent, Negaunee, Mich.

Negaunee Mining Co. is the corporate name.

THE BARASSA.

East from the Negaunee mine and joining it, two different explorations are in progress, the one north of tae other. The N. W. ¼, N. E. ¼, Sec. 5, 47, 26, is held by John F. Mack, of Marquette, who is working to find ore with the churn drill, south of this in the S. W. ¼, N. E. ¼.

THE U. S. GRANT IRON CO.

is also working just east of the Negaunee mine. They have a stand pipe to the ledge and have started a diamond drill. Their prospects of finding ore are excellent, and if found it is likely to be good Bessemer ore. Mr. Anthony Broad has charge of the work.

THE BUFFALO, SOUTH BUFFALO, QUEEN, AND PRINCE OF WALES MINES

are all in Sec. 5, 47, 26. and all together hold 145 acres of land. All the mines comer at the ⅛ post in the north and south center line, to the S. ½ of Sec. 5. The Buffalo being the N. ½, and the South Buffalo the south forty of the W. ½ of the S. E. ¼, Sec. 5. The Prince of Wales the north part and the Queen the south part of the E. ½ of the S. W. ¼, Sec. 5.

The great deposit of ore that has given to these properties such extraordinary prominence and value, is in the low ground right about this common corner. They all share in it. It was plain to see that four mines operated by four separate companies, all working about a common point, were liable to get matters a good deal mixed. It was impossible that they could work to advantage, or even properly. A wide deposit of very soft ore cannot be safely and economically worked in the manner that this was undertaken by these companies. And it was not surprising that accidents already began to occur, and much greater danger and difficulty were foreshadowed.

Fortunately these mines are now all under one management; controlled and operated by a single proprietor. The stock had not been greatly scattered; it was gathered up and transferred to a single purchaser, Mr. Ferdinand Schlesinger, who now owns the four mines.

The transfer was made in the fall, and already a great change is manifest. It is one of the most active mining locations in the country, new shafts are sinking, shaft houses building, engine houses going up, and powerful machinery being placed in them, extensive ware house, machine shop, carpenter shop, blacksmith shop, boiler house, office, dwellings, etc., are building, and with all, the underground work, the mining and hoisting of ore goes on rapidly; 1,000 tons per day being the average production. There is a good deal to do to get things into shape, the ore is in a basin, a fold of the formation, which forms a valley running east and west in which is the ore. The ore has an extreme width of 400 feet, and a length of 1,000 feet and upwards. Of course it is not continuous but there is ore a long way, nearly the half mile of the length of the property. It generally has a good width, and near the center, at the north and south ¼ line the ore is extraordinarily wide. There is certainly ore enough in sight in all the mines to insure a large out put.

They have adopted a sensible plan to work, having located four shafts in the south side in the foot wall, these will be 300 feet deep, and double skip shafts from which they will crosscut to the ore and through it, and take it all out, letting the surface settle as the ore is removed. The new buildings and machinery are first class. The engine houses are covered with corrugated iron and no pains or expense is spared to make the equipment equal to the best.

The Buffalo, the oldest of this group of mines, seemed, a year or, two ago, to be pretty well worked out. It was first opened on its higher ground near the east line, but working west the Buffalo also has its share of ore near the common center.

There is a run of ore a little west and east of the main deposit, that is 200 feet long and 50 to 75 feet wide. The ore in these mines is all well up in iron, but more variable in phosphorus. It contains about 60% iron, 60 to 65%, and from .046% to .090% phosphorus.

Although worked under one management and as a single mine, each mine will be credited with its share of the product, etc. There will still continue four corporations under one head.

Ferdinand Schlesinger, President; Thomas C. Cole, Supt., Negaunee, Mich.; J. B. Jeffery, Mining Capt., Negaunee, Mich.

These mines produced in the years indicated as follows:

Mines.	1886.	1887.	1888.	1889.
Buffalo	10,860	24,086	30,801	60,359
South Buffalo		4,914	24,707	64,122
Queen				
Prince of Wales				

The change of owners was made at three of the mines on Nov. 1, the South Buffalo on Dec. 1. The mines have the tracks of both C. & N. W. and D., S. S. & A. R. R.

THE LUCKY STAR

and other locations lying west of the Queen, etc., mines, are being further explored. At the Lucky Star the diamond drill is employed.

The old south side Negaunee hematites, the Grand Central, Boiling Mill, Manganese Mines, etc., are no longer worked. The active ones are:

THE LUCY,

the Milwaukee, the Grand Rapids, the South Jackson and the Pendill, or, as it is now called, the East Jackson, mines.

The Lucy was formerly known as the McComber, and has always been a pretty good hematite mine, yielding manganiferous ore. It was first opened hi 1870 by Wm. C. McGomber, on lands owned by James l'. Pendill. The mine is in the N. W. ¼, N. W. ¼ of Sec 7, 47, 26. There are five large open pits, made years ago, as the milling is all under the surface. As at the Jackson mine, the formation is very irregular and the strata very much folded. The ore has a banded, jasper appearing structure, precisely similar in appearance to the jasper, which contains it.

The underlying rock is diorite and the jasper and ore are contained in the folds, basins and hollows of the diorite. Here, at the Lucy, there is, dipping south, a belt of banded jasper and manganese ore. It makes a broad synclinal, coming up at the south in the sharp, irregular folds, of which the pockets of ore are found.

The ore in all the mines in this entire range, in which I include the Negaunee, etc., mines in section five, further east, has every appearance of having been derived from the jasper, which must have been highly silicious and greatly impregnated with felsite. Subsequent chemical forces of nature have removed the silica, while the alkaline bases, iron, manganese, etc., remain. The presence of feldspar as an original element in the rocks, is apparent, from the white, greasy feeling kaolinite that is found, more or less, in all the ore.

At the Lucy and south Jackson, which are antiguous, the ore all contains a percentage of manganese and some of it is highly manganiferous. Analyses of the ore vary greatly. One made by Mr. C. E. Wright, some years ago, of ore from No. 1 pit at the Lucy, gave:

Metallic iron	40.90 %
Metallic manganese	10.90 %
Phosphorous	.070 %
Sulphur	.034 %
Silica	.021 %
Alumnia	2.030 %
	2.200 %

I noticed, when I was at the mine a few days ago, that they are making a separate stock pile of ore high in manganese. It yields 48 per cent and upwards in iron and 11.06 per cent manganese, .070 per cent phosphorus, silica, 7.51 per cent. Of this they will get 5,000 tons. They are making three grades of the ore. About half of the product yields 54 per cent iron, 5 per cent manganese, .04 per cent phosphorus.

The mine is looking extremely well, better than for years. At No. 5, the new shaft at the southeast, they have drifted in the ore 300 feet and have crossed it a width of 100 feet. The shaft is 300 feet deep. No. 3 is 270 feet perpendicular and the pit is showing a greater length of ore than it did a year ago. The product for 1890 will be about 60,000 tons.

Mr. A. Maitland, of Negaunee, General Manager; James Rowe, Mining Captain.

Year.	Tons.	Year.	Tons.
1870	4,856	1880	31,028
1871	15,442	1881	28,230
1872	25,030	1882	40,200
1873	28,332	1883	34,676
1874	2,042	1884	
1875	10,257	1885	
1876	17,282	1886	
1877	19,091	1887	
1878	30,180	1888	11,584
1879	28,961	1889	32,276
			32,862
Total			374,409

THE MILWAUKEE MINE

is but a short distance southeast from the Lucy, over the high greenstone ridge that intervenes. There is nothing new at the Milwaukee. The entire work is confined to the No. 9 pit, heretofore described in former Reports. It is probable that the ensuing year, 1890, will exhaust the mine.

They are working along close to the Grand Rapids mine where all the ore exists that is known of on the property. Carmichael Bros, continue to operate the mine for the company.

A. Kidder, Agent, Marquette; W. E. Stone, Treasurer, Boston, Mass.

Product, 1889, was 52,728 tons, making an aggregate of 349,608 tons.

THE GRAND RAPIDS MINE

lies just west of the Milwaukee. The old workings are not promising; but further west the result of recent diamond drill borings indicate something more favorable for the future. It is contemplated to sink a shaft to reach the ore thus found. The Superintendent, Mr. Wm. B. Davis, estimates that the mine will produce 25,000 tons of ore in 1890, even if the new shaft is not sunk. There are the pillars of ore about No. 1 shaft and other pillars and small stopes in the mine from which to derive the estimated product. However, the work of another year may change the outlook of matters.

The officers are L. H. Withey, President, Grand Rapids; J. C. Holt, Secretary and Treasurer, Grand Rapids; W. B. Davis, Superintendent.

The product in 1889 was 20,059 tons, making a total of 39,203 tons.

THE EAST JACKSON MINE

is an enterprise in which Negaunee and Houghton parties are interested-It comprises the estate of the old Pendill mine, south of and including the Union Depot grounds at Negaunee. The exploratory work has been in progress during the past year under the supervision of Capt. Jas. F. Foley.

Jas. M. Close, President; Win. B. Northup, Secretary and Treasurer, Hancock, Mich.

The first work was to pump out the water in the old mine and explore it. No satisfactory results were derived from this operation and so they are now sinking a shaft over in the hollow, south of the mine and just west of the road leading to the Lucy. Ore was struck in this shaft at about 100 feet below the surface, and the shaft is now sinking in ore. A crosscut south, 14 feet-long, is all in ore, so that further developments seem likely to give a good body of ore. Up to this time they had sunk and drifted in jasper, chloritic schist, paint rock, etc. The jasper holds quite a percentage of ore mixed with it. The situation is favorable for ore and it is more than probable that at least enough of it will be found to compensate for the effort that is made to ascertain it. It is said that the ore found contains 13% manganese.

One of the new hematite mines that is turning out well is the

EAST NEW YORK,

which is situated just east of the old New York mine, and close to the south line of the Cleveland Iron Cos. land. The mine is in the S. W. corner of what has long been known as the "old brass wire" property. The company holds the whole quarter section, being the S. W. ¼, Sec. 3, 47, 27. The ore is under a jasper knob that rises prominently above the surrounding level ground. The dip of the basin holding the ore is both south and north.

The average of the analysis of the ore shipped in 1889, as shown to me by Mr. Johnson, President of the company, is:

Sample.	Per cent.	Sample.	Per cent.
Metallic iron	60.10	Lime	.123
Silica	11.64	Alumina	1.11
Phosphorus	.066	Magnesia	.331
Sulphur	.029	Manganese	.41

Thus the ore is within the Bessemer limit. No. 2 shaft is at the southeast corner of the jasper knob; in the 150 foot level they have drifted north and also gone west 500 feet; much of all the ground represented in the opening is ore. Intervening in the ore is an altered diorite that is soft and white, like the dike material in the Gogebic mines. The company has been feeling its way, not quite understanding the situation—no one could—and not knowing how much ore would be found, and of how good quality it would prove to be. The mine is better than most people, long familiar with this ground, and knowing how many futile efforts have been made in the past to find ore here in paying quantity, could believe. Few had much faith in a favorable outcome of any mining enterprise undertaken here.

