STATE OF MICHIGAN,

MINES

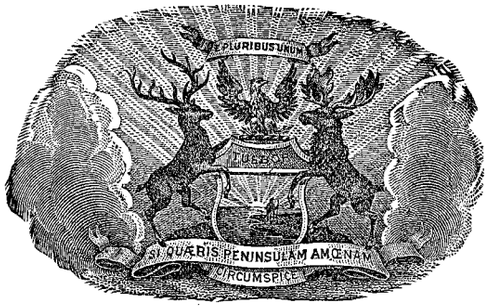
AND

MINERAL STATISTICS

BY

CHAS. D. LAWTON, A. M. C. E.,

COMMISSIONER OF MINERAL STATISTICS.



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STATE OF MICHIGAN,
OFFICE OF THE COMMISSIONER OF MINERAL STATISTICS,
Lawton, Michigan, June, 1889.

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.

INTRODUCTORY NOTE.

In a scrap book I have a clipping, cut from a Detroit paper twenty years ago, in which the writer states, to quote his own words, "We want to know more about the Upper Peninsula; how rich its ores are, how they lie, where they are to be found, and what chance there is for working them." "We want more definite and satisfactory knowledge about the mines in that region." "There are fifteen or twenty copper mines in the Keweenaw peninsula, but very few persons have any definite information about them." "At one time we hear of their surpassing richness, what masses of solid copper are taken from their depths, and what a large percentage of silver." "And thus, when encouraged to expect a dividend on shares already held or be led to invest our savings that we may become shareholders, we are again told that the machinery is idle, that the workmen are discharged, and the locations are becoming a desert." "There are not fifty men in Michigan today who can be sure that it is safe to invest money in the copper mines or in the iron mines of this State." "We want to know all about these mines ourselves, and we want to make them known to the world." "We want to invite foreign capital to aid in developing our resources, and to give definite information." "We want to know, not only the extent and richness of the ores and other minerals, but also whether the land is worth anything without the minerals, or if it ever will be." "This region, the northern peninsula of Michigan, lies directly in the track of the Northern Pacific Railway, on which the future course of our empire is to run, and therefore it behooves us to know something about it."

The knowledge asked for by this writer many years ago is, in substance, the information which I have endeavored to impart in this and in previous reports.

In a mineral region like ours that is constantly developing and each succeeding year is assuming greater importance, there cannot, in the nature of things, be such a matter as a finality of information. All science is cumulative, and this is especially true of mineral exploration, mining and geological work. Practical results are attained by the slow and laborious accumulation of facts. Every fact is a stepping-stone, but it takes many, and these

carefully weighed, to furnish the data for true conclusions. It is my effort to investigate the facts from year to year that are brought to light in exploring and mining work in this State, and to arrange and chronicle them in convenient form for present use and for future reference.

There is a vast amount of money expended annually in the Upper Peninsula in exploring for mineral; some of this work is successful, much of it proves abortive; but in any event there are in many instances valuable scientific facts developed which it is important to preserve. They are generally useful now, and are sure to be wanted in the future. They form the nucleus for the subsequent aggregation of similar facts.

It has been my purpose to set forth in a concise and reliable form such information regarding the mineral resources of the State as I have judged would be of most practical value, such as shall enable any one to form definite and correct views of our vast and rapidly developing mineral wealth. I do not expect to produce an exhaustive report, but I visit annually every mine in the State, and have within the past year been under ground and examined, with scarcely an exception, every mine and exploration that is in operation; some of them more than once—several times. I mention this to show that the report is not made up from hearsay. It is altogether written out from my own notes of observations made on the ground. As heretofore I have gathered full statistics of products, and have reported to the Auditor General such as are subject to specific taxes and the amounts to be paid thereon.

CHARLES D. LAWTON,
Commissioner.

THE COPPER INDUSTRY.

has experienced the extremes of fortune within a brief period. Nevertheless, the year 1888 was an unusually profitable one for the copper mines of our State, as is evident from the fact that the seven leading mines paid an aggregate of dividends to their stockholders during the year of $3,500,000.

From about the close of the year 1884 to December, 1887, the market value of Lake Superior copper in New York ranged at about 11 cents per pound —sometimes at 10 cents; and during 1887, previous to December of that year, the price scarcely got above 10½ cents. Naturally so long a period of very low prices was damaging to the interests of the mining companies. Our copper mining companies are used to the practice of economy. They have learned to trace the cost of the, apparently, most insignificant items, and are equal to moderately depressed periods. That is, they can easily survive a time of low prices if not too long endured. But 10 or 11 cents per pound is too low a market price for copper for all but a few of the mines to work at all. The Calumet and Hecla, Tamarack and the Quincy, being richer mines, can be worked at a profit with copper even at 10 cents and even less; but with the others such a condition of the market forces them to the wall. The margin is too small to insure them profit and prosperity. But in December, 1887, the price of copper advanced to 17 cents, and subsequently, through the action of the French syndicate, that was formed to control the copper production of the world, the price was maintained at above 16 cents throughout the year. The outlook for the copper producers seemed very bright, since the syndicate, holding apparently unlimited resources, had entered into contracts with the mining companies for their products for three years from May, 1888, at the minimum price of 13½ cents per lb.; all the net amount derived from sales at prices above that, to be divided equally between the companies and the syndicate. The syndicate seemed to have all the financial ability necessary to maintain its contracts. The future could be forecast pretty accurately, that is, so far as the production and consumption of copper is concerned; but, unfortunately, the market price of copper was maintained at so high a figure as to greatly stimulate production and to diminish consumption. The result was that at the close of the year 1888 there was an estimated surplus of copper in our markets, unsold, of 78,000,000 of lbs., against about one-half of that amount on hand at the end of the previous year.

Soon after January 1, 1889, it became apparent that the syndicate had a bigger load than it could carry, that unless something was done to

relieve its responsibilities it must inevitably succumb to the pressure of the unfortunate conditions, which foreshadowed its ruin. Much has been said, many plans suggested, but what was really done to relieve the situation, if anything at all, is of no consequence now—March 20—since the syndicate has collapsed. Naturally there is considerable loss somewhere, though it is believed that it falls largely on the syndicate itself. The mining companies that sold their copper at a large price, and received their pay, cannot be sufferers, so that the greatest part of the loss must fall on the French people who were the holders of the stock of the syndicate. The contracts were all made in the name of *Societe des Metaux,* and the outcome is that the society is probably utterly ruined. And in the unfortunate collapse of this most important copper manufacturing concern is also involved the bankruptcy of the Comptoir d' Escompte, which, with a single exception, is the largest banking concern in France.

Besides these there is much embarrassment even if not utter ruin in other lesser establishments.

The syndicate has had an existence of about ten months; it took all the copper on hand in this country at the time, so that it absorbed and controlled all the copper production of 1888. It has been the means of promoting the temporary prosperity of the copper producers, and has, no doubt, enabled them to recover, in part, from the effects of the previous year's depression, It has stimulated the opening of new mines to some extent, and the greater development of those already in operation.

The great rise in the price of the stocks has no doubt enabled some people to make money. Those who bought before the advance in prices and who sold before the decline have profited by the circumstances; but those who sold their stocks and who perhaps bought when the price was up will now chew the bitter cud of disappointment and reflect on the mutability of human expectations. This combination to control the copper production of the world has held a large share of public attention everywhere. It created an abnormal condition that in the nature of things could not long endure. The inevitable tendency of its course was to increase the surplus of copper in the world and finally to augment its proportions so greatly as to make it beyond the ability of any combination of capital to carry it. On the whole I do not think it has been of advantage. Experience is worth something, and it has helped in that way. Mining companies have received more for their copper, etc., and have been able to pay larger dividends and to make needed improvements, etc. On the other hand, money has been advanced under the stimulation of high prices and the expectation of their continuance, to start up mines that cannot now be profitably worked; men have invested in stocks

at prices which cannot, probably, again be realized, and thus they are losers.

The consumers have been forced to pay a price for the metal which was beyond its legitimate value—a price that was maintained by the *fiat* of the syndicate. It is useless to speculate what the result will be. The mining companies of Lake Superior are not likely to be sufferers beyond the falling off in price. They are not involved in the ruin only to that extent. They must keep on as before, and take for their copper such prices as they can get. Copper, like everything else, must take its chances in the world's markets, and I do not think that the copper men of our State ask for or expect anything else. They were willing to accept whatever of good fortune might come, but to my knowledge there are men connected with our large copper mines who deprecated the action of the syndicate in placing the price of the metal so high, and who predicted the result which has arrived.

I read a private letter written by the agent of a leading copper mine in this State, last July, in which he accurately portrayed what has since transpired in the copper world.

It would seem to be demonstrated that a market price of 10 to 11 cents per pound for lake copper will not result in sufficiently keeping up production while an abnormally great price will stimulate an over production. Under the low prices of 1885, '86 and '87, a condition of the market was finally reached when the inevitable law of supply and demand caused the advance in the market. The first ten months of 1887 the average price was but 10½ cents, but in December it had gone up to 17 cents, a price which was afterwards sustained by the action of the syndicate. The syndicate controlled 80 per cent and upwards of the copper of the world and thus could dictate what the price should be. The contracts with the mining companies varied somewhat, but in every case the syndicate fixed the market price.