No. 1 shaft is away south of the ore, with which it is connected by a drift. The shaft was sunk as an exploring pit and is too small to avail properly as a working shaft. They are now engaged in enlarging it into a double skip shaft, timbering it as it should be and sinking it, also. It will be sunk to 200 feet in depth, when they will drift north to the ore and east in the ore under No. 2, when they will rise up and thus bring No. 2 to the 200 foot level. The company works about 100 men; has now, March 1, 10,000 tons of ore in stock.

W. H. Johnson, President; C. R. Ely, Secretary and Treasurer; Geo. Bodana, Mining Captain; all of Ishpeming, Mich.

THE NEW YORK IRON MINE

lies close to the Cleveland mine; just north of the line which separates them. It was once a valuable mine, having produced annually a great product of hard ore at a large profit. The mine is in the south part of the S. W. ¼, S. E. ¼, Sec. 3, T. 47, 27, in the city of Ishpeming. It begins at the southeast corner of the section and runs west along the line to the limit of the property. The company has not worked as far west as this but the Cleveland company has and is deeper thus it is shown that the New York has some ore along the line to greater length and depth than it has worked.

The New York mine shut down in 1882, some ore has been shipped since then but it was all mined previously. The ore had also become of poorer quality than formerly, higher in silica and sulphur. In fact it was not readily salable and besides the stopes were small. The New York mine is in the north upturn of the ore basin which contains the Cleveland mine.

The company is pumping out the water now, March 1, and purposes to renew mining work.

August Beering still remains as Supt. of the mine. The entire shipment 1889, amounted to 14,325 tons of ore and the total production of the mine amounts to 1,065,474 tons. Fifteen men are now employed at the mine. It is not probable that the number will be greatly increased.

THE NONPARIEL MINE

in the S ½, N. W. ¼, Sec. 5, 47, 27, is offered to be let on lease by Mr. John E. Wood who still holds the property. The mine is quite fully described in report for 1882, and it remains now about as then. The mine furnished 51,953 tons of ore. John E. Wood, Agt.

THE DEXTER CONSOLIDATED MINING CO.

is still exploring at its mines in the E. ½, N. E. ¼ and W. ½, N. W. ¼ of Sec. 3, T. 47, R. 28. There is nothing in particular to record that I know of beyond the fact that the company produced 4,269 tons of ore in 1889. The company has expended considerable money and, as yet has not succeeded in finding enough ore to constitute a good mine. The formation is favorable enough.

Edward A. Gott, Treas., 70 Griswold St., Detroit, Mich.

THE AMERICAN IRON CO.,

which owns the Sterling mine and also leases the Boston, that joins it, is working to a good purpose. In 1881 the old Sterling company bored a number of diamond drill holes under the swamp west of the mine, which passed through 5½ to 16 feet in thickness of ore. The borings seemed to show a length of ore of about 1,000 feet west of the line. As it was so wet it was nearly impossible to sink a shaft in this low ground, so that the new company has been gradually working west to reach these drill holes.

The shaft near the line is 350 feet deep and they are west 500 feet. The product in 1889, was 20,032 tons, and the aggregate, with that of previous years, is 48,844 tons. The formation is a typical one, ore lying on jasper and covered with quartzite, the walls standing at an angle of 82° to south. The foot wall is banded jasper and the hanging wall grey compact quartzite.

The description of the land is W. ½, S. W. ¼, Sec. 32, T. 48, R. 28, and the Boston joins it on the east.

Wm. H. Johnson, President; C. R. Ely, Sec'y and Treas., Ishpeming, Mich.

They expect to produce 25,000 tons in 1890, possibly 50,000. Recent analyses of the stock pile of the ore give, metallic iron 65.84%, phos .048%, metallic iron 64.36%, phos .050%.

The Mat. Gibson, Pascoe, Phoenix mines have all been wholly idle during the past year. A very small amount of exploring has been done at the Phoenix with good result, so far as it went. I examined these mines in September last. There does not seem to be a large amount of ore that one can certainly count on.

THE PASCOE

however is likely to be operated the coming year. A few men are now engaged at the mine making preparation for future mining. There is a vein of ore plain to be seen; 10 feet or more in width, which if the quality could be improved would be valuable.

These mines are situated a mile north of Champion. The land belongs to the Atlantic Iron Co.

D. H, Merritt, Sec'y, etc., Duluth, Minn.

THE NORTH CHAMPION MINE

joins the Pascoe on the east. The description of the land is the E ½, N. E. ¼, Sec. 29, T. 48, R. 29.

The location is a pleasant one. The mine is provided with suitable machinery and buildings; but, so far, the mine is not a large one. It supplies a moderate product of very good ore. It is high phosphorus ore, but contains other elements that are an advantage and make it an easy working furnace ore. The best runs about 56 per cent to 59 per cent in iron and .18 per cent to .20 per cent phosphorus.

The mine is all underground and is worked in a very quiet way. It is about a mile and a half distant, south of the Champion Station. The dip is slightly to the south. The foot wall is jasper, and the hanging, slate.

Product, 1887, 883 tons; 1888, 5,685 tons; 1889, 7,757 tons; total, 14,325 tons.

Office, 37 West Larned St., Detroit.

S. Brownell, Secretary and General Manager.

THE MICHIGAMME MINE.

is at the northwest corner of Michigamme Lake. It is a hard magnetic ore mine in the northerly outcrop of the jasper and quartzite fold, that dips south, forming a synclinal, beneath the lake. North of the jasper that underlies the ore, is the diorite; and, again north, the granite.

This jasper foot wall is very rich, a banded structure of ore and rock, that can be made to separate readily; that is, if broken up, the rock and ore tend to separate into independent fragments.

There are, also, sometimes, horses, etc., of jasper occurring in the ore that destroy the stope. This formation, as it is found at the Michigamme, extends along the range, west, two or three miles at least. The jasper belt is a wide one; they have bored into it, at the Michigamme mine, more than 100 feet, without getting through it.

Another troublesome feature, is the occurrence of particles of hornblendic schist in the ore. The ore

sometimes contains this and it is a great annoyance, as it is an ingredient that furnace men object to; the hornblend being so nearly non-fusible.

A new feature in the working of the Michigamme mine is the introduction, within the last year, of a magnetic machine to separate the ore and rock in the mixed ore. The machine used is the Venstrom Magnetic Ore Separator. Mr. Fowle, the Superintendent, has taken great interest in this matter and has given much time and attention to it, and is making it a success. The use of the separator will greatly magnify the output of the Michigamme mine, augment its value and importance. There is an endless quantity of this jasper foot wall that is rich in iron ore that can be cheaply mined, and after treatment through the magnetic machine gives a first-class product.

It will be remembered that the ore at the Michigamme is all magnetic, and that the jasper is banded, so that when crushed, the flakes of rock and ore fall apart, so that when run over the cylindrical dynamo, the rock drops away and the ore adheres and is discharged in the proper chute. There is a great deal of this mixed material that is unavoidably broken in the mine in the process of mining, that formerly has gone to waste, but now is treated and helps swell the product of good ore. Besides, there are thousands of tons of waste rock and lean ore that have accumulated during the past years, that may now be utilized. Mr. Fowle has experimented with a small dynamo machine, since June last, and feels sure now of having mastered the situation; certainly he has done a good deal and the experience acquired is an important one for the company and for the country also. The preparations now making will enable them to work quite largely, that is, to treat several hundred tons per day, and do it, as their work thus far assuredly indicates, at a low cost, not above 50 cents per ton, all told. The fine stuff is run directly to the separator from the mine, or if too wet, it is dried by being passed over a fire, propelled slowly by an endless screw. The large stuff goes through a Blake crusher, of which there are, or will be, seven, whence it is taken up by elevators to the screens, which discharge the stuff, of different sizes, into respective pockets from which it is drawn out on the dynamo that makes the final separation. The rock, not adhering, falls off when the vertical tangent is reached, while the ore adheres and is carried around to the lowest point of the cylinder and discharged into a chute. The fine, powdered stuff is not cast directly upon the cylinder, since the rock, being so light, adheres somewhat with the ore and will not separate well; to secure the more perfect separation, this powdered stuff is carried on a belt that turns down over a small roller close to the face of the dynamo, the power of attraction takes the particles of ore from the carrier to the dynamo, while the particles of rock drop down when the carrier turns to go back. This arrangement is a complete success. They have ordered three large magnetic machines, which will have a capacity of 600 tons and upwards per day. The small machine which they now have has treated 13,000 tons.

From Mr. Fowle's statements, it seems that the work is done at a much less cost than one would imagine. For instance, he gives the cost of treating the rock taken from the old stock pile, at 6 cents per ton, making it, from material that is valueless, into 61% ore. There is a stock pile of 16,000 tons of Spersberg, hornblendic ore, that is unsalable, they have offered it at $1.00 per ton, for a mere trifle they are making it into good merchantable ore.

It is worth noting, that in this treatment, which raises the percentage of iron, the percentage of phosphorus is diminished. The phosphorus is contained largely in the rock. I have seen many analyses of the material, of different kinds, made before and after treatment, and they are of a very encouraging character. It seems nearly certain to open a new future for the Michigamme mine. Aside from what has been given, the mine proper has improved, that is it yields more clean ore than it has at any time for several years past.

In my last Report I described the ore going west from No. 5 shaft. They have continued stoping this body of ore west, until they are now 200 feet west of No. 6 shaft which they are sinking to connect with the mine under it. No. 6 is an old abandoned shaft, which was sunk in 1874. It is now 350 feet deep and will have to be sunk nearly as much more, and they are west of No. 5 probably, 700 feet. The ore is 14 to 16 feet wide, perfectly clean, no rock in it. There is a fine quartzite hanging and a complete separation between it and the ore. The ore has to be "trammed" 700 feet to the shaft. The No. 6 shaft should have been sunk long ago to nave avoided much inconvenience to which they have been subjected in the underground work, and from motives of economy. Mr. Fowle has been anxious to do it, but was not allowed to. The control of the company has now passed into other hands. The chief owners now are the Messrs. Mather & Co., of Cleveland; the same parties who control the affairs of the Cleveland Iron Mining Co. The order of the new regime is to push things and to raise the product of the Michigamme mine to at least 100,000 tons in 1890.

For more particular description of the mine reference is made to former Reports.

The annual products have been as follows:

Year.	Tons.	Year.	Tons.
1872	141	1881	57,315
1873	28,100	1882	43,712
1874	45,218	1883	42,388
1875	44,756	1884	28,797
1876	20,054	1885	12,072
1877	28,238	1886	48,805
1878	56,822	1887	51,975
1879	56,035	1888	36,448
1880	52,944	1889	26,000
Total			661,310

The estate covers 1,400 acres of land owned by the company in fee.

Wm. G. Mather, Sec'y and Treas., Cleveland, Ohio; John C. Fowle, Supt., Michigamme.

THE IMPERIAL IRON CO.

is the name of the corporation to be organized to own and operate the Wetmore mine, west of Lake Michigamme, that has been recently purchased—February.

The company owns the lease of the mining right of the N. W. ¼ of Sec. 25, T. 48, R. 31. A lengthy description of this property is given in my report for the year 1886. It has been pretty well explored and the ore shown up, but has not been greatly worked. Unquestionably, there is a large amount of ore in the succession of lenses that, apparently, lap one another as they extend east and west across the property, and it can be cheaply mined; its comparatively low percentage of iron and high percentage of phosphorus have rendered it unmerchantable, I presume, since but a small quantity has been produced annually.

It averages 58 per cent to 59 per cent iron, .14 per cent to .20 per cent phosphorus and 5 to 6 per cent silica. Probably the new owners, who have what Mr. Wetmore could not easily command, abundant funds, will mine a good deal of ore, and so do it at a small cost, and thus be able to sell it cheaply and, in that way dispose of a good deal.

The ore is said to smelt easily and to make a good flowing iron. Shipments of ore in 1889 amounted to 18,612 tons, making the total production 49,833 tons.

W. E. Stone, Secretary and Treasurer, 37 Franklin. St., Boston, Mass.; Richard A. Parker, General Manager, Marquette, Mich.

THE WEBSTER MINE

joins the Imperial on the west. No work has been done at this mine in 1889 except to ship a small amount of ore that was in stock, mined two years before. Unfortunately for Messrs. Watson & Palmer, the proprietors of the mine, they had this ore mined on contract, by a party who was not a miner, and whose work was not properly superintended. The result was that the ore, so called, which this contractor mined and received pay for, contains too much rock to be merchantable. The stock pile is thus nearly valueless. The mine, however, has a good vein of ore, plain to be seen, and can be made to produce clean ore of, I presume, as good quality as the other mines in this range. There are several good dwelling houses, engine house, suitable machinery, etc. The description is the N. ½, N. E. ¼, Sec 26, 48, 31. Amount of shipment, 1889, 448 tons, making a total of 15,116 tons of ore. Corporate title is the Webster Iron Co.

E. B. Palmer, Treasurer, Marquette, Mich.

THE OHIO AND NORWOOD,

and Section 23 mines that were sold under option and lease by Mr. J C. Fowle and explored by him, are now owned by Mr. Ferdinand Schlesinger who is opening them extensively. Under the experienced supervision of Capt. Elisha Morcom. The location is rapidly taking on the appearance of a mine of large magnitude. The opening work of the mine and the construction on the surface go on simultaneously and both are of the character that signifies large operations.

There is, seemingly, a world of ore in these mines, such as it is, which make a, apparently, continuous belt of it, through all the three properties, three-fourths of a mile in length of ore of a width of 20 to 30 feet perpendicular between the walls. But the facts about the magnitude of the ore deposit its purity, etc., will be better known after the mine has been operated for a year or so. Samples of good ore can be got in this belt, but when a stock pile is examined it is invariably poor. There is too much rock in with the ore. And here when they come to mine it on a large scale it will be sure to be found to be low grade.

It is expected to ship 100,000 tons and upwards in 1890. Analyses of the ore from these mines give a result of 55% to 59% in iron and .14% to .27% phos. Probably when it comes to be shipped it will scarcely average above 50% in iron and below .25% or .30% phos.

THE BEAUFORT IRON MINING CO.

has surrendered the lease of the Beaufort mine to the feeholders, Mr. John Thoney, of Marquette, and Capt. John McEncroe of the Lake Superior mine, and others.

The estate consists of 160 acres, and has been re-leased to Mr. Schlesinger. The mine joins on the west the Norwood, one of the new Schlesinger mines. Beaufort is quite a mining location, having a school, post office, etc. It is three miles west of Michigamme, in the same belt of limonite ore in which are all of these mines west of the lake. The Beaufort is low grade, high phosphorus ore. The deposit is well defined, has a width of 20 feet, but the ore is not very clean and it will not pay to pick out the rock, it is too low price. Mr. Schlesinger having now such a length of this ore will be able to produce, possibly, as much as the market requires. Product 1889, 16,671 tons, making a total of 114,519 tons of ore.

The mine is in the N. W. part of the N. W. ¼, S. W. ¼, Sec. 22, 48, 31, and just across the line that divides them is

THE TITON MINE.

The two are in the same pit, and both are idle. The Titon has yielded 89,513 tons.

THE CHAMPION IRON CO.

The Champion mine yielded in 1889 the largest product of any year in its history, which indicates pretty clearly that the mine has reserves of ore; that its stopes are far from exhausted.

The Champion is a valuable mine. It produces the best hard ore, rich in iron and low in phosphorus. No where

else, perhaps, is so much pains taken in sorting and grading the ore as at the Champion. Mr. Kidder states that their success is greatly due to this matter of sorting the ore. There is no doubt but the Champion is an exceedingly well managed and well operated mine. The location is unusually pleasant, neat and orderly. The dwelling houses for the men are substantial with, generally, good yards and gardens. There are fine church buildings, a fine graded school, a fine opera house, public hall, library and reading room, that are first-class, to which all have access freely. In the change house for the men are eleven good bath rooms, supplied with hot and cold water, etc., pure water, pumped from lake Michigamme. An excellent hospital building that is admirably conducted. There is no sham, everything is thorough and well done. Another thing that Mr. Kidder observes, both at the Champion and the Pittsburgh and Lake Angeline mines, is that when an employee, of the company, who is the head of a family, is killed, the widow has the house in which she lives free of rent; has it as long as she continues a widow, as long as she desires to make it her home. In exceptional cases the company gives them fire wood, etc., also. Throughout, the policy of the company is a liberal and enlightened one.

The mine is a deep one, but it has seven shafts, three of which, 3, 4 and 5, are to the bottom, below the eighteenth level, 1,100 feet deep. The lenses of ore are set up on end, inclining down to the west, so that the tendency has been to find the ore in the shafts to west, further down, while losing it in the east. Sometimes there is disappointment when ore is expected it is not found, and again it occurs unexpectedly, and so on the whole, they are able to keep up the product uniformly.

The formation is one of the best defined of any in the country, a typical quartzite covering the ore that is underlaid by jasper.

I have written up this mine very fully in the past and I find nothing special to add.

The Champion has produced as follows:

Year.	Tons.	Year.	Tons.
1863	6,225	1879	98,393
1869	21,585	1880	112,410
1870	73,961	1881	144,025
1871	67,588	1882	137,516
1872	68,403	1883	104,960
1873	72,782	1884	208,156
1874	47,097	1885	173,914
1875	56,877	1886	137,592
1876	66,002	1887	140,330
1877	70,883	1888	174,643
1878	73,764	1889	215,098
Total			2,391,994

W. E. Stone, Treasurer, Boston; A. Kidder, General Manager, Marquette, Mich.; Walter Fitch, Superintendent; James Cundy, Mining Captain.

THE SAMSON IRON MINING CO.

Mr. Parker has continued to explore with the diamond drill at the mine at Humboldt. The drill has operated mainly on the flat southeast of the mine. Several holes have been bored and some ore has been found, not apparently, I am informed, in large lenses. Mr. Parker states that it is contemplated to sink a shaft to reach ore thus found.

The ore shipments from the mine in 1889 were 2,797 tons, making a total to date of 263,253 tons.

Morris Sellers, President, Chicago, Ill.; Richard A. Parker, Secretary and Treasurer, Marquette, Mich.

THE HUMBOLDT MINE

shows some improvement in the amount of ore. For two years they have only operated one shaft, No. 2, the one furtherest to the southwest; have stoped a lense of ore, ten feet wide, lying still further to southwest. They find now, at their present depth, that there is a "run of ore" back to No. 3, and they are now, March 1, pumping the water out of No. 3, in order to sink it to this ore. No. 2 is 600 feet deep. They think now that they will have this ore all the way to No. 3 and north of it, which will give a length of ore of several hundred feet, instead of about 100, which is all they now have.

They have already worked as far north as No. 3 shaft, and have the ore above and below and, still, also in the breast. The Humboldt produces first-class non-Bessemer slate ore; also has black ore.

The Humboldt mine is about a mile from Humboldt station, on the Republic branch of the D. S. S. & A. R. R., in the center of the N. W. ¼ of Sec. 11, 47, 29.

The mine is owned by the Washington Iron Co. and held on a lease by the Humboldt Co.

J. B. Maas, Agent; Ed. Maas, Superintendent, Humboldt, Mich.; G. A. Garretson, Secretary and treasurer, Cleveland, Ohio.

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

Year.	Tons.	Year.	Tons.
1865	4,782	1878	23,921
1866	15,150	1879	18,204
1867	25,440	1880	14,727
1868	37,757	1881	36,302
1869	58,462	1882	43,436
1870	79,712	1883	31,866
1871	48,725	1884	29,764
1872	39,841	1885	11,776
1873	88,014	1886	20,207
1874	27,990	1887	17,974
1875	9,642	1888	11,036
1876	8,893	1889	15,800
1877	16,546		
Total			671,935

THE GERTIE

is the name of a new company that is exploring for ore in the W. ½, S. W. ¼, Sec. 35. T. 48, R. 29, situated about a mile northwest of Humboldt station. The parties are the Messrs. Maas and others. They have a shaft down now, March 1, 110 feet deep, and are in a hard hematite ore, a very similar ore, if not identical with that found at the Nonpariel mine.

THE BESSIE MINING CO.

organized in Negaunee. Ed. Lobb, President; Ed. A. Maas, Vice-President; S. P. Kline, Sec'y and Treas., Negaunee; Win. Pelmear Humboldt, Chas. McGregor, E. A. Maas, S. P. Kline, and Ed. Lobb, Directors. They hold the 80 next to the Gertie, to wit: E. ½, S. W. ¼ Sec. 35, 48, 29. Have thus far hematite ore but not as yet of very good quality.

THE REPUBLIC IRON CO.

I find nothing strikingly new or suggestive at the Republic mine. It is simply a large mine yielding the best quality of magnetic and slate ores, situated in a bold, rugged range of beautiful banded jasper that rises to a heighth of 150 feet above the waters of the bay which it borders on the east and south, curving with the bends of the shore which it follows at a convenient distance away.

The deposit of ore partakes of the nature of a belt of the formation, beneath the jasper and the quartzite. The formation is much contorted, pressed together laterally so that it is "kinked" in places into sharp, deep minor folds. The ore following the formation, which contains it, into these narrow lateral folds gives to these portions the form and appearance of lenses of ore lying accross the formation. This is the manner of the occurrence of the ore in the west end pits, the Morgan, Pascoe, Ely, etc., which are in the bend of the horse shoe form of curve to which the formation corresponds. Further north the formation is more regular; the ore deposit is wider and proportionately less cost has been necessary in mining it. Nearly every pit has been a separate affair, not connected underground, you had to come to the surface several times if you wished to visit all the pits of the mine. That is less the case now as the main pits at the west end are connected and so are also those at the north. The location is one of the most interesting and attractive in all the mining region. The mine extends for three-fourths of a mile along the side of the steep rugged jasper bluff, near the upper edge of which are the shaft openings. The buildings, which contain the hoisting machinery, pumps, steam boilers, machine shop, etc.

The dip of the formation is towards the bay, to the west, northwest and north, evidently forming the bottom of the basin, which holds the waters of the bay.