It seems strange that a scheme of such magnitude, organized with so much openness and care; a plan requiring such a vast combination of capital, which was secured, and so much financial ability, should have so quickly collapsed. And that its ruin should have been caused by inherent weakness, by the continuance of a policy of abnormally high prices that any tyro could have foreseen, would bring about the result that has transpired. The ability, which could combine so much, one would have supposed, would have been sufficiently far-seeing in its policy to have avoided being stranded on shoals whose position was so obvious. It overreached itself by making the profits of copper mining too great, thus too greatly stimulating production and causing a diminution of consumption resulting in a constantly increasing surplus of the metal which it was obliged to take and to hold. No combination of capital, however large, could long sustain such a strain.

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Dividends paid by Lake Superior Copper Mines in 1888, and the aggregate dividends of those companies.

Name of Company.	Dividends in 1888.	Total Dividends to date.	Market Value of stock, Jan., 1889.	No. Shares of stock.
Calumet and Hecla	$2,000,000	$31,350,000	$29,800,000	100,000
Atlantic	120,000	480,000	720,000	40,000
Central	70,000	1,890,000	400,000	20,000
Franklin	160,000	800,000	640,000	40,000
Osceola	150,000	1,172,000	950,000	40,000
Quincy	360,000	4,970,000	3,400,000	40,000
Tamarack	640,000	640,000	6,280,000	40,000

The following valuable tables are largely taken from the Engineering and Mining Journal of N. Y., published in its issue of January 12, 1889.

Copper Production of Arizona.

	1884.	1885.	1886.	1887.	1888.
Copper Queen	7,700,000	6,721,535	3,800,000	5,945,550	9,379,949
Old Dominion	7,400,000	4,688,640	4,567,665	1,444,770	4,870,000
Arizona Copper	3,760,000	6,832,880	5,250,000	5,714,600	7,133,188
Detroit	2,940,000	3,456,000	2,135,000	4,404,321	5,420,224
United Verde	3,680,000	.....	.....	272,124	3,200,000
Other mines	1,254,345	1,007,301	.....	.....	3,196,639
Total	26,734,345	22,706,366	16,000,000	17,790,000	32,200,000

Copper Production of Montana.

	1884.	1885.	1886.	1887.	1888.
Anaconda	23,000,000	36,000,000	33,267,864	57,000,000	63,245,473
Parrot	9,300,000	9,809,000	10,000,000	10,000,000	10,750,000
Boston-Montana	6,600,000	7,500,000	500,000	1,500,000	18,273,667
Liquidator	.....	.....	1,500,000		
Clark's	600,000	10,000,000	7,000,000	7,100,000	700,000
Butte Reduction Works	2,000,000	2,500,000	1,700,000	1,565,000	3,521,565
Williams	.....	1,200,000	2,000,000	1,500,000	*1,488,000
All others	1,593,054	798,864	1,643,621	.....	521,295
Total	43,093,054	67,798,864	57,611,485	78,700,000	98,500,00

* The Colorado Smelting and Mining Company.

Summary.

	Pounds.		Pounds.
Lake Superior	86,840,000	Domestic production	231,000,000
Arizona	33,200,000	From imported ores	5,000,000
Montana	98,500,000		
New Mexico	2,000,000	Total production	236,000,000
Colorado	3,000,000	Stocks December 31, 1887	40,000,000
Utah	2,500,000		
All other sources	4,960,000	Available supply	276,000,000
Deduct exports in ore, matte, ingots, etc.		78,000,000	
Consumption in 1888		120,000,000	198,000,000
Stocks on hand December 31, 1888			78,000,000

The quantity of electrolytic copper produced was about 17,000,000 pounds.

Copper Production of the United States.

	1882.	1883.	1884.	1885.	1886.	1887.
Lake Superior	56,982,765	59,702,404	69,353,202	72,148,172	79,890,798	75,471,890
Arizona	17,984,415	23,874,963	26,734,345	22,706,366	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	869,489	823,511	59,450	79,839	558,385	283,664
California	826,695	1,600,862	876,166	496,028	430,210	1,600,000
Colorado	1,494,000	1,152,652	2,013,125	1,146,460	409,306	2,012,027
Utah	605,880	341,885	265,526	166,199	500,000	2,500,000
Wyoming	100,000	962,468	.....	.....	.....	.....
Nevada	350,000	288,077	100,000	8,871	50,000	.....
Idaho	.....	.....	46,667	40,381	.....	.....
Middle States	294,695	324,706	232,114	190,000	.....	.....
New England	1,555,000	612,124	904,423	211,602	315,719	200,000
Southern States	400,000	395,175	317,711	40,199	29,811	.....
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	6,056,841	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

The home consumption of copper amounted to about 120,000,000 lbs. Total domestic production 231,000,000 lbs. The total value of raw and manufactured copper exported from the U. S. in 1888 was about $11,500,000.

Average price per pound of Lake Copper at New York.

Year.	Jan. cts.	Feb. cts.	Mar. cts.	April. cts.	May. cts.	June. cts.	July. cts.	Aug. cts.	Sept. cts.	Oct. cts.	Nov. cts.	Dec. cts.	Year. cts.
1860	23¾	23⅞	23⅜	23¾	22⅞	22⅛	21⅝	21½	21⅝	21¾	20⅞	20	22¼
1861	19½	19¼	19½	19⅜	19½	18½	17¾	18⅜	19⅝	20⅛	21⅝	24¾	19⅛
1862	27½	26½	24	22¼	21⅛	21⅞	23½	24¼	25⅝	29⅞	31⅝	31	25¾
1863	33	36	34	30½	30¼	30¼	30½	30	31⅝	33⅜	36¾	38⅝	32⅞
1864	40⅞	41⅝	42	43¼	43½	46½	59¾	51¼	50	47½	48	49¼	46¼
1865	48¼	45	39¼	34½	32	29½	29⅛	31⅛	31⅞	32½	39⅛	42⅜	36¼
1866	40	36¾	32½	29¼	29⅞	32½	32¼	30⅝	31½	30⅞	28¾	27¾	31¾
1867	28⅛	27½	25¾	24	24⅛	24¼	25	26	26¾	24¾	22⅞	22⅝	25⅛
1868	22¼	23¼	23½	23¾	24⅛	23⅝	23¾	24⅛	23⅞	23½	23¼	24⅛	23⅝
1869	25	26½	25⅜	23⅝	24	22⅞	22	22½	22½	22⅜	22¼	21¾	23⅜
1870	21⅜	20⅞	19¾	19⅛	19	19¾	20⅜	20½	21⅛	21¾	22¼	22¼	20⅝
1871	22⅛	21⅞	21½	21½	21¼	21⅜	22⅛	22¾	23⅜	23½	24⅛	26⅛	22⅝
1872	27¾	28⅜	33	41¼	36½	33½	33¼	33½	33⅛	32⅛	31⅜	32¼	33
1873	34¼	34⅝	34¼	33¼	31⅛	29¼	27¾	27⅛	26	23½	22⅛	24¼	29
1874	24¾	24⅝	24⅜	24⅞	24¾	24⅜	21⅞	20	21⅛	21¾	21¾	23¼	23¼
1875	22¾	22¼	21½	21½	21½	22¾	22¾	23	23¼	23⅛	23	23⅜	22½
1876	23⅛	23⅝	22	22	21⅞	20	19¾	19	20	20¾	20¼	19¾	21
1877	19¼	19¼	19¼	19⅜	19⅛	19⅛	19	18½	18	17⅞	17⅝	17⅝	18⅝
1878	17½	17¼	17	16⅞	16½	16¼	16⅛	16⅛	16	15¾	15⅝	15⅞	16½
1879	15¾	15½	15¾	15⅞	16	16⅛	16	16⅛	16½	19½	21½	21¼	17⅛
1880	23	24⅛	23¼	21¾	19	18⅛	18½	19	18¾	18¾	18¾	19	20⅛
1881	19¼	19¼	19⅛	18⅞	18½	17	16¼	16⅜	17½	18⅛	18½	19¾	18⅛
1882	20¼	19½	19	18⅞	18⅛	18⅛	18⅛	18⅛	18⅛	18⅛	18	18	18⅛
1883	18	17¾	17¼	15⅞	15⅞	15¼	15	15	15⅛	15⅛	15	14⅞	15⅞
1884	14⅞	14⅞	14⅞	14½	14¼	14⅛	14	13⅞	13⅛	13	12¾	11⅝	13⅞
1885	11¼	11⅛	10⅞	11	11¼	11⅜	11⅛	11⅛	11⅛	11	11	11¼	11⅛
1886	11⅜	11⅜	11⅜	11⅜	10⅝	10	10	10	10½	11¾	12	12	11
1887	11⅝	11	10½	10¼	10	10	10⅜	10½	10½	10½	12⅝	17	11¼
1888	16¼	16⅜	16⅛	16⅝	16⅝	16½	16¾	16¾	17¼	16½	16⅛	16½	16¾

Fluctuations of Prices of Mining Stocks in Boston during 1888.

Name and location of company.	Par value.	January.		February.		March.		April.		May.		June.	
		H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.
Allouez, Mich.	25	2.50	1.50	3.00	2.00	2.13	1.50	1.75	1.25	1.75	1.00	1.13	.50
Atlantic, Mich.	25	15.50	12.75	20.00	15.25	19.00	17.00	18.00	17.00	18.00	17.00	18.00	17.00
Calumet and Hecla, Mich.	25	216.00	190.00	250.00	208.00	219.00	235.00	243.00	230.00	247.00	237.00	244.00	239.00
Central, Mich.	25	.....	.....	24.00	8.00	20.50	.....	.....	.....	20.25	.....	20.00	.....
Franklin, Mich.	25	15.25	13.00	17.00	14.50	16.00	13.00	15.87	12.75	15.50	14.50	15.50	12.13
National, Mich.	25	3.31	2.00	4.00	3.00	3.50	2.00	2.00	2.00	2.50	2.00	2.25	2.00
Huron, Mich.	25	5.50	5.00	5.50	5.00	5.25	4.25	4.75	4.00	4.50	4.25	4.50	4.00
Kearsarge, Mich.	25	7.75	5.25	8.88	7.25	8.00	7.00	7.25	6.25	7.00	6.00	6.75	5.50
Osceola, Mich.	25	25.00	20.00	27.00	23.87	24.25	20.50	23.00	19.00	23.00	20.50	21.50	18.25
Pewabic, Mich.	25	2.25	2.13	3.25	2.00	3.00	2.25	2.75	2.50	2.75	2.50	.....	.....
Pontiac, Mich.	25	.50	.40	.50	.25	.30	.25	.....	.....	.....	.....	.....	.....
Quincy, Mich.	25	64.25	60.00	73.00	61.75	71.50	68.00	70.00	67.00	77.00	69.100	72.63	69.25
Ridge, Mich.	25	3.88	2.00	3.00	2.50	2.00	1.75	1.75	1.50	.....	.....	.....	.....
Rockland, Mich.	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tamarack, Mich.	25	165.00	122.00	172.00	151.00	171.50	165.00	151.00	140.00	165.00	150.00	165.00	150.00

Name and location of company.	July.		August.		September.		October.		November.		December.		Sales.
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Allouez, Mich.	3.25	.63	3.13	2.13	3.75	3.00	6.13	3.38	5.63	4.00	4.50	3.75	123,926
Atlantic, Mich.	17.75	16.00	17.00	16.50	18.50	17.00	20.50	18.00	20.38	18.00	18.50	17.63	27,535
Calumet and Hecla, Mich.	271.00	239.00	275.00	265.00	299.00	265.00	320.00	293.00	324.00	255.00	300.00	258.00	19,182
Central, Mich.	20.00	.....	20.00	.....	19.00	.....	21.00	20.00	.....	.....	.....	.....	675
Franklin, Mich.	22.25	11.75	23.00	17.50	21.50	17.75	21.00	17.25	19.25	16.75	18.25	15.50	91,304
National, Mich.	3.50	2.00	4.50	2.75	6.25	4.38	9.75	5.00	9.00	8.00	9.00	7.50	58,510
Huron, Mich.	6.38	3.88	6.50	5.00	6.00	5.00	8.00	4.75	7.50	5.50	6.25	5.50	43,120
Kearsarge, Mich.	7.50	5.75	8.75	6.25	10.00	8.63	16.50	9.75	14.00	12.13	12.50	10.00	109,339
Osceola, Mich.	22.00	18.00	22.00	20.00	23.00	19.75	23.00	19.13	23.00	21.00	21.00	17.50	40,863
Pewabic, Mich.	3.00	2.00	3.63	3.00	4.00	3.50	5.75	4.00	6.50	4.75	6.00	5.75	27,840
Pontiac, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,665
Quincy, Mich.	75.00	68.50	75.00	72.00	85.00	75.00	90.00	83.00	88.00	84.00	86.00	79.00	13,729
Ridge, Mich.	.....	.....	1.75	1.31	2.50	1.63	3.00	1.75	2.25	1.50	2.25	2.00	29,029
Rockland, Mich.	.....	.....	.....	.....	.....	.....	1.50	.....	.....	.....	.....	.....	100
Tamarack, Mich.	165.00	152.00	174.50	163.00	187.00	173.50	183.00	175.00	182.00	170.00	175.00	156.00	7,623

In January, when it was known that there was a large surplus of copper on hand, and that this quantity was continually augmenting, public confidence in the stability of the syndicate became shaken, and thenceforward copper stocks continually depreciated in value until now, April 18, 1889. The Boston stock report is as follows:

Calumet and Hecla	$202 00
Franklin	9 50
Quincy	45 00
Atlantic	9 00
Allouez	1 00
Huron	2 00
Tamarack	105 00
Pewabic	3 00
Osceola	9 50
Kearsarge	5 00
National	2 00
Boston and Montana	28 00
Santa Fé	60
Ingot Copper	17 00

What will be the outcome in the copper situation it is impossible to tell. The mines are producing right along and holding their copper. They are waiting for events to shape themselves. Probably a conference will be had representing the general copper interests of the world, that will seek to adopt a uniform policy of production and sale that shall harmonize, as much as may be, conflicting interests.

No doubt that the plan that is the best is one that shall proportion production to consumption so that a living price for the mines will be naturally maintained. Twelve or thirteen cents per pound would be a fair price, and the mines could prosper on that, and would be satisfied. The solution of the problem rests with the large producers, and they are few in number. The smaller producers, those mines in low grade rock, are of equal importance to the laboring class, for they employ as many men and pay as good wages as the richer mines. A policy that shall sustain the weaker companies, that is the companies that have demonstrated their right to exist, is the best one. The Calumet and Hecla and the Atlantic, for instance, are so far apart in richness of rock that it would seem at first glance impossible to harmonize their interests, but the latter can live and make a little money when the other could prosper and make a great deal. The consumption would not be lessened were the market price fixed at say 12½ cents per pound, and such mines as are worth working, under the circumstances, could keep even with the world and make a little money.

It would be exceedingly short-sighted policy, it seems to me, for the mining companies, having once effected a combination and learned its value, to sacrifice all the advantages and benefit of it. It would be ruinous for them, in the present glutted condition of the market, to keep up the maximum production and to throw the copper upon the market and still further weigh down what even now cannot be floated without the control that holds. The syndicate lived up to its promises and contracts to the last. It never appealed for help. It seemed to inspire a certain amount of confidence from the very fact of the brave face it maintained to the world. One can scarcely realize that it has collapsed. Some preliminary signs of dissolution were looked for, some efforts made for recovery; but the great copper combine held out to the last and gave up without a struggle.

ONTONAGON COUNTY MINES.

FEBRUARY, 1889.

Just now Ontonagon county seems to be rather quiet, especially at the villages; many of the men are in the woods on homesteads or cutting and drawing logs for the Diamond Match Co.

At nearly all the mines in the Evergreen range a few men are working and, for the effort made, are obtaining good results; but the properties here are too restricted for the modern methods of copper mining on Lake Superior. There are mineral veins, so called, in this portion of the range that are fairly well charged with copper, in which it is reasonably certain that mines could be opened and worked to a profit. Both the Evergreen and Knowlton veins are well defined and wherever worked have yielded what is now considered a fair percentage of copper. In the former are the Evergreen Bluff and Ridge mines and both have yielded a good percentage of copper to the fathom of ground. The former has not, until recently, been worked for many years; but within the past year a party has obtained a lease of the property and pumped out the water from the mine and secured 23,888 lbs. of copper, all in mass and barrel work.

The Ridge mine is, comparatively with the mines in Houghton county, a small affair, but it has yielded in round numbers 2,600 tons of copper.

The Ridge, Evergreen Bluff and Merrimac are contiguous properties, so situated as to embrace all the known lodes in the district, and, combined, would comprise an estate that would be worth operating.

Still better than the Evergreen vein, doubtless, is the Knowlton, which has been the most extensively worked in at the Mass mine, and also explored to a more or less extent at the Knowlton, Ogima, Hilton and Belt mines.

The Mass is a small mine but it has yielded 2,500 tons of copper, and has

proved that the Knowlton lode is a good one. The mine afforded, regularly, a uniform yield of copper. Copper in large and small masses is found along the foot wall, and there is also afforded a good amount of stamp rock. Just now in the bottom of the Mass mine is exposed a fine run of stamp rock for which the men who are working it have no use, as the stamp mill is not available. The stamp mill was never a very effective affair at best, and having been unused for several years, it is much out of order. There are situations in Ontonagon county, and it may be true of other localities, where the soil is lacking in stability; becoming saturated with water it is like a semi-fluid, susceptible of movement as occasion offers. The location of the Mass stamp mill is of this character, on the level ground between the bluffs that border the valley. The water, which penetrates the soil, holds it in such partial suspension that the blows of the stamps tend to unsettle the foundations and also to gradually enable the water to penetrate beneath the dam and carry it away, which it has done several times, notwithstanding the precautions that were taken. The same difficulty was experienced at the new stamp mill at the National mine. It was found that the fine clay loam, when it was wet, had little stability, and it was with exceeding difficulty that foundations sufficiently permanent, were finally secured. Even then the floor of the washhouse, which had been constructed to rest upon the earth—properly "hammered"—with which the space within the exterior foundation walls had been filled, very soon settled out of place when the mill was started up. The soil became like wet mortar and necessitated the raising of the floor timbers into place and the building of a stone foundation through the center.