Thus the shafts are not parallel, they descend in the ore at right angles to its strike at the point of location, and of a consequence tend to approach each other as they go down. Naturally there is great irregularity in the ore, corresponding to that of the formation. And naturally too, these shafts have become deep, and after all these years of action mining there is a great deal less ore than there used to be.

The Republic still has good stopes of ore, if not as great as they used to be, and the pillars of ore and floors yet standing, are a final resource. The greatest depth of the mine is at No. 6, which is 1,000 feet vertically down.

Reviewing the several pits in their order of occurence from the west, there is some exploratory work in progress near the line, but no ore is mined until the Morgan pit is reached. The shaft has been sunk 60 feet during the year. The shaft yielded specular ore 26,217 tons, Magnetic ore 4,100 tons, Kingston 12,175 tons, total 42,492 gross tons. The estimate for 1890 is about the same.

The Pascoe pit shows a little falling off. The shaft will be sunk another "lift" though it is expected that the product will be 10% less than in 1889, when the pit yielded 233,355 tons of ore.

The Ely pit holds its own since it is about the same now as it was in the upper levels. The shaft was sunk in 1889, 122 feet, and the product was 19,478 tons, some of this however was taken from upper levels, pillars.

The Gibson is a small pit, the ore running back into the foot wall; a party of three men work it and got out in 1889, 1,128 tons of ore.

No. 1 turned out better than was expected. The shaft was sunk 59 feet. The magnetic ore which formerly predominated has given place to specular slate ore, so that the shaft will afford as much as usual. The product 1889 was of specular 22,808 tons, magnetic 15,500 tons, Kingston 7,500 tons, total 45,808 gross tons.

From No. 5 pit about 2,000 tons will be taken, mined from the pillars.

No. 6 gave a good deal of ore in 1889, and is likely to duplicate the result in 1890, though there is no certainty as to the outcome. The shaft was sunk 77 feet, and the total product was 60,785 tons. A recent fall of ground in Nos. 6 and 7, will delay matters and may affect the product. The fall was occasioned by the giving way of a pillar of ore due to a "crossing" in the formation that practically cut the pillar loose on the foot wall side, so that a heavy mass of ore falling on it from above, the whole went, causing a serious collapse.

Here again in No. 7, specular ore takes the place of magnetic, in about equal quantity. The shaft was sunk 79 feet, and other opening work made in proportion. The product was 51,831 tons.

No. 8 does not come up to its usual standard; unless it improves greatly there will be a falling off in its product in 1890, of fully 20%. The yield in 1890 was 17,250 tons. They are putting in a new pumping plant at No. 8. Have improved the machinery at water works, added new engine so that now the compressor power is kept up to the requirements.

The product in 1889 was greater than ever before, dividend paid to stockholders $4.00 per share. Number shares 100,000, par value $25, present market quotation $50.

It is reported that the company will pay $7 per share in 1890.

Chas. Hickox, President, Cleveland, Ohio; W. D. Rees, Secretary and Treasurer, Cleveland, Ohio; Morgan, Agent, Republic, Mich.; Peter Pascoe, Superintendent, Republic, Mich.

The product for each year has been as follows:

Year.	Tons.	Year.	Tons.
1872	11,625	1881	231,451
1873	105,435	1882	235,108
1874	122,039	1883	152,565
1875	114,726	1884	277,789
1876	120,045	1885	249,070
1877	165,830	1886	241,351
1878	176,321	1887	293,275
1879	135,181	1888	225,964
1880	235,365	1889	287,391
Total			3,366,657

THE WEST REPUBLIC MINE

was shut down two years ago; but the company has just begun to work in a, shaft, which is just over the line from the Republic, about ten rods south from the margin of the bay. The shaft is about 100 feet deep and has some ore which it is proposed to mine, and also to go down with the shaft. 1,510 tons of ore were shipped in 1889, making a total to date of 133,496 tons. No mining was done in 1889. The ore sent away was culled from old stock piles or rock burros.

A. C. Saunders, Sec'y and Treas., Cleveland, Ohio.

THE REPUBLIC REDUCTION CO.

is an organization made to extract ore from the rock piles of the Republic mine. The matter was first undertaken by Peter Gottstein and S. D. North, of Houghton, who sold out to Messrs. D. H. Merritt, J. R. Deveraux and others, of Marquette. What has been done in this work has been described briefly in previous reports.

Messrs. Gottstein & North set out to grind up the rock and effect the separation of the ore from it by a process of "washing," not unlike the stamp mill work in separating copper. To this end they bought the old Isle Royal stamp mill and moved it from Houghton to Republic. The method of manipulation employed did not prove satisfatory, and hand sorting was resorted to with good results up to a certain point where it seems to be necessary to break up the ore by some cheaper and more expeditious process than hand labor.

Mr. Deveraux, who manages the business, has, finally, after some failures, hit upon a method which he states works satisfactorily. The trouble is that the material becomes dirty, covered with fine powdered ore, which adheres to it and makes the pieces of rock and ore alike appear to be ore. It thus becomes essential to wash it; and, to do this, it must be spread out in some way so that it can be worked and sorted. Mr. Deveraux's recent method is to cause the broken fragments to drop upon a carrier that moves slowly, where the pieces, spread out, are washed clean by water, applied with a hose, after which the material passes along, when the sorters on each side pick out the rock and the ore is carried on. Mr. Deveraux tells me that this plan works admirably, and they look forward with confidence to the results of the coming year's work. The product of 1889 was 22,102. tons; in 1888, 20,846, total, 42,948 tons.

D. H. Merritt, Secretary; J. H. Deveraux, Manager.

The machinery now used was made by the Link Belt Co., Chicago.

THE RIVERSIDE IRON CO.

has a small mine two miles northwest of Republic, on the Michigamme river, in Sec. 35, T. 47, R. 30. The company is exploring diligently; and, just at this time, February 20, have met with some trouble with the water. The product in 1889 was 3,573 tons; in 1888, 5,761; total, 8,334.

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

THE METROPOLIS

and other explorations along the Michigamme river to the northwest from Republic, are being worked, looking for ore. None of them have, as yet, ore enough to assure a mine of any commercial value. It seems easy to find small pockets, or lenses, of ore it this formation; but these deposits are generally small or the ore is too lean to be of any value. A great deal of exploring has been done northwest of Republic, but no good mine has ever been discovered. The indications are so good that there is every incentive to search. West of the Michigamme mine is

THE STEWARD

and, also, the King, both old properties, worked a little, years ago, without success; and there are others, of the magnetic black ore properties, that, in view of the success that is being attained at the Michigamme, in the separation of the ore and rock with the dynamo, possess, now, an increased value. The jasper foot wall, made up of magnetic ore and jasper, extends for three miles across 19 and 23. It has been traced and worked as far west as the Stewart, in Sec. 23.

THE SPURR MINE,

in Sec. 24, S. ½, N. W. ¼ and N. ½, S. W. ¼, 48, 31, is wholly idle. If the magnetic separator process proves a success, the Spurr will be valuable.

The mine has produced 164,941 tons of ore.

Capt. Win. H. Stevens, Detroit, Mich., is one of the chief owners.

THE VOLUNTEER IRON CO.

owning and operating the West End or Palmer mine is preparing for extensive operations in the future. A full description of this valuable property is contained in my report of 1888, and there is nothing necessary to add at

present. They are operating the three downright shafts designated as A B and C. The first named being the most easterly one. It has also been decided to sink a fourth shaft about midway between B and C, as it has been found by boring, that the ore continues through this ground. The diamond drill has been used to the east and to the north of the mine, and has proved that the ore continues, undiminished in width, in both directions.

Mr. Kidder, the Agent, informs me that he expects to mine, etc., 100,000 tons in 1890, and 300,000 tons in 1892. As by that time the mine will be opened and machinery, shafts, and surface arrangements made adequate to the production of the larger out put. The property comprising 1,800 acres, was purchased about a year ago from the Pittsburgh and Lake Superior Iron Co., and the Volunteer Co. organized. The location is four miles south of Negaunee, at the west end of the Cascade range, and is reached by a branch of the C. & N. W. R. R., also from the D., S. S. & A.

A. C. McCaul, Sec'y, 3 Telegraph Block, Detroit, Mich.; A. Kidder, Agt., Marquette; Thomas Waters, Supt. Ishpeming.

Table of Production.

Year.	Tons.	Year.	Tons.
1871	4,171	1881	36,273
1872	34,495	1882	40,590
1873	41,304	1883	19,414
1874	18,106	1884	11,742
1875	4,050	1885	5,679
1876	15,324	1886	24,084
1877	20,211	1887	47,454
1878	4,704	1888	56,321
1879	24,141	1889	60,157
1880	38,595		
Total			512,793

THE WHEAT MINE

situated east of the Volunteer in the S. E. ¼, S. E. ¼, Sec. 29, T. 47, R. 26, is a small hematite deposit of very good ore. Recent developments give to the mine a far better outlook than it has had for several years, at a depth of 225 feet a new vein of ore has been found, which is said to yield 67% in iron and to be Bessemer. So far it seems to have a width of 40 feet or more and to be clean.

Thomas Axworth, Sec'y, Cleveland, Ohio; Thomas Prout, Supt., Palmer, Mich.

The following is the table of production:

Year.	Tons.	Year.	Tons.
1879	850	1885	9,200
1880	3,324	1886	15,851
1881	9,040	1887	17,537
1882	9,354	1888	4,082
1883	6,025	1889	7,997
1884	6,824		
Total			95,005

THE CASCADE RANGE

in which the last two described mines are situated, has been, from the earliest days of iron mining in the peninsula, the scene of much exploration.

There are many old mining locations in sections 27, 28, 295 30, 31 and 32; and, while they did not prove valuable in the past, the indications are such as to induce further examination, from time to time in some of them.

Just now, under the stimulus of the active iron ore market, there are several parties exploring in the vicinity of the Wheat, I judge, in the valley north of the jasper range.

THE PLATT MINING CO.

is a new organization, operating just east of the wheat, in the N. W. ¼ of the S. E. ¼ of Sec. 29, 47, 26, of which land it holds a lease from the Henry Wick Banking Co., Cleveland, Ohio. Exploring has been in progress some time, under the supervision of M. P. Cook. Test pits indicate that they have found a wide deposit of ore and have tested it several hundred feet in length, also. The ore is identical with that of the wheat: about 60 per cent iron, .040 per cent phosphorus.

R. J. Whaley, President, Flint, Mich.

THE MINOWAN IRON CO.

In the N ½, S. E. ¼, Sec. 28, 47, 26, John E. McEvera is exploring and has found ,a deposit of hematite ore of good quality. It may be said that it is not difficult to find ore, either hard or soft ore in the Cascade range; but the trouble has been to find enough of it in a single deposit, and have it clean. Slate ore and hematite ore exist, of good quality; but it is too much mixed with rock to make it possible to mine it, etc., at a profit. It seems now that better results are likely to follow from the present efforts.

A. L. Conger, President, Akron, Ohio.

The location is a mile east of the Wheat. So far, these new hematite "finds" in the Cascade range seem very promising.