The Mass and Knowlton are contiguous mines, the former on the east; and still further east joining the mass is the Ogima. These three mines, with the Hazzard, which latter the Mass company already owns, if combined under one management, would make a fine mining estate. Thus consolidated and properly worked, there is every reasonable assurance that the enterprise would be a profitable one. The situation is admirable for economical working, and sufficient water for two heads of stamps and a good situation for a mill could be secured by going down the valley about a mile and a half to the Flint Steel river at the point of its junction with the several streams that are the drainage outlets of this portion of the range.

At the Hilton four men are working on tribute in the Knowlton vein, and have a good showing of copper now.

At the Adventure three men have a lease of the mine and are putting up a Krause pneumatic stamp and separator, to work over the rock that was accumulated many years ago. They have their arrangements well under way.

It seems to be quite possible that the Belt company will resume work in

the Knowlton vein during the current year. An English gentleman, interested in the property, visited the mine not long ago and expressed himself as deeming it the part of wisdom to further explore the ground; so much money had been expended on the surface, it were probably better to go on and raise some more money to ascertain if something could not be found beneath it to pay for all the outlay. He is endeavoring, it is said, to carry out this plan.

Of course the chief mining interest in the Ontonagon district at present is

THE NATIONAL MINE,

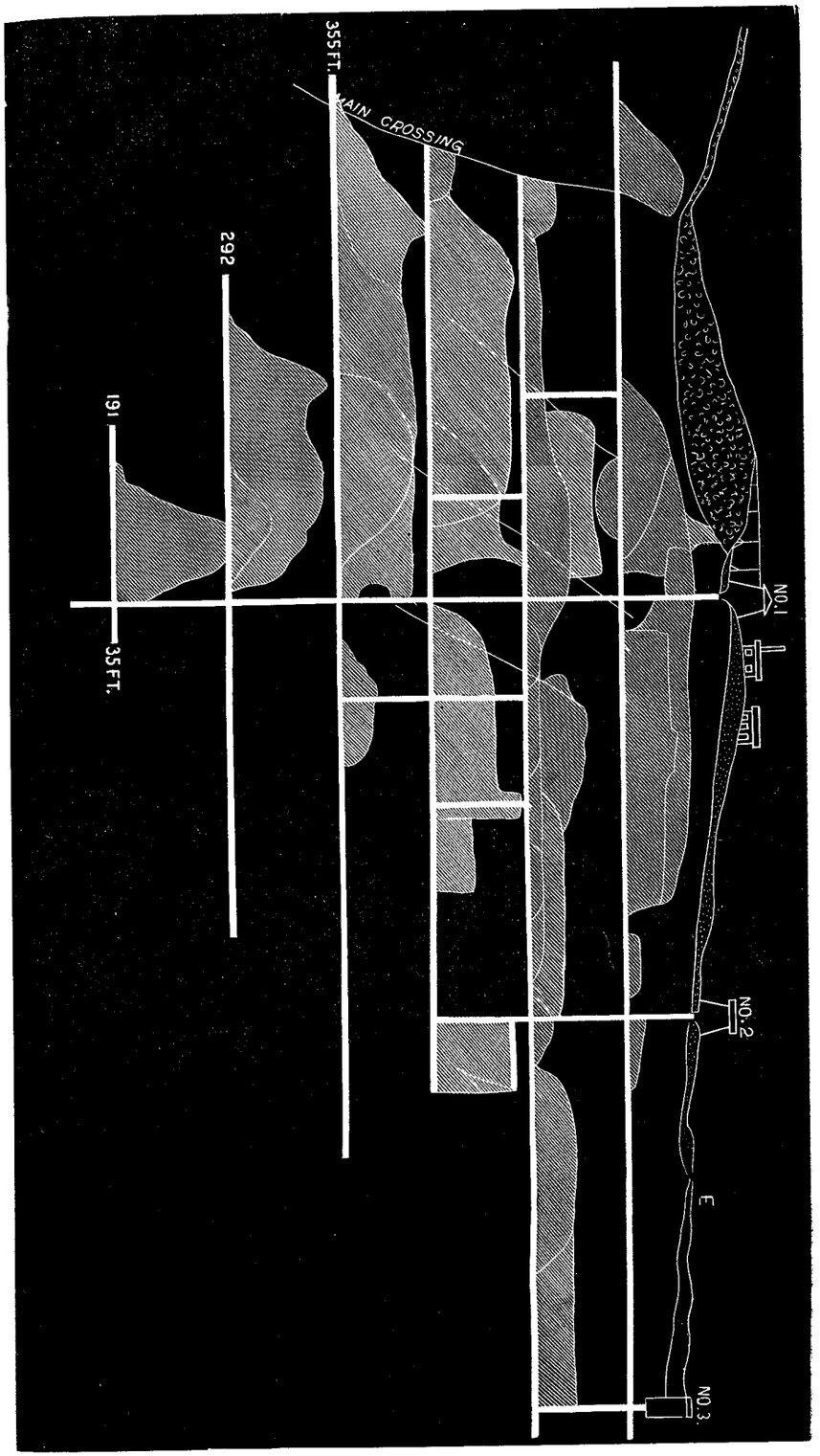
which is now fairly on the tapis to be thenceforward a regular producer. The National is one of the old mines of the county, and was once a profitable one. It is conspicuous in the early mining history of the country as one of the few well managed and paying enterprises. The National was a large producer of mass copper; it proved profitable from the start, and the owners were called upon for but very little to open the mine, and in the end received back in dividends nearly $4.00 for every one which they had been called upon to advance. But little use was made of the stamp rock; in fact, in the vein which was worked not much stamp rock was found; it was nearly all mass and barrel work, meaning by the latter the small pieces of copper obtained, which were too small to be included under the term mass. A portion of this mine proved very rich indeed, and the succession of great masses that were found here and in its neighbor, the Minesota, were among the marvels of this very wonderful country.

Naturally they served to stimulate effort to a high degree, and great mining activity prevailed throughout that region. Mines innumerable were opened and worked for a while, some of which absorbed a great amount of capital, but nearly all resulted in disappointment and failure. These two only, the National and the Minesota, situated side by side, are almost the only mines that redeem the mining history of Ontonagon county from a record of total failure; but the wealth of these two was of such a remarkable character that they can never cease to be of interest. The situation at the National is an exceedingly interesting and pleasant one. The topography is romantic and attractive; from the summit of the elevation at the mine the surface to the north slopes gradually downward and again rises, far away in the distance, and also inclining gently downward to the west. In this broad synclinal is situated the pleasant village of Rockland amidst the surrounding fields of well kept and productive meadow lands. To the west, from the east end of the mine, the ground soon descends rapidly, making a total fall of upwards of 600 feet to the level of the Ontonagon river, a distance away of one and

three-fourths miles; and beyond the river is exposed to the view a great expanse of the rugged and varied copper range, with its forests of pine trees and hardwood, its elevations and depressions, among which are reflected the lights and shadows of the setting sun as it disappears beyond the waters of the great lake that bounds the horizon in the west. A quarter of a mile to the south of the ridge, in which is the National mine, is the parallel and equally elevated peninsula bluff, and in the valley between these, through which courses the small stream on which was the former stamp mill, are placed the chief buildings of the company. It is the scene of the surface operations of the mine. Here are the agent's and other houses, office, shops and warehouse, etc., and a little higher up, on the side of the bluff, are substantial stone engine and boiler house, compressor house, machine shop and the new rock house, from which extends the track that conducts the cars to the head of the incline down which they speedily descend to the stamp mill.

The trend of the formation is north about 65° east and the dip about 54° northwesterly; the old mine is in a vein of contact that outcrops along the side of the southerly slope of the bluff, and which is contained between an underlying conglomerate and the overlying trap; the gangue of this vein is chiefly quartz, calc, spar and epidote, and has afforded, in times past, many fine specimens of all these minerals. It is usually known as the conglomerate vein, and sometimes it is incorrectly supposed that the conglomerate yielded the copper; but the copper was invariably the product of the vein. Sometimes the vein matter penetrated into the conglomerate, and masses of copper were obtained in such places; but not otherwise was copper found in the conglomerate. A prominent feature of the old mine was what was called the counter vein, a branch of the main vein, which extended diagonally, northwesterly, across the formation to intersect an amygdaloid belt that is situated 140 feet north of the conglomerate and runs parallel with it. This counter vein was also productive in copper, and especially so along its lines of intersection with the main vein and with the amygdaloid. In the vicinity of these lines of intersection, in the upper levels, were found the richest portions of the mine.

The mine was owned and operated during the productive period of its history by what is known as the Pittsburgh company; the same parties who also owned and operated the Cliff mine, etc., and more recently the Mass. In 1870, it having become probable that further operations at the mine would lead to the necessity of levying assessments, the company decided to discontinue work on company account and let the mine on tribute, and as a result of such work succeeded in obtaining $40,000 in dividends. Thenceforward the mine was allowed to fill with water, in which condition it remained until

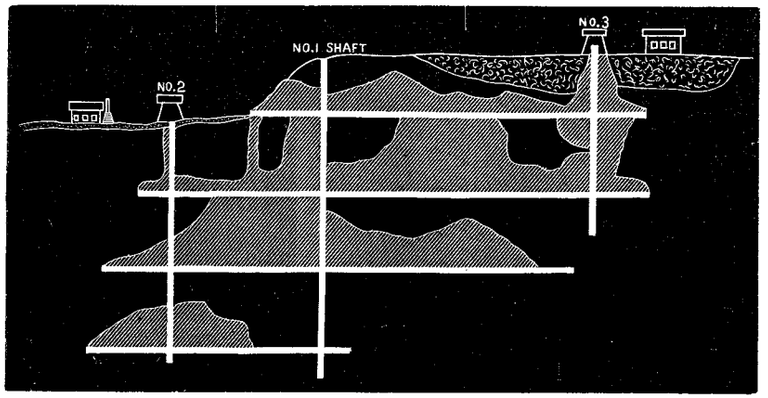


LONGITUDINAL SECTION OF THE MASS MINE, 1889.

Scale: 120 feet to an inch.

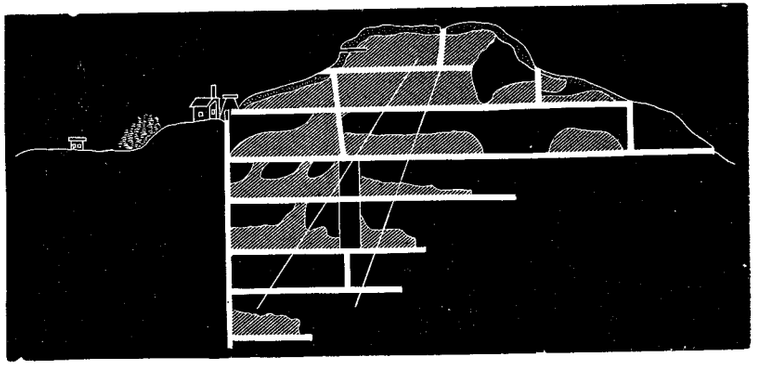
LONGITUDINAL SECTION OF THE KNOWLTON MINE, 1889.

Scale : 180 feet to an inch.



LONGITUDINAL SECTION OF THE EVERGREEN BLUFF MINE, 1889.

Scale: 250 feet to an inch.



1880, when the property having passed into other hands, work was resumed under the supervision of Capt. W. E. Parnall, the present local agent of the company. It will be remembered that Capt. Parnall undertook the task of restoring No. 2 shaft and of freeing the mine of water, a work which proved unusually difficult but which was finally accomplished. It was hoped that by sinking deeper and drifting on the vein better ground would be found than was afforded in the old bottom of the mine, especially near the line of junction of the veins; at the same time a shaft was sunk in the amygdaloid lode and some drifting done for the purpose of further proving its value and determining whether it possessed sufficient magnitude and richness to justify the erection of a stamp mill in which to manipulate the rock. As the amygdaloid is a stamp lode, and the former company possessed but very primitive and meagre facilities for stamping, the lode was never worked and thus was of undetermined value.

To further explore the mine, and for other ultimate objects, it was decided to drive a long adit horizontally through the mine from the westerly side of the hill, commencing at a point 645 feet below what is called the Creek shaft, the most westerly sinking made by the old company. This adit is 3,960 feet in length, and its mouth is 183 feet above the river and about 4,130 feet east from it, and is made to be the gathering place for the water used in the stamp mill.

The new stamp mill is situated 640 feet distant above this point, near Creek shaft in a spur of the ravine, which forms the bed of the creek where it cuts through the steep declivity on its way to the river.

The rocks in the valleys and along the river are, generally, covered with soil, principally clay that has been triturated by the mechanical forces of nature to a great degree of fineness, so that a good deal of excavating had to be done to secure the requisite firmness for the foundations of the stamp heads. The mill is 25'x60' and the wash-house connected with it is 142'x30', well arranged and substantially built. The stamp head—16" cylinder—is identical with those at the Huron; capable of crushing 175 tons per day—18 washing machines, wooden frames, and one slime table now in use. The water for manipulating the rock is at present brought from the river, where is a Gordon steam pump, size 18½ and 28x14x18. It draws the water from the river 17 feet, and forces it up into the mouth of the adit 4,130 feet distant and 183 feet rise, through a 12" pipe. The water runs through the adit towards the mill into the Creek shaft, where it is pumped up into the mill by a machine a duplicate of the one at the river.

The water for the boilers at the mill is brought from the Minesota creek,

from a point 1,000 feet away. To secure a channel for this water a tunnel 310 feet long was cut through an intervening ridge.

A dam has been nearly completed across the valley nearly opposite the rock house, which will, when done, secure a large pond—a reservoir of water that will probably suffice to supply the mill for a considerable portion of the year. It will be conducted to the mill in a launder. In addition, Capt. Parnall has nearly completed a launder that will re-conduct the water escaping from the mill to the adit, to be again used for washing the rock; in this arrangement suitable provision is made to free the escaping water of the sand held in suspension.

The rock from the shaft is run on an elevated trestle about 100 feet long to the rock house, whence, after going through the breaker, it drops into the bin and from thence is drawn into cars standing on the track beneath. The cars run by the force of gravity over the track 1,600 feet in length, which has a down grade of 2 3-10 inches in a 100 feet to the head of the incline, where they descend 141 feet in a distance of 1,075 feet, and thence on a level of 80 feet, run into the mill. The descending loaded cars of course draw up the empty ones, and the matter is regulated by a suitable brake. From the head of the incline to the rock house the cars are drawn up by a horse.

The ground was first broken for the mill in June last, and it was started the 5th of December following; but there has not been as yet, full regularity in its work; many interruptions have been met with in various ways, caused in some cases, by the inexperience or incapacity of employes and more recently through the failure of the pump at the river to perform its functions—a fault which has been remedied, and when I last saw the mine all the machinery and all the departments of the work were moving nicely.

It is a far more difficult matter to inaugurate a mining enterprise of this kind in Ontonagon county than it is on Portage Lake. There are no foundries, shops or supply stores there from which to get castings, machinery or materials. Such things must be ordered from abroad, and without railroad connection there is much trouble and delay.

There are comparatively few skilled workmen, machinists, builders, firemen, etc. Men for important departments of such work must be brought in from elsewhere and cannot always be had at a few moments' notice; when it is desired to push the work rapidly forward, it may not be possible to obtain the proper men to do it.

All these difficulties Capt. Parnall has experienced in a full measure, in his recent operations at the National. Happily he is nearly "out of the woods and can now see daylight," as the saying is, and can enjoy a "let up" of his anxiety. I can see no reason why, from this time on, the National

should not have a uniform product of copper. The rock that comes up from the mine and goes to the mill is certainly well impregnated with copper. It is mostly a greenish colored amygdaloid, with copper well distributed through it.

The rock that they will treat will average, probably, 1 % to 1¼ %, and the mill will work up 150 tons per day. Should copper remain at 14 cents, they will more than meet expenses, certainly.

To get 1 % I think that they must select the rock, that is, must open well and stope only the good, and leave the poor rock standing in the mine.

All the rock has come from the openings, shafts and drifts, and there are many thousands of tons on hand now, which I inspected somewhat and was favorably impressed with. These burrows are conveniently placed for economic handling. A portion of the rock is beside the track and a slight further extension of the latter can be made so that all the rock may be crushed and easily loaded into cars. The exposure of the rock to the atmosphere, some of it for several years, has served in a measure to disintegrate it, or at least to tend to render it friable and more easily ground under the mortar.

The shaft is sunk to the depth corresponding to the 6th level in the old mine, about 100 feet from the surface on the dip of the formation. The bottom level is about 150 feet in length each way from the shaft, and the others are of much greater extent. The vein is narrow in portions of it, but sometimes expands to a width of 20 feet. Capt. Parnall states that it will average about 8 feet wide. The productive portion of the belt is between the intersection of the counter vein and the amygdaloid east of the Minesota boundary.

The length of this productive ground increases rapidly with each successive level downward, owing to the fact that the lines of intersection of the vertical plane through the boundary and the plane of the counter vein get farther and farther apart as greater depth in the lode is reached. Its length in the adit level is about 1,200 feet and increases in length about 150 feet in each lift downward.

The adit is in the 5th level—3,960 feet in length, driven in the conglomerate vein. Two crosscuts were made from the adit to the amygdaloid. The first one of which was driven at a point in the mine 600 feet east from No. 8 shaft; and the second one was made at a distance of 1,200 feet east of the shaft. This shaft is 2,275 feet west from No. 2, or 1,040 feet east of the Creek shaft or of the new stamp mill, and is 1,685 east from the mouth of the adit. At these crosscuts the amygdaloid belt was explored somewhat and was found to be worthless.

The amygdaloid is opened in four levels, designated respectively as the 20, 40, 50 and 60, and the shaft is on its way to the 70—twenty feet further down.