THE GOGEBIC IRON RANGE

certainly shows as favorably as it did a year ago. There is nothing new, of a discouraging nature, relative to the magnitude or continuance of the ore deposits. In my last Report, I have endeavored to describe the ore formation and the occurrence of the numerous dikes, which seem to constitute the chief element of danger of the range. Since they form the bottom of the ore in the mines, the matter to be determined was, and is, whether the ore will be found in quantity under these dikes. If the main dike, which forms the bottom of the ore in any mine, is the limit of the deposit and the ore does not continue beneath it, then it is easy to see that these mines cannot be of long duration. On the contrary, the ore may be found under the dikes, and it is so in cases of smaller ones, and thus the deposit be of lasting duration. There are some facts, recently come to light, in this connection, that favor this latter supposition, and they will be referred to in the course of the description of the mines.

Explorations conducted east of Sunday lake are looking much more favorable than they were; also, east of the Anvil, ore has been found in quantity sufficient to constitute a mine, for one year at least. Aside from these, no discoveries of importance have been made. The mines are looking well and will furnish more ore this year than ever in any season before. The plan of lighting the mines with electricity was tried recently, as an experiment, at the Ashland mine and was found to work admirably. It is a perfect success. All the mines in the vicinity of Iron wood will soon be furnished with all the necessary arrangements for underground lighting. The insulation of the wires is perfect and the light can be taken anywhere in the mine with the utmost facility. It seems certain that this method of lighting the mines will prove of much value. It will lessen the danger of accidents from fire, will render the men less liable to danger from falling into shafts, etc., and will enable them to accomplish much more work.

Nearly all the abandoned or idle properties are now again under option, and under much better auspices than formerly. There is a tendency to legitimate work, and not to boom for speculative purposes only.

THE ASHLAND MINE

is in admirable shape both on the surface and underground. The new structures over the shafts, mentioned in my last report, have been completed. The new hoisting machinery put into operation, in fact all the important changes and improvements held in contemplation a year ago have been carried out, and it is plain to see that the Ashland mine is now well equipped.

The underground work has been made to keep pace with the surface changes and there is no better looking mine in the State than the Ashland below surface.

There is no cleaner stock pile of ore—150,000 tons now ready to ship. There are eight shafts, numbered from the west end east, and they are hoisting ore in five of them—No. 4 to No. 8. A length of 1,800 ft., and from No. 5 east, in the sixth level, nearly all the distance the ore is 80 to 110 ft. wide.

The shafts are sunk to the seventh level. No. 4 shaft struck the dike before the sixth level was reached and the drift from the shaft east is through the dike.

From No. 5 east the ore body is fine. Nos. 5 to 6 is 443 ft., No. 6 to No. 7 is 300 ft., No. 7 to east line is 550 ft. The ore is clean and there is no trouble in keeping it so. The "cap rock" is very firm, and no where has any tendency to come down and mix with the ore. In the east end of each level the ore goes a long way under the cap rock, and this rock, it seems, would keep its place even if there were no timbers.

There is a main bottom dike that underlies the whole ore body, which comes up to the surface between No. 2 and No. 3 shafts. They sunk through it in No. 3 shaft and found ore 10 ft. wide, but non-Bessemer. They reached this dike below the fifth level in No. 4 shaft, and in the sixth level the dike is 50 ft. east of No. 5; thus the dike gradually cuts off the ore on the west as the mine deepens.

There are several minor dikes. One comes to the surface between Nos. 7 and 8 shafts and the ore above this was worked out between No. 8 and the east line in open pit. Below this is a dike that comes to the surface near No. 5 shaft, and they got ore above it west to the line. Now, below these is the main underlying dike that comes up at No. 2.

Under the two first mentioned dikes there is ore, but whether it will also be found under the main dike or not, in any amount, is not known as yet. In the meantime the Ashland people have ore enough in sight to last two or three years, assuming a large production. That for 1890 is estimated at 400,000 tons.

The following table will be of interest showing the quality of the ore shipped in 1889:

No. of Shaft.	Tons of Ore.	Percentage of Iron in Ore.	Percentage of Phosphorus in Ore.	Tons of Iron in Ore.	Tons of Phosphorus in the Ore.
Four	85,435	63.88	.0380	54,572.73	32.46656
Six	65,769	63.35	.0445	41,700.71	29.2684
Total stock piles	41,491	63.15	.0380	26,204.99	15.8488
Total shipments exclusive of stock piles	172,302	63.75	.0439	109,849.66	74.87317
Grand total	213,793	63.64	.0420	161,054.65	90.22197

There are three 10 ft. drums in the new engine house and a fourth one is to be added, space having been left for it. Also a new pump house has been built south of No. 6 shaft, and they are now placing a new plunger pumping plant, 14” plunger on solid foundations. This pump will raise all the water in the mine.

An analysis of the dike material shows it to be mainly silicate of Aluminum.

The ore is all shipped by the Wis. Central R. R.

The mine has produced annually as follows:

Year.	Tons.	Year.	Tons.
1885	6,471	1888	164,134
1886	74,015	1889	256,840
1887	175,561		
Total			677,011

Joseph L. Colby, Sec'y and Treas., E. A. Hayes, Gen'l Manager, Iron-wood, Mich.; John A. Taylor, Mining Capt.

THE NORRIE MINE,

next east of the Ashland, still holds the supremacy in the matter of production. It is wonderful that a mine should yield so much ore in only the fifth year after it was first undertaken. The product in 1889 was alone nearly equal to the total of all the previous years, and the output in 1890 will be greater still. The Norrie has a marvellous record, I do not recall its parallel in the history of iron mining in this country. The mine begins at the west line and is opened nearly the entire length of the property, three-fourths of a mile. It is one continuous run of ore through which one can walk and in which they are milling, from the Ashland almost to the Aurora line. It is

also the widest deposit of ore yet found on the range. As has been explained in former Reports, there is a peculiarity about the foot wall at the Norrie mine which is an advantage, in one respect, in working so wide a deposit. The underlying quartzite instead of continuing down with a uniform dip is "benched" that is it goes off to the north horizontally 50 ft. or more and then dips down again. These broad horizontal shelves afford a convenient and solid foundation on which to rest the timbers in building up the sets to hold "the back."

The method of mining that has been pursued is the one practiced by all the mines along the range, opening a series of rooms and timbering them. At the Norrie they are constantly mining the pillars also, and allowing the the overlying earth to fall in. Mr. Curry tells me that they lose very little ore. There are eight shafts, all working, they are one level deeper than a year ago, now to the sixth level about 500 ft. on the inclination of the shafts. The machinery was all small, never intended for the work of so large a mine.

A new plant of hoisting machinery, consisting of four 10 ft. drums has been put into operation during the year. Mr. Curry is boring with a diamond drill, north of the mine near the west line.

The Norrie and the East Norrie comprise the S. ½, S. E. ¼, Sec. 22, and W. ½, S. W. ¼ Sec. 23, 47, 47.

They have not reached a dike except at the west end, where they are on the one that comes to the surface near No. 7, Ashland shaft.

The Norrie is operated by the Metropolitan Iron and Land Co.

The officers remain as heretofore: S. S. Curry, President, Metropolitan Iron and Land Co.; H. S. Haselton, Secretary; E. H. Hanna, Treasurer, Milwaukee; Jeff. D. Day, Superintendent; Wm. Trebilcock, Mining Supt., Ironwood, Mich.

The mine has produced annually as follows:

Year.	Tons.	Year.	Tons.
1885	15,620	1888	410,768
1886	124,835	1889	674,290
1887	217,384		
Total			1,442,892

In the above is included the product of the East Norrie, which produced in 1889, 117,444.

THE AURORA MINE,

which joins the East Norrie, has changed owners; it is now controlled by the same gentlemen who hold the Colby and Palms, etc., mines. The new officers are:

Charles L. Colby, President, 36 Wall St., New York; Edwin H. Abbott, Vice President, Milwaukee; Joseph L. Colby, Treasurer, Milwaukee; Chas. H. Ropes, Secretary, 36 Wall St., New York; Alton L. Dickerman, Manager, Ironwood, Mich.; George Brewer, Superintendent, Ironwood, Mich.

The estate consists of the E. ½, S. W. ¼ and N. ½, S. E. ¼, Sec. 23, 47, 47.

The Aurora has ever been held to be one of the best mines in the range, and it still holds its place in the front rank, among the largest producers of the best ore. The mine extends all the way from the west line of the property, adjoining the East Norrie, to within seventy-five feet of the north line near the east boundary.

The west end of the mine is no longer productive of ore. It is open cut and the ore has all been removed down to the dike. The ore now is from No. 3 shaft easterly to the Pabst line, 1,100 feet in the fifth level. East from the shaft, the ore is twenty-one "sets" wide, and west it is fifteen "sets." West of the shaft they are rising up on the dike.

At the east end the ore becomes quite narrow. No. 4 shaft is to the sixth level; but, in reaching it, they had to cut through the dike and also drift east through the dike for the level. The depth to the sixth level is 400 feet, 300 feet to the fifth. Immediately under the dike, at No. 4 shaft, good ore was found, 64 per cent in iron and Bessemer. They have drifted west in the ore thirty feet, but have not sunk nor crosscutted in it yet. This is an important fact and greatly adds to the probable value of the Aurora mine. No. 2 shaft was sunk below the dike 100 feet, all in cap rock, with a narrow deposit of ore. The plan is now to sink No. 3 shaft through the dike, since finding the ore under it, in No. 4, gives hope of good results. They are laying the foundations for a new plant of machinery, two ten-feet hoisting drums to operate Nos. 3 and 5 shafts. Some good ore has been found in the fourth level by drifting north eighteen feet. The ore is four sets wide, and they hope it continues up to the surface capping. It is expected to mine, this year, 300,000 tons of ore, and upwards.

The mine will soon be provided with the electric lighting system.

The mine has yielded as follows:

Year.	Tons.	Year.	Tons.
1886	101,037	1888	170,650
1887	154,095	1889	216,061
Total			650,843

THE NORTH AURORA.

Exploration here has been kept up by Mat Fitzsimmons. He has sunk another shaft a little further west and has what may be called ore, but not salable ore; it is not good enough to be of any value, except as indicative of better results to come. An option has been given on the property to the Aurora Iron mining Co., or to the Penokee and Gogebic Development Co., which controls the Aurora, and which will continue the exploration at the North Aurora. If the property develops into a mine, all parties interested will participate in the advantage. It is west of the Pabst and north of the Aurora.

THE PABST MINE

has also changed owners; it being now controlled by the Metropolitan Land and Iron Co., the owners of the Norrie mine. The Pabst has steadily improved each year ever since the ore was found in the north vein (to use a local expression to designate the north ore). The mine, first opened on the quartzite foot wall, did not prove to be valuable; but the north shaft, 360 ft. north of the foot wall, near the east line and in continuation west of the Iron King mine deposit of ore, quickly made the mine an important producer.

This A shaft having developed so well, it was decided to sink another—B shaft, 500 ft. west of the former, and now this latter is also in ore and they are hoisting from it at a lively rate. The shaft is 360 ft. deep and the ore is 17 "sets" wide, and further west, 1,000 ft., is a new shaft 200 ft, in which they also have the ore 5 or 6 "sets" wide—30 to 40 ft.