When the workings in the amygdaloid become deeper than the old mine, the latter can be reached and readily tested further down by means of cross-cuts, south from the amygdaloid, a much cheaper proceeding than further sinking No. 2 shaft. And it is nearly certain that mass copper will be found along the line of the crossing and counter vein, which were formerly so rich and productive in the upper levels, but gradually became poorer and unprofitable lower down, never, however, entirely failing to yield some copper.

The mine is well equipped every way. The houses and other buildings, old and new, are in good order. The engine and boiler house, at the mine, are of masonry and founded upon the rock. The new rock house has a foundation of masonry, upon two sides, 40 feet high, and the shaft houses, built by Capt. Parnall, are of the best. There is a powerful hoisting engine, a new Norwalk compressor, etc., etc., sufficing for all present demands. Some changes in the arrangements of the buildings are contemplated, which, when ultimately made, will be advantageous—as, for instance: Capt. Parnall suggests the building of a new engine house south of the rock house opposite the shaft, where water can be run into the boilers from the dam, and to use the present house for a machine and blacksmith shop.

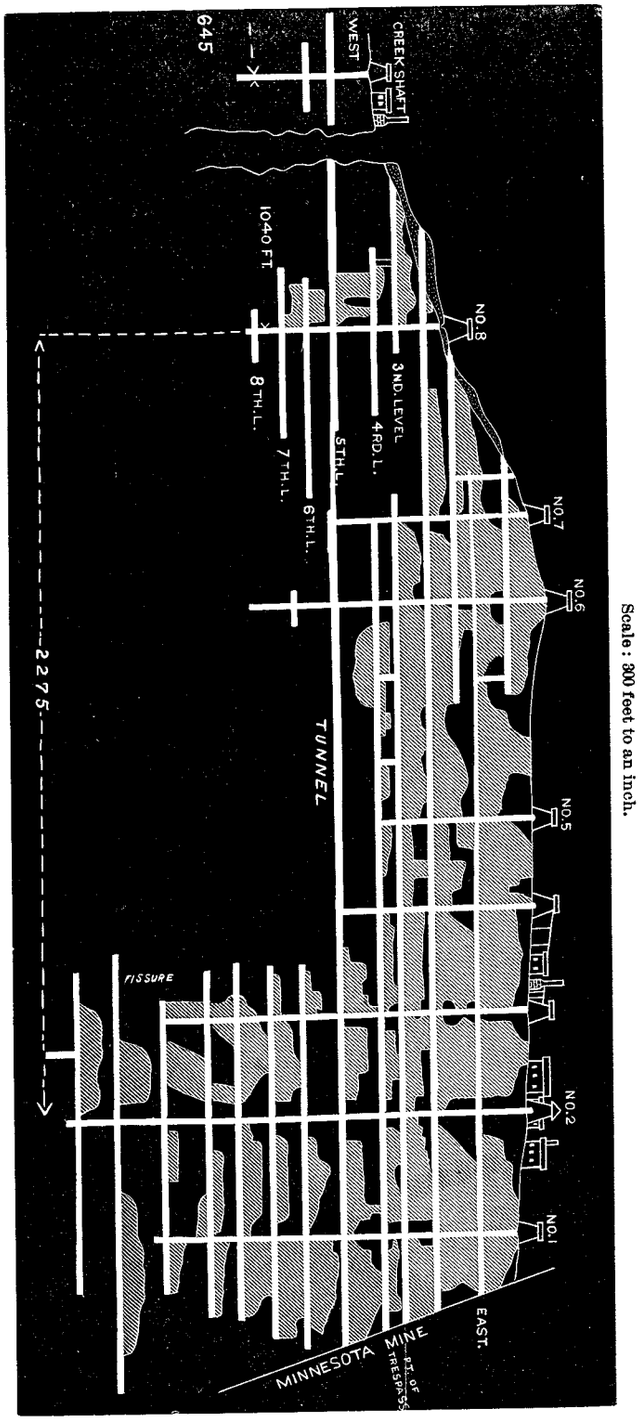
When the spring opens and the dam shall be completed, and the water be conducted to the mill in a launder, there will, of course, be a great saving of fuel, and other matters may be perfected tending to diminish cost and increase production.

So that looking over the whole situation, the efficiency of the machinery, the convenience of handling the rock already broken and hoisted, it would seem that the company should be able to produce copper cheaply. If the rock averages 1 % ingot, which is a safe estimate, and they manipulate 150 tons per day, as they may readily do, there will be a product of 3,000 lbs. per day, which, if it sell at 14 cents will give a gross income of $420, or for 26 days $10,920, which, after deducting all costs, should leave a margin of profit.

Capt. Parnall, the superintendent, is an energetic and intelligent mining man. He has been a miner from boyhood, and is fully equal to all demands upon his experience and ability that are required at the National. While there may have been delays in the work, they were inevitable to the situation, and have terminated as soon as energy and skill could accomplish it. Since the present plans were determined on by the company, he has labored incessantly to bring the enterprise to a successful termination, and one must

LONGITUDINAL SECTION OF THE NATIONAL MINE, 1889.

Scale: 300 feet to an inch.



"put himself in his place" to appreciate all the difficulties he has had to encounter and overcome.

Mr. Benj. F. Chynoweth continues to have charge of the books, etc., at the office.

Statement of Products of Mines in Ontonagon Connty in 1888, and for Previous Years.

Name of Mine.	Product in 1888.		Aggregate Production.	
	Tons.	Pounds.	Tons.	Pounds.
Adventure			590	57
Aztec			353	683
Caladonia			188	1,588
Carp Lake			15	1,135
Douglass			84	1,502
Evergreen Bluff	13	888	694	1,835
Flint Steel River			415	458
Hilton	7	631	52	1,046
Belt			333	1,772
Knowlton			323	1,993
Lake Superior			7	921
Mass	35	944	2,446	1,730
Minesota			17,352	668
National			5,453	1,764
Nonesuch			181	1,777
Norwich			496	1,360
Ogima			491	308
Trap Rock			20	1,185
Ridge	25	890	2,596	1,956
Rockland			3,105	309
Superior			283	1,331
Toltec			206	1,433
Victoria			186	1,279
Windsor			34	

ATLANTIC MINING COMPANY

maintains its record for economical work. Its rock yields a lower percentage than that of any other mine except the Copper Falls, and since 1878 the company has not failed to pay an annual dividend of not less than $20,000, and in 1887 $60,000, in 1888 $120,000. The average yield of copper to the ton of rock, last year, was but 13 lbs. The falling off in percentage is attributed by

Capt. Tonkin to the rock in the north end of the mine being less rich than formerly, or to the fact that they have been using more of it than heretofore, and that it is less rich than the rock from No. 3 shaft.

Some changes have been made in hoisting in the last year that are important to note. They have introduced a counter balance in each of the shafts.

The counter weight is simply a flat mass of iron weighing 7,000 lbs., with a hole through it to insert iron to increase the weight, if desired. The axles for the wheels extend through the mass, and the whole runs on a narrow track beside the other, the whole length of the shaft.

At No. 2 the hoisting machinery is in a small building that has been moved up to opposite the shaft. The boiler, two small engines and drums, all in the same room. One man attends to the whole, one man for each shaft, and Capt. Tonkin states that two cords of wood suffice for 24 hours. The drums are made at the mine. Skip part 12′ diam., and counter weight portion, 11′, weight of load 1½ tons of rock. Shaft now to 13th level. It is a simple enough hoisting plant, and, from Capt. Tonkin's statement, a very economical one. The Atlantic is probably the poorest copper mine in the world, that is profitably worked, and the good results are not secured by any large investments in new machinery. They do their work with the same hoisting drums and engines that were in operation away back in the days when all was failure and the mine was known as the South Pewabic. They splice the arms of the drums to increase the diameter and so save the cost of new ones. They face the wire rope schives with wood, properly grooved, because the U section iron facing wears the ropes more, and it costs more to buy ropes than it does to relay the schives. Capt. Tonkin declares that the engines at No. 2, which are 12″ x 18″, could not haul up the load 1½ tons, 1,300 feet maximum, without the aid of the counter weight. They have a model, from which a drum is making, designed by Mr. Frank Stanton, that is intended to balance the skip and counter weight at any point in the shaft.

No. 1 has a similar plant, similar to No. 2, equally simple and effective.

In the old hoisting house, near No. 4 shaft, one of the drums has been in use 10 years without change or repairs. It was made at Norristown, Pa., in an early day. The other, a duplicate of it, manufactured elsewhere, has been changed three times. Capt. Tonkin attributes the failure to last to want of attention given in construction to the necessity of allowance to be made for expansion and contraction. He thinks that the old drum is properly constructed in this respect, hence its durability.

One-half of a compressor has been added, made at Cleve's foundry, Houghton.

In the rock-house, by a slight change in the setting of the jaws of the large Blake crushers, they are made to do all the work, to break the rock to sufficient fineness without using the small breakers. Capt. Tonkin states that he thus saves $150 per month.

The rock-house is at the south end of the mine, a half mile south of No. 1 shaft; an elevated trestle extends all the way from the rock-house to the shaft. From No. 3 shaft south to the rock-house the track is double, and the rest of the way it is single.

The car starts at No. 1 with a skip load and stops at No. 2 for another skip load, when it goes on to the rock-house. The same way with Nos. 3 and 4—one car takes two skip loads each trip.