A shaft is sunk to the dike, 360 ft; in the 300 ft. level they have connected it by a drift, with B shaft. The dike, as has been heretofore explained, seems to pitch west both in the Iron King and in the Pabst, contrary to their usual angle of depression, which is easterly. Away to the west, however, in the new shaft—which I think is called C—the pitch of the dike is easterly. The probability is, that the dike, being pretty flat, is somewhat folded and the so-called pitch at any point is due to the inclination of the fold at that point.

In the C shaft the bottom of the ore was found at 175 ft. depth. They went through the dike, under it, and drifted east, through it again at 200 ft. level, and are now in the ore, in this level, on the dike. West they are rising up in the dike, mining ore. This "new find," so far to the west of the mine, and north of the No. 6 Aurora shaft, is of much interest. It is quite possible that the ore continues, uninterruptedly, the whole length of the property, in this north vein. They are building a track to the C shaft and expect to send out in all this year, 150,000 tons of ore.

The officers are H. S. Haselton, Secretary; Wm. Trebilcock, Superintendent.

Table of Production.

Year.	Tons.	Year.	Tons.
1885	1,153	1888	49,077
1886	17,925	1889	96,990
1887	19,806		
Total			185,951

Adjoining the Pabst is

THE NEWPORT AND LAKE SUPERIOR LAND CO.,

the name of the corporation that now operates the Iron King mine, the name of which mine the new organization has changed to Mount Hope.

The Bessemer Consolidated Iron Co. mined 34,946 tons of ore up to July, when the change was made, and the remainder of the total product was credited to the Mount Hope mine, by the new proprietor, the Newport and Lake Superior Land Co. The change, however, has occasioned another lawsuit, brought by aggrieved stockholders. The Iron King, as an independent enterprise, and well managed, should have been a profitable mine; but it was one of the Burton group, and the only one that produced ore in any amount, so that for several years it has been a bone of contention; and, in many ways, through the misfortune of its early ownership, the property has been seriously hampered.

I have described the mine very fully in my last report and I do not find the prospects in the mine any more encouraging now than they were a year ago. The shafts are all down to the dike, and the ore above it is pretty well exhausted. The amount of ore in sight is not very great. They are hoisting, mainly in No. 1 and No. 4 shafts. In the south vein, are sinking, etc., near the Pabst line, and have developed quite a deposit of ore, which they will soon have opened ready to stope. They are also driving a crosscut south from a point between No. 3 and No. 2 shafts, in which some ore has been found. Exploration will, perhaps, result in discovering ore; possibly, a good deal of it. The estate is the N. W. ¼, Sec. 24, T. 47, 27.

Capt. W. W. Stephens, formerly at the Pabst, is now in charge of the mining work at its neighbor. Mason W. Burt, Superintendent, Ironwood, Mich.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1886	27,343	1888	69,145
1887	74,699	1889	101,745
Total			273,842

Adjoining the last described mine, on the east, is

THE BONNIE,

at which no work has been done in the past year. Probably there would be exploring done if the property could be secured for the purpose. It is not yet freed of the complications growing out of the Burton affairs. West of the Bonnie, and joining it, is

THE FIRST NATIONAL,

on which the Metropolitan Iron and Land Co. is doing some exploring. The estate is the N. W. ¼, Sec. 19, 47, 46. Joining this on the north is

THE GENEVA,

the S. W. ¼, Sec. 18, 47, 46, is held on an option by some residents of Ironwood. They are sinking a shaft just south of the county road, on the land. North of the road, in the S. E. ¼, S. E. ¼, Sec. 13, 47, 46, is

THE NEWBERRY.

The water has been pumped out of the shaft recently, with the purpose of prosecuting further exploration. It is now called the Power, after Hon. John Power, of Escanaba, who is the one chiefly responsible for the work, I am told.

THE NORTH PABST

in the N. ½, N. E. ¼, Sec. 23, 47, 47, is an active exploration. They are sinking a shaft close to the Pabst line. The shaft is 300 ft. deep, all the way in slates. East of the Geneva and joining it is the

BLUE JACKET,

the S. E. ¼, Sec. 18. No work is doing there; but at

THE RUBY,

formerly the Puritan, which joins the Blue Jacket on the east, they are exploring and mining ore. They are mining in No. 4 shaft and are exploring in the side hill to the north for the north vein. I have given an extended description of this property in the Com. Report for 1886. It would seem to be a favorable property to explore.

The discription is the S. W. ¼, Sec, 17, 47, 46.

Geo. H. Abeel, Supt, Hurley, Wis.; S. Hitchcock, Sec.; M. A. Hanna, Pres.; A. C. Saunders, Treas., office 101 St. Glair St., Cleveland, Ohio.

The title is the Ruby Iron Mining Co. The mine, while not disclosing much yet is certainly improved within the year. A year ago there was but a small body of ore in sight and it contained 2½ to 4% of manganese so that it was of not much value. They have found two other bodies of ore, one is very irregular, is 60 ft. north of the foot wall and so far does not amount to much. The ore lies on a dike which has been sunk through 38 ft. thick. The other body of ore is further east and looks promising. The company employes a small force, and Mr. Abeel looks closely after the work.

The following is the table of production:

Year.	Tons.	Year.	Tons.
1886	16,288	1888	3,066
1887	42,005	1889	9,472
Total			70,981

THE IRONTON MINE,

like the Ruby, has proved very disappointing. They both showed so well at first that great expectations were raised. They both were sold at high figures and while the sellers reaped a rich harvest the purchasers were correspondingly injured. There was a fine deposit of ore on the line between the properties, but it was worked out and nothing so good has been found to take its place.

The property is the W. ½, S. E. ¼, Sec. 17, 47, 46, lying between the Ruby and the Federal.

During the past year and more they have been mining ore in the deposit which was found with the diamond drill as mentioned in a former Report. They are now 240 ft. deep and are still sinking and drifting in a deposit of ore that does not seem to be very large. They are working a few men.

It is quite probable that at greater depth than has yet been reached, ore will be found to the east below the hill on the flat land. The results at the Federal rather indicates it.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1886	16,307	1888	1,735
1887	27,887	1889	9,449
Total			55,378

M. W. Burt, Agt, Ironwood, Mich.

THE FEDERAL MINE

formerly the Tontine, is improving. It promises to be a mine of value. It is only within two years that any ore was found on the property. In fact, the Tontine Co. had become entirely discouraged and relinquished the lease of the land. The new proprietors pushed the work moderately and soon found ore, which has since continued to develop until now the "showing" is such as to make it nearly certain that the Federal will be a good mine. The situation is in the valley near the Ironton Bluff, the estate being the E. ½, S. E. ¼, Sec. 17, 47, 46.

There are now two shafts, which are 400 ft. apart, the new one being the east one and in the foot wall. It is 210 ft. deep. At the 200 ft. level they are crosscutting to the ore, north. They have drifted in ore for 200 ft. east of this shaft, besides which there is ore nearly all the way from No. 1 to No. 2.

No. 1, the west shaft, is 225 ft. deep, and also are crosscutting to the ore at the 200 ft. level.

They do not know very much about this deposit of ore yet, but when the crosscuts are made, etc., at the 200 ft. level and below, the development will tell the story.

E. S. Dingwell, Sec'y, Milwaukee, Wis.; D. A. Bennett, Supt.; E. Stepan, Mining Capt.

The product of the mine, 1888, was 3,182 tons, 1889, was 9,912 tons.

The lease of

THE VALLEY

mine estate, consisting of the N. ½, S. W. ¼, and S. ½, N. W. ¼, and N. ½, S. E. ¼, Sec. 16, 47, 46, having been relinquished by the Valley Iron Mining Co., has been taken under option by different holders who are preparing to explore the several subdivisions. The 80

first mentioned is held by the Metropolitan Iron & Land Co. and they are already vigorously at work. The 80 north of it to wit: the S. ½, N. W. ¼, Sec. 16, was taken by Messers. Swain & Riley, of Bessemer, and three-fourths interest transferred to Messrs. Ed. Ryan, Hermon Nunnemacher, and H. H. Benjamin. It was on this 80 that most of the mining work was done by the original company. In all 2,164 tons of ore were shipped.

This south 80 is owned by Capt. Nat Hibbert, Wm. H. Sedgewick, and Capt. Sam. Mitchell, I believe, and the north 80 by J. M. Longyear, of Marquette.

These properties start from near the foot of the Colby bluff and with the Federal, compose the valley to the Ironton bluff on the west.

THE COLBY MINE

has not been very strongly worked during the past year; for some reason, the company has seen fit to employ a comparatively light force. Now, however, the effort is to get out all the ore possible.

It has been a matter of a good deal of delay and trouble, etc., to get the surface rearranged and things put into their present more convenient and intelligent shape. Formerly, the machinery was all over the mine; now it is mostly on the foot wall. The outer buildings have been moved and placed in positions of greater safety, and the surface relieved of the stumps, logs, rocks, etc., that marred its appearence and impeded progress.

The stock pile ground is now all on the foot wall side, and the arrangements for storing and handling are adequate and convenient. In February last, the mine caved in down to the sixth level, so that, for several months, there was only one shaft in the mine that could be used—No. 5, the double skip shaft, sunk in the foot wall, the most easterly shaft. The shafts that were crushed in are 3 and 4. The latter has been restored, so that it is now again used in hoisting. No. 3 will not be repaired. The compressor house foundations and machinery went down, but the machinery was rescued from the ruin without material injury and quickly set up again, over on the foot wall. The crush came suddenly, though premonitory symptoms were not wanting, and Capt. Dickinson had ordered all the miners out, so no one was caught in the crush. Only one man was hurt, and he by the concussion of air.

They have ore in all the levels, from the second, down. In east end of the mine, the new body of ore, described in the last Commissioner's Report, as having been found in the second level, in drifting from No. 4 to No. 5 shafts, has developed well. In puncturing the ground that inclosed the main deposit, minor pockets of ore are found, which are of importance. The mine is looking well at the east end, and there is a mile of ground yet to explore. The whole of Sec. 15, between the Colby and the Palms, is held by the company that controls the Colby.

At No. 5 shaft, in the mine, the ore goes off to the northeast, away from the foot wall, and, apparently, there is likely to be a good deal of it. Have gone in east 300 feet. No. 3 shaft strikes the dike at the sixth level; No. 4 at the seventh, and No. 5 has the dike in the eighth level. The angle of the slope down east is about 20°.

The product in 1890 will be 250,000 tons.

Of the product in 1889, 25,500 tons Sellwood ore averaged .0892 per cent in manganese; the combined iron and manganese was 63.52 per cent; 50,018 tons contained .0674 per cent manganese, and combined, gave 63.17 per cent; 75,578 tons contained .0748 per cent manganese, and combined, gave 63.28 per cent. These are returns from the purchaser.

The corporate title is the Penokee and Gogebic Development Co.; but the mine has the same proprietors as the Aurora, Palms and Eclipse.

Joseph L. Colby, Treasurer; Alton L. Dickerman, Manager; W. E. Dickinson, Superintendent.