The cars open and discharge automatically at the rock-house. There is no delay. All the arrangements for filling, running and discharging the cars are excellent, and I have no doubt but the whole matter of the conveyance of the rock from the shafts to the rock-house, is as well accomplished as the situation will admit of. It only seeme to me, however, that it would be cheaper to do away with this long trestle entirely, and to crush the rock directly at the shafts, having a rock-bin at each shaft, and to run the railroad track along by the shafts to receive the rock into the cars.

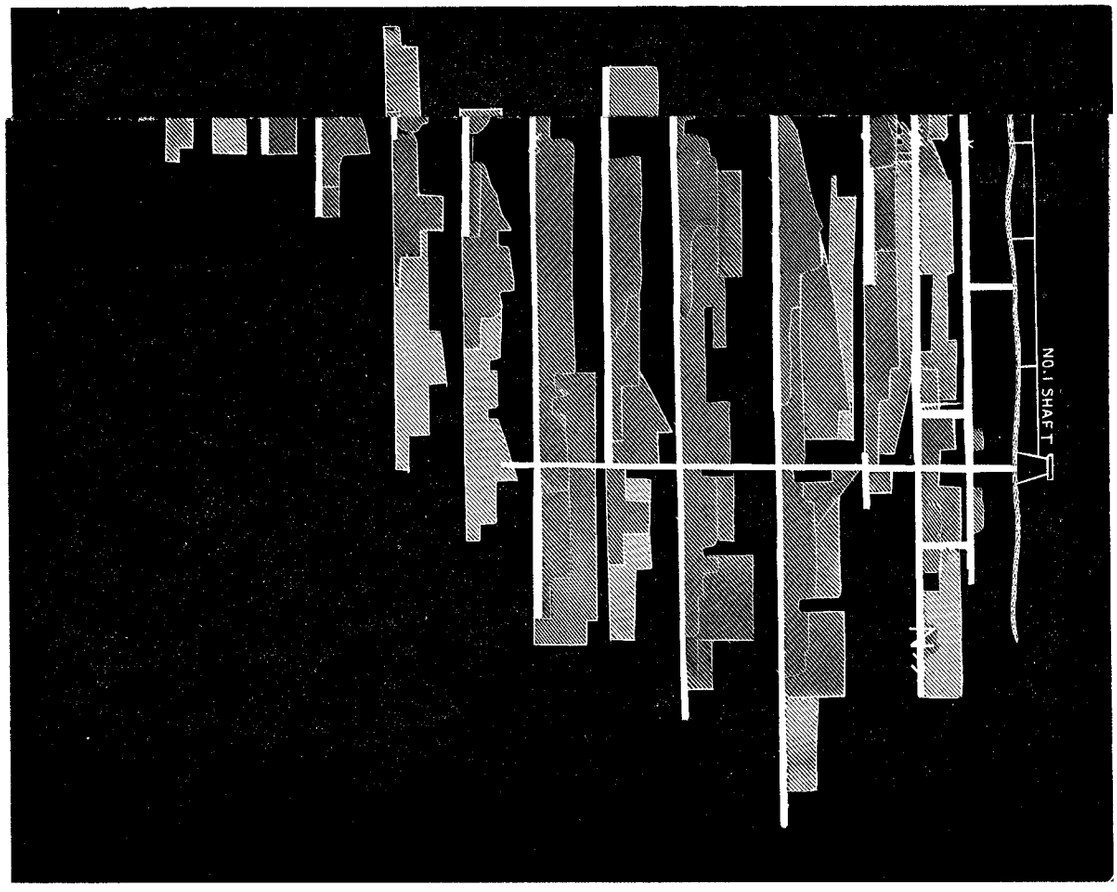
At the mill, they are experimenting a little in solid bottoms to stamp dies. They use blocks of wood 1′x1′x15″, planed smooth, and with those and mortar make it as solid as possible.

With the price of copper at 12 cents and upwards, the Atlantic, under its present good management, is a profitable mine.

The following table gives the important results of the Atlantic mine's operations for the past 14 years:

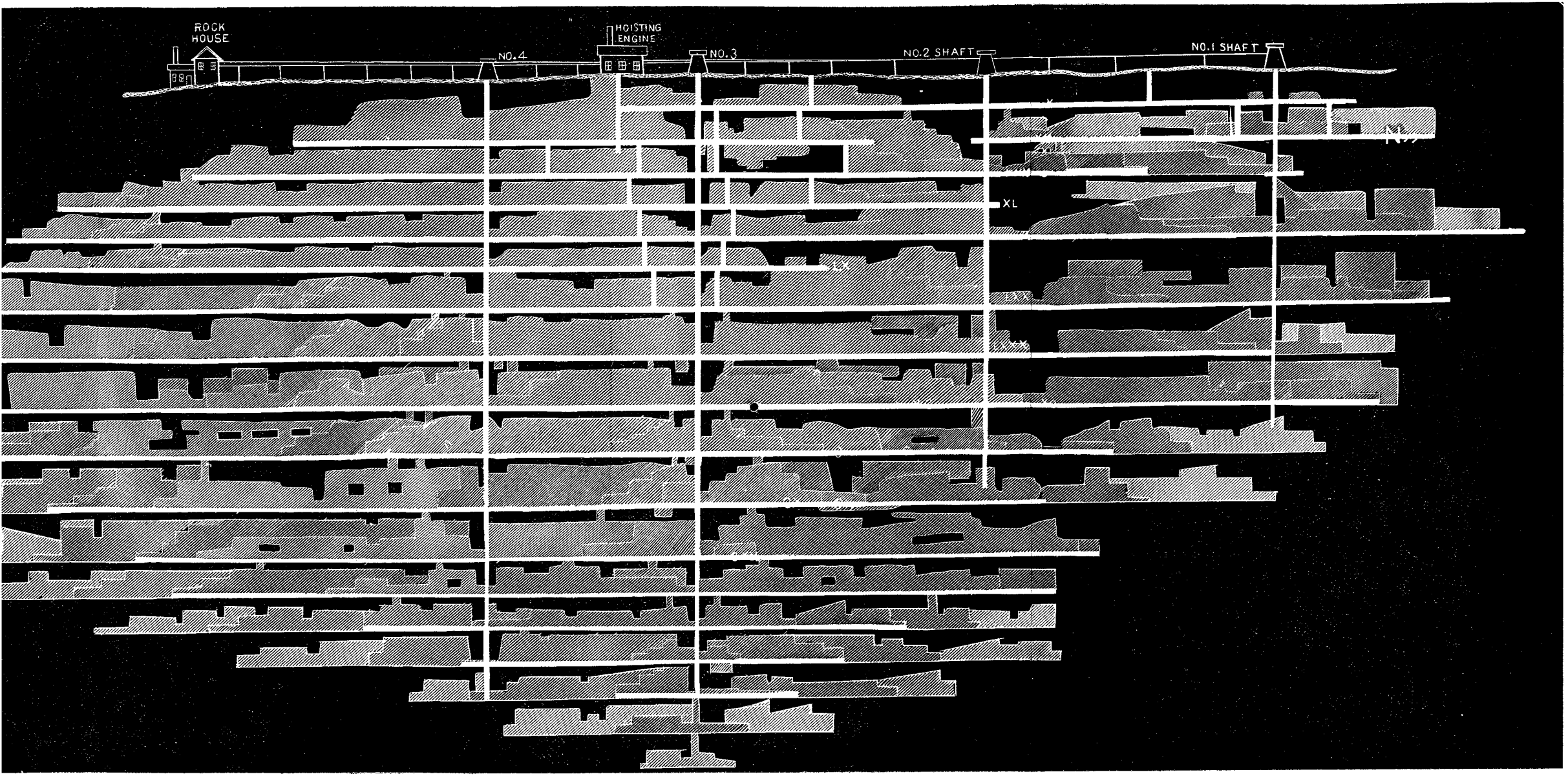
	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Number of tons of rock stamped	80,000	96,696	105,780	121,709	112,668	169,825	176,555	189,800	195,669	209,510	241,010	247,035	255,750	298,055
Yield of ingot per ton in pounds	19.58	18.99	19.42	18.50	19.00	14.27	14.36	13.866	13.708	15.1	14.86	14.18	14.24	13.34
Number of fathoms broken in mine	5,628	6,550	7,091	8,299	8,665	9,929	9,240	10,170	11,163	12,210	13,403	14,724	15,552	16,844
Yield of ingot per fathom, pounds	278	280	290	243	266	244	2,735	259	240	259	267	238	234	228
Cost in cents per ton for stamping and washing	87.96	67.09	57.79	48.85	42.44	38.13	42.54	37.07	35.25	39.95	30.36	26.53	27.31	26.89
Total cost per ton of rock mined, etc.	3.90	3.58	3.08	2.78	2.33	2.25	1.96	1.9082	1.7789	1.71	1.436	1.2801	1.4522	1.1409
Total average cost per pound, ingot	$0.2212	$0.1895	$0.1637	$0.1683	$0.1220	$0.1584	$0.1368	$0.1376	$0.1256	$0.1087	$0.936	$0.908	$0.1020	$0.1070
Average price per pound received for copper	.2247	.2135	.1854	.1615	.1630	.1997	.1712	.1756	.1500	.1181	.1116	.1092	.1212	.1478
Dividends paid	-------	-------	-------	20,000	30,000	40,000	80,000	80,000	40,000	20,000	40,000	40,000	60,000	120,000
Net profit per ton of rock	-------	.44	.51	1.01	.87	.5000	.4711	.4958	.2483	.0919	.2205	.1529	.2706	.5436
Per cent. of copper in rock	.976	.949	.971	.925	.95	.713	.718	.693	.685	.755	.743	.709	.712	.667

There were 41,000 tons more rock sent to mill in 1888 than in 1887 without any increase of cost at mill except for fuel. The yield in ingot was one pound less per ton, but the cost of treating, etc., was less than formerly, and no increase in any other items. So that the falling off in percentage of yield does not make any figure.