The mine has produced as follows:

Year.	Tons.	Year.	Tons.
1885	84,312	1888	285,195
1886	257,433	1889	188,019
1887	258,518		
Total			1,023,477

THE PALMS MINE

from a possibility has become a reality. At first the original company sank the four shafts to a depth of about 100 ft. and drifted to connect them but the work was all in "cap rock" and the ore that was found was "mixed" with rock.

When Capt. Christopher was called to take charge of the mine he speedily decided that if any ore was to be mined they must first find it, and the purest way to do that was to "go down" for it. He sank deeper and got limited pockets of good ore. Still he did not do enough, the policy of the company was restrictive. They did not want to advance money for exploratory work. But they have been getting deeper all the while and the result has verified the conjectures made of the value of so doing. No. 4 shaft is 450 ft. deep and they have a length of ore of 800 ft., and still continuing both ways. At the west end the ore is five "sets" wide and growing wider. In some portions of the deposit it is eleven sets wide, 70 or 80 ft. It is sure to be a good mine, to give a product in 1890 of between 50,000 and 100,000 tons of ore.

The quality is shown by the following averages of analyses of shipments to Joliet and to Chicago: The former gave, metallic iron 63.56%, phos. .052%; the latter gave metallic iron 63.35%, phos. .055%.

At present, May 1, they are limited in hoisting to No. 4 shaft. They are "rising up" in No. 2 and will have that in readiness to aid production by and by. Also are sinking

a new shaft 300 ft. west of the east line and 150 ft. north of the quartzite foot wall, on surface. As the foot wall dips 63° to north and the shaft is vertical, the distance down to the point of intersection will be 300 ft.

No. 2 is the east shaft and is about midway between No. 4 and the new shaft, and when they are all in readiness the ore will be gotten out rapidly.

The Anvil mine, which joins the Palms on the east, is worked up to the line on the dike. The ore is wide and of good quality, so that there is all probability of its continuing on the dike through the Palms land.

The mine is now controlled by the Messrs. Colby, et al., the same parties who own the Colby, Aurora, etc., mines.

Chas. L. Colby, President; Joseph L. Colby, Treas., Milwaukee; Alton L. Dickerman, Manager; Capt. J. P. Christopher, Supt., Bessemer, Mich.

Product—1887, 1,600 tons; 1888, 23,184 tons; 1889, 35,434 tons; total, 60,218 tons.

The corporate title is the Palms Iron Mining Co.

THE ANVIL MINING CO.

holds the quarter section next east of the Palms, being the N. E. ¼, Sec. 14, T. 47, 46. While the Anvil is, undoubtedly, a valuable mining property, it so happens that just now there is, perhaps, not above 25,000 tons of ore in sight. Still they expect to mine 75,000 tons, and probably will do so. The reason is that the ore has all been obtained at the west side of the property, and the ore is limited by the underlying dike, the west line and the rock that terminates it in other directions. These bounds of the ore were determined some time ago; and, for several years, the deposit has been undergoing depletion. It is now nearly exhausted, but still comprises all the ore that is known to a certainty. There is, however, every reasonable assurance that ore exists in large quantity in the east part of the property.

They are sinking a new shaft at 800 feet west from the east line, and, south of it, have built an engine and boiler house. The shaft is now, May 1, 230 feet deep, and, over it, they are erecting the frame work of a substantial shaft house.

They soon expect to reach the ore found in the Eureka, just east of the line. The shaft is now in the formation that was found over the ore at the Eureka. No. 2 shaft is at the west end, where they are mining ore. From there to No. 3, it is 550 feet; and to No. 4, the new shaft, 1,300 feet. No. 3 is 330 feet down to the dike, but there is no ore at that point, so far.

The shafts are connected by a drift, on the dike, 330 feet down from surface, and they are cutting a cross drift north, on the dike, which will be continued until ore is encountered, if possible. The same will be done at No. 4, and, if ore occurs, the two will be connected by a drift in the ore. Judging from the position of the ore at the Eureka, with reference to the quartzite, it is expected to find it at about 150 or 200 feet north of this foot wall. They look confidently to the finding of ore at No. 4 shaft.

The present officers are:

G. E. Tarbell, President; F. J Kipp, Vice President; E. Nunnemacher. Secretary and Treasurer; D. A. Bennett, Superintendent.

General office, Milwaukee; mine office, Bessemer.

The ore shipments have been as follows: 1887, 10,076 tons; 1888, 24,677 tons; 1889, 44,054 tons.

Amount received from sale of the ore in 1889 was	$205,841 74
Expenditures: cost of mining, shipping, etc.	174,718 20
Profit	$31,123 54

THE EUREKA IRON MINING CO.

is the corporate title of the company that was formerly known as the East Anvil, and, later, as the Dangler. The mine joins the Anvil on the east, where the efforts, applied through several years, to find ore, have recently been crowned with success. The mine is in the side hill, which descends from the Anvil boundary, easterly for half a mile to the Black river. The description is the W. ½, N. W. ¼, Sec. 13, 47, 46. At the time I was last at the mine, about the first of April, the situation was as follows:

No 1 shaft is on the quartzite foot wall, sunk vertically until the quartzite is reached when it descends with the dip of the rock.

It is 400 feet east of the west line, and the surface descends, in that distance, 100 feet. The shaft is 300 feet deep: 140 feet to the dike, 45 feet through it, and the rest of the distance under the dike, through the same kind of rock as occurs above the ore "capping."

From above the dike, they drifted north 140 feet and found the ore 43 feet wide. They have drifted west 317', nearly to the line, all the way in ore.

No. 2 shaft is 217 feet east from the north end of the crosscut. The ore is reached in this shaft at 40 feet below surface, and continues to 65 feet, where the dike is reached—25 feet thickness of ore. The shaft continues in the dike until the level of the drift, coming from No. 1 shaft, is reached, where they have drifted each way, east and west, through the dike into ore again. In all, the drifting, east and west, is 600 feet; ore all the way. No. 2 shaft comes down onto the dike on the apex of a fold, anticlynal, in the formation. Each way the dike descends, to east and to west. The surface at No. 2 is about 130 feet below the top of the hill at the west, while the Gogebic shaft, which is about 600 feet east from No. 2, is 230 feet below. Still down by the river, 300 feet further east, is another shaft on the Gogebic mine property, in which the dike was found at 140 feet below the surface, showing that here the dike dips rapidly to the east. From No. 2 shaft, it dips west; but, further on, it runs pretty flat across the Anvil property. It

is probable that the Eureka has, ore the width of the property, 1,320 feet.

The analysis of the ore gives, I am told, 62 per cent iron; .070, phos. They are putting up shaft houses over each of the shafts, and will soon be in good shape for producing ore. They have an engine house and a suitable plant of machinery.

It will be observed that, as far as known, the ore is all above the dike, and, unless more of it than now appears is found, a few years will exhaust it.

W. H. Whiteside, who is a miner of much skill and experience, superintends the work.

F. T. Ives, Secretary and Treasurer, Cleveland, Ohio; Jas. Corrigan, General Manager.

THE EAST DANGLER

is just across the river in the W. ½, N. E. ¼, Sec. 13. Parties of Ironwood, Mich., have the option.

Capt. Peter Conley is in charge of the work.

They are sinking, but are much troubled with an excess of water.

THE GOGEBIC

has been referred to in speaking of the Eureka. They have sunk three shafts and are down on the dike, but have not found ore yet. Capt. Harry Pearce is in charge of the work.

AT THE RHINELANDER, MIKADO

and other properties east from the river towards Wakefield, exploring is in progress or soon will be commenced. There are a good many properties in this portion of the range from Black river to Wakefield, all of which have been somewhat explored and a few of them a good deal. It is a good ore formation, ferruginous schists and slaty jasper, etc., but at none of them has ore enough been found to give assurance of a mine. In previous Reports I have described all these explorations and I find nothing new that I think will be of interest. The finding of a good workable deposit of ore in this locality would be a matter of much interest and value. I think that some important work is being done.

THE CROWN POINT

mine has been purchased by the Brotherton Co. The mines join. The Brotherton being on the northeast margin of Sunday lake, the land extending into the lake so that the water covers about half of the west 40. The description is the N ½, S. E. ¼, Sec. 9, 47, 45. The Crown Point being the S. W. ¼ of same section, all of which, save a narrow strip on the north side, is under water. Ore was found at the Crown Point as described in my last Report, and as it is of the same character as that in the Brotherton mine and the line of the continuation of the Brotherton, and Sunday Lake mine ore deposits, and as the Brotherton ore, going west continues under the water, it seems quite probable that ore will be found beneath the lake on both properties.

THE BROTHERTON MINE

holds its own very well indeed. It is a good mine, affording a fair amount, annually, of excellent ore. The general features of the mine remain almost unvaried from one year to another. The same formation exists at other explorations west of Sunday lake, but they do not find the ore that, fortunately, occurs at the Brotherton. The company has been investigating the problem of pumping the lake dry. They have ore under it possibly all the way accross it, but it is scarcely safe to attempt to mine it with the water over them. It is expected that the output in 1890 will exceed that of any previous year. The maximum depth is 400 ft. and the width of ore 50 ft. The length of working is 1,500 ft. from the lake to line on east.

The officers are Joseph Sellwood, President, Duluth, Minn.; Edward Niedecken, Sec'y, Milwaukee, Wis.; M. J. Luther, Treas., Milwaukee, Wis.

Product, annually, has been as follows:

Year.	Tons.	Year.	Tons.
1886	8,880	1888	40,629
1887	21,721	1889	76,300
Total			147,830

THE SUNDAY LAKE MINE

joins the Brotherton on the east; the dividing line crosses the ore. Pending litigation between the fee owners and the lessees, the mine is idle, no work having been done since February, 1889. I find nothing special to add to previous descriptions given.

Table of Production.

Year.	Tons.	Year.	Tons.
1886	14,250	1888	
1887	18,138	1889	3,240
Total			35,648

Daniel McVichie, Supt., Wakefield, Mich.

THE IRON CHIEF,

which is close to the former on the east, and which was given up a few years ago as, apparently, of no value, is again undergoing examination. This time they are on the east side of the property, and have a shaft down 120 feet, and have a crosscut north from the shaft forty feet.

Superintendent, D. McVichie; John Anderson, Captain, Wakefield, Mich.

THE SPARTA,

or Chicago, is still worked; Capt. John McLeod is superintending the work. It lies just north of the Crown Point. The prospect seems to be becoming more favorable as the work progresses. Exploring work is in progress at other points, west of the lake, and northwest and southwest of it. I look for valuable results to grow out of this work.

East of the Iron Chief, the most, valuable results have been achieved; work at

THE COMET,

formerly the Eclipse, which is the S. ½, S. W. ¼, Sec. 11, 45, 47, has developed a mine. Every preparation is now in progress for pursuing active mining work. The lease has been purchased by the Penokee and Gogebic Development Co., and the Eclipse will constitute one of the series of this company's mines.

They have sunk to a depth of 165 feet and drifted a length, east and west, of 300 feet. The ore is twelve or fourteen feet wide. In pursuing the opening work, they have raised 1,500 tons of ore, which is now in stock. They are putting in suitable machinery for mining work, and the M. L. S. & W. R. R. Co. is extending the Brotherton spur to the location.

There will be two four-feet drums, two eighty-horse power boilers. They are locating the machinery on the foot wall, 250 feet south of the ore.

The ore is of best quality, like the Brotherton.

THE PITTSBURGH

is the 80 north of the Eclipse, to wit: the N. ½, S. W. ¼, Sec. 11, 45, 47. Capt. M. L. Tallon, who has charge of it, is working a few men, employed in sinking a shaft, which is now 65 feet in depth, 8'x12' inside timbers. The plan is to go on down with the shaft until they find the ore in its underlay, north from the comet, which, it is estimated, will be at about 350 feet in depth.

THE COMMERCIAL

is the W. ½, S. E. ¼, Sec 11, 45, 47, thus making it join both the Comet and Pittsburgh. I think the holders of this lease are delaying further work just at present, awaiting results at the Comet and Pittsburgh, so that when they start in again, they can pursue a course of more certainty. Mr. Dan Kloeckner, of Hancock, Mich., and other prominent men in the copper region and at Negaunee, are interested in the property.

THE WASHBURN

and other gold mining explorations at "Wakefield, have collapsed utterly.

TABLE of Mine Products, 1889, and specific tax thereon as reported to the Auditor General, State of Michigan, by the Commissioner of Mineral Statistics.

Names of Mines and Companies.	Tons of Ore.	Specific Tax.
American Iron Co.	20,062	$300 32
Aragon Mining Co.	1,748	17 48
Aurora Iron Mining Co.	216,061	2,160 61
Ashland Iron Mining Co.	256,930	2,568 30
Anvil Mining Co.	44,054	440 54
Armenia Mining Co.	47,775	477 75
Beaufort Iron Co.	16,505	165 05
Brunsteel Mines	153,842	1,538 42
Buffalo Mining Co.	51,000	510 00
	5,388	53 88
Brotherton Iron Mining Co.	76,590	765 90
Champion Iron Co.	215,000	2,150 00
Cleveland Iron Mining Co.	274,048	2,740 48
Colby Mine	138,019	1,380 19
Chapin Mining Co.	518,990	5,189 90
Cambria Mining Co.	72,780	727 80
Dexter Consolidated Mining Co.	4,209	42 09
Detroit Iron Mining Co.	10,114	101 14
East New York Iron Co.	29,799	297 99
East Champion Iron Co.	2,607	26 07
Federal Land and Iron Co.	9,912	99 12
Grand Rapids Iron Co.	20,058	200 58
Hamilton Ore Co.	8,369	83 69
Hartford Mining Co.	599	5 99
Humboldt Iron Co.	15,896	158 96
Imperial Iron Mining Co. (Westmore Mine)	19,679	196 79
Iron Star Mining Co.	38,451	384 51
Ironton Iron Mining Co.	9,449	94 49
Iron Cliff Co.	293,189	2,931 89
Iron River Co. (Florence Iron River Co.)	179,238	1,792 38
Jackson Iron Co.	128,992	1,289 92
Lake Superior Iron Co.	288,784	2,887 84
Lumbermen's Mining Co.	136,300	1,363 00
Lucy Mining Co.	32,982	329 82
Lillie Mining Co.	33,916	339 16
Marquette Ore Co.	65,096	650 96
Michigamme Co.	56,999	569 99
Metropolitan Iron and Land Co. (Norrie)	771,280	7,712 80
Mastodon Iron Co.	63,080	630 80
Milwaukee Iron Mining Co.	52,728	527 28
Monitor Iron Mining Co.	21,820	216 20
Millie Mining Co.	18,995	189 95
Mount Hope Mining Co.	66,799	667 99
Negaunee Mining Co.	78,318	783 18
North Champion Iron Co.	1,737	17 37
New York Iron Mine	1,293	12 93
Newport and Lake Superior Land Co.	34,946	349 46
Paint River Iron Co.	32,161	321 61
Perkins Mine	12,302	123 02
Penn Iron Mining Co.	256,773	2,567 73
Pittsburgh and Lake Angeline Iron Co.	229,070	2,290 70
Palms Iron Mining Co.	35,434	354 34
Queen Mining Co.	66,129	661 29
Ruby Iron Mining Co.	9,472	94 72
Riverside Iron Co.	3,373	33 73
Republic Reduction Co.	22,106	221 06
Republic Iron Co.	287,391	2,873 91
Samson Iron Co.	2,797	27 97
South Buffalo Mining Co.	69,999	699 99
Sunday Lake Mine	3,240	32 40
Shafer Iron Co.	11,166	111 66
South Mastodon Iron Co.	4,006	40 06
Sheridan Iron Co.	1,102	11 02
Volunteer Iron Co.	60,157	601 57
Wheat Mining Co.	7,997	79 97

Table of Mine Products, 1889.—Continued.

Names of Mines and Companies.	Tons of Ore.	Specific Tax.
West Republic Mining Co.	1,510	$15 10
Walpole Mine	9,614	96 14
Webster Iron Co.	448	4 48
York Iron Co.	131,828	1,318 28
York Mining Co.	13,082	130 82
Youngstown Mining Co. (Florence, Iron River Co.)	7,471	74 71
Totals	5,829,823	$58,298 28

Products of Copper Mines and Specific Tax thereon, reported to the Auditor General of Michigan—1889—by Commissioner of Mineral Statistics.

Name of Company.	Product.		Specific Tax.	
	Tons.	Pounds.	ollars.	Cents.
Atlantic Mining Co.	1,889	287	1,416	84
Allouez Mining Co.	881	836	661	06
Calumet and Hecla Mining Co.	24,324	596	18,250	61
Central Mining Co.	633	302	474	47
Copper Falls Mining Co.	434	1,186	325	93
Franklin Mining Co.	2,173	42	1,629	77
Evergreen Bluff Mining Co.	14	778	10	79
Lac La Belle Mining Co.	1	1,738	1	33
Huron Copper Co.	1,109	1,473	839	30
Kearsarge Mining Co.	959	849	719	57
Osceola Consolidated Mining Co.	2,297	127	1,700	29
Quincy Mining Co.	3,202	1,886	2,402	13
Ridge Copper Co.	12	1,013	9	37
Tamarack Mining Co.	5,302	1,451	3,977	04
Mass Mining Co.	26	1,742	20	15
Peninsula Copper Mining Co.	368	507	276	19
Totals	43,613	468	32,709	88

Product of Coal Mines and Specific Tax thereon, as reported by Commissioner of Mineral Statistics to the Auditor General of the State of Michigan, 1889.

	Tons of Coal.	Specific Tax.
R. H. Emerson & Co.	17,282	$80 41
Eureka Coal Co.	100	50
Corunna Coal Co.	15,000	75 00
Bennett Sewer Pipe Co.	5,000	25 00
H. J. Stark	30	15
Star Coal Co.	325	1 62
Standard Mining Co.	9,888	49 44
Grand Ledge Coal Co.	260	1 80
Poole Mining Co.	10,120	50 60
Totals	58,105	$290 52

Total number of tons of iron ore produced in Michigan in 1889, 5,829,828 long tons. Aggregate, including production of previous years, 43,824,957 long tons.

Total production of refined copper in Michigan in 1889, 43,613 tons, 468 lbs. Aggregate, inclusive of that of previous years, 613,596 tons, 369 lbs.

The usual tables of products of iron ore and copper, covering all the years since mining was begun in this State, which have heretofore accompanied the annual Reports of the Commissioner, are omitted from this volume. I do not deem it necessary that these tables should be re-printed every year. In the description given of every mine, is found a table of the mine's yearly production and its aggregate yield also. The tables of production in the former Reports can be referred to to ascertain the output of idle or abandoned mines.

The same may be said of the plates of the copper mines, which are contained in previous volumes. I made the additions to these maps bringing them down to the end of the year 1889, but they show so little change from those in the previous Reports that I omitted them from this. Reference to the maps in Report for 1888, will suffice for all purposes taken with the descriptions herein given.

PIG IRON.

Statistics of Production of Pig Iron in Michigan Blast Furnaces, 1889 and several previous years.

Name of Company.	1886.	1887.	1888.	1889.
Eureka Iron and Steel Works, Wyandott	11,068½	12,484	10,765	15,568
Gaylord Iron Company, Detroit	8,098	6,760	8,858	6,455
Detroit Iron Furnace Company, Detroit	6,741	15,272	17,466	15,842
Union Iron Company, Detroit	6,000	8,758	8,782	11,826
Peninsular Iron Company, Detroit	5,293	9,207	9,903	9,515
Bangor Furnace Company, Bangor	12,041	8,361	7,696	
Elk Rapids Iron Company, Elk Rapids	17,484½	14,888	15,739	20,181
Spring Lake Iron Company, Fruitport	17,768	18,381	14,811	20,376
Jackson Iron Company, Fayette	10,581	13,325½	14,706	12,069
Vulcan Iron Company, Newberry	17,360	11,854	16,580	16,699
Deer Lake Iron Company, Ishpeming	10,896½	10,165½	8,717	10,168
Iron Cliff Company, Negaunee, Pioneer	11,079	18,797	23,285	24,678
Antrim Iron Company, Mancelona	9,414	16,240	18,158	22,958
Pine Lake Iron Company, Ironton	5,079	10,842	12,320	12,529
Martel Furnace Company, St. Ignace	7,096	10,890	9,552	
Gogebic Furnace Company, Iron River		3,700		
Total	148,052		187,095	198,745

ADDITIONAL MINE ACCIDENTS.

The following information was not obtained until too late to have it appear in its proper place with the summaries of the other Inspector's Reports:

IRON COUNTY—ELISHA MORGAN, *Inspector*.

List of killed and seriously injured in mines in year 1889:

Dominic Codell, in Dunn Mine, by fall of rock, May 22, 1889; two men injured, but not killed, at Iron River Mine.

GOGEBIC COUNTY—J. PARKE CHANNING, *Inspector*.

Total number killed in mines in Gogebic, Mich., from Sept. 1, 1888, to Sept. 1, 1889, 24

Classification of Fatal Accidents.

Nationality.		Nature of Accident.	
English	4	Fell down shaft	7
Swedes	7	Fall of ground	8
Finlanders	3	Explosions	3
Italians	3	Fell off timbers	3
Irish	3	Simple falls	2
Austrian	3	Riding in skip	1
Canadian	1	Blown down from cave	1
Total	24	Total	24

Occupation.		Mine.	
Miners	14	Colby	6
Trammers	7	Palms	4
Timbermen	2	Ashland	3
Shift Boss	1	Norrie	2
Total	24	Pabst	2
		Mount Hope (Iron King)	2
		Anvil	1
		Aurora	1
		Ironton	1
		Explorations	1
		Total	24

ERRATA.

[original document]

Page 87, Josiah Hull should read Josiah Hall.

Page 93, All were Bessemer hematites, should read *non*-Bessemer.

Pages 108 and 109, McKibbon Bros, should read McKinnon Bros.

Page 98, James Hoskins should read James Haskins.

Page 104, Frank Corbis should read Frank Carbis.

Page 106, N. B. Hulst should read N. P. Hulst.

Page 134, James McMiller should read James McMillen.

Page 152, Thomas Waters should read Thomas Walters.