LONGITUDINAL SECTION OF THE ATLANTIC MINE, JAN. 1, 1889.

Scale: 300 feet to an inch.



ATLANTIC MINING COMPANY'S ANNUAL REPORT.

The directors present the following report of operations during the year 1888:

The production of mineral was 5,383,910 pounds, which yielded 73 83-100 per cent, or 3,974,972 pounds of refined copper, which realized an average price of about 14 78-100 cents per pound.

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

PRODUCTION.

3,974,972 pounds copper at 14 78-100c			$587,690 42
Add balance of interest account			5,592 18
			$593,282 60

COSTS.

Working expenses at mine as per clerk's tables		$340,045 78	
Freight	$15,041 54		
Smelting	38,030 67		
Expenses	6,866 22		
Brokerage	2,588 23		
Insurance	995 39		
Storage	319 70		
		63,841 75	
			403,887 53
Showing a mining profit in 1888 of			$189,395 07
There has been expended for additions to plant, as per detailed statement hereafter		$20,366 03	
There has also been expended for purchase of 200 acres of land		10,000 00	
And for explorations on section 16		1,430 37	
			$31,796 40
Leaving a net gain for the year of			$157,598 67
The surplus from 1887, after payment of dividend, was		$284,966 13	
Less dividend paid August 1, 1888		60,000 00	
			224,966 13
Making the net surplus December 31, 1888			$382,564 80

as shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of two dollars pet share ($80,000) was paid Feb. 1, 1889.

The foregoing figures show an increase of production over that of the previous year, as well as a large increase in the average price obtained for same.

Although the advance in the price of copper caused an advance likewise in the wages paid to our workmen, yet the increase in the quantity of rock mined and treated has resulted in a further decrease in the average cost of treatment per ton, to the lowest figure we have yet reached, as shown by the accompanying table of results. The cost of the refined copper, has, however, been slightly increased by a decrease in the average yield of the rock to the extent of about 93-100 pounds copper per ton. It is difficult to account for this decline in the yield of the rock mined, but it probably arises from the fact that a large portion of the increased output was drawn from extensions of the upper levels, where the rock is somewhat poorer than in the deeper portions of the mine. As similar fluctuations in yield have occurred in former years, this change does not seem to be of any special significance.

We have made some explorations on section 16, which have exposed several belts of

amygdaloid, and conglomerate carrying more or less copper, but nothing of value has yet been met with. This examination is not, however, conclusive, as only a small part of the section has been explored. The advent of frost caused suspension of work at this point, but the exploration can be resumed whenever desirable.

We have purchased for the sum of $10,000 a tract of 200 acres of land adjacent to our mining location. The principal copper bearing belts of the "mineral range" should traverse this tract, but as they have not yet been located, nothing is known of their value. As a portion of the surface will shortly be required by us for building purposes, and as the entire tract has a prospective "mineral value," it was deemed best to secure it while we had an opportunity of doing so at a reasonable price.

The maps which accompany this report show the relative position of our mine and stamp mill and of the lands we have acquired from time to time. The lands along "Cowles Creek" and "Portage Lake" were purchased for the purpose of controlling and protecting the stream of water which flows by gravity into our stamp mill and those lying adjacent to the ship canal (about 2,000 acres) are held as timber reserve.

The improvements contemplated at the time of last report were only carried out to a partial extent, some changes in plans making it expedient to defer until this year the erection of a new hoisting plant at one of the deepest shafts.

The comparatively high prices obtained for our copper in the early part of the year and the satisfactory profits resulting from the business of the year, have enabled us to make fair returns to stockholders, besides providing for purchase of the lands named and carrying forward a surplus of about $17,000, towards paying for any extraordinary expenditures that may be necessary during the current year.

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

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

New York, March 2, 1889.

ASSETS AND LIABILITIES, ATLANTIC MINING COMPANY, DEC. 31, 1888.

Assets.

Cash		$47,139 32
Accounts receivable		2,933 97
Loans		205,000 00
Copper on hand, sold		71,398 24
		$326,471 53

At Mine.

Cash	$2,206 30	
Coal	14,412 83	
Wood	14,919 40	
Supplies	34,112 62	
Merchandise in store	39,207 60	
		104,858 75
Total assets		$431,330 28

Liabilities.

Indebtedness at mine	$18,694 33	
Agent's drafts outstanding	6,818 27	
Accounts payable	23,252 88	
		$48,765 48
Balance of assets		$382,564 80

(Less dividend payable Feb. 1, 1889, $80,000.)

SUMMARY OF RECEIPTS AND EXPENDITURES OF ATLANTIC MINING COMPANY, FROM DATE OF ORGANIZATION TO DEC. 31, 1888.

Receipts.

Capital stock paid by consolidation	$700,000 00	
Capital stock paid by assessments	280,000 00	
		$980,000 00
Sales of copper		6,256,785 24
Other sources		853 15
		$7,237,638 39

Expenditure.

Real estate ("South Pewabic" and "Adams" mines, buildings, railroad, stamps, etc., as valued at consolidation)	$659,642 11	
Real estate (lands since purchased)	33,464 41	
	$693,106 52	
Net expenditure for additional equipment, mining operations, smelting and marketing copper, taxes and incidentals	5,681,967 07	
		6,375,073 59
Balance of receipts, being net profit to date		$862,564 80
Deduct dividends paid		480,000 00
Net surplus Dec. 31, 1888		$382,564 80

(As shown in detail in preceding statement.)

STATEMENT OF WORKING EXPENSES AT THE ATLANTIC MINE FOR THE YEAR ENDING DEC. 31, 1888.

Underground Expenses.

Sinking 93 feet, average $24.19 net		$2,249 96	
Drifting 3,912.4 feet, average $4.73 net		18,505 65	
Stoping 16,844 15-216 fathoms, average $4.31 net		72,599 91	
Timbering, tramming and labor		73,200 00	
Timber, materials and supplies		7,298 61	
Pumping and operating air compressors:			
Labor	$6,168 39		
Fuel	14,284 50		
Supplies and materials	3,925 37		
		24,378 26	
			$198,763 39

Surface Expenses.

Superintendence, and labor of all kinds (less sundry credit items)	$32,159 43
Supplies and materials	2,311 06
Fuel	14,696 74
Feed for teams, etc.	1,014 75
Fire insurance	390 00

Taxes	$3,143 67	
Canal tolls on copper	289 20	
Expenses and sundry repairs	970 39	
	$54,975 24	
Less amount received for rents	4,177 20	
		$50,798 04
Railroad Expenses.		
Labor	$6,626 86	
Fuel	2,633 60	
Supplies	1,506 26	
	$10,766 72	
Less received for transportation	438 13	
		10,328 59
Stamp Mill Expenses.		
Labor	$29,415 72	
Fuel	39,495 74	
Supplies	9,546 08	
Fire insurance	950 00	
Teaming, mineral, etc.	748 22	
		80,155 76
Total working expenses		$340,045 78

CONSTRUCTION ACCOUNT.

At Mine.			
Moving No. 2 engine House, materials used in equipping No. 2 hoist, and No. 2 shaft balance road, rails, etc.		$6,335 00	
One fire-box boiler	$1,333 00		
Addition to boiler-house, labor, etc	1,742 00		
		3,075 00	
One side duplex compressor	$2,000 00		
Labor and materials used for same	575 00		
		2,575 00	
One 17x24-inch rock breaker	1,450 00		
Labor and materials used for same	150 00		
		1,600 00	
One 24-foot "E. B." planer	$345 00		
Labor and addition to carpenter shop	205 00		
		550 00	
Fixtures for heating office with steam		300 00	
Additions to dwelling houses		855 00	
			15,290 00
At Mill.			
One new boiler		$1,725 00	
Addition to boiler house, labor, etc.		889 51	
One log dwelling		184 79	
Additions to dwellings		425 00	
			3,224 30
At Dock.			
Materials for new dock			1,851 73
Exploring on Section 16.			
Labor		$1,401 87	
Supplies		28 50	
			1,430 37
Total expenditure			$361,842 18

SUMMARY OF RESULTS.

Ground broken in openings and stopes	16,844 152-216 cubic fathoms.
Rock stamped	298 tons
Product of mineral	5,383,910 lbs
Product of refined copper	3,974,972 lbs
Yield of refined copper per cubic fathom of ground broken	236 lbs
Yield of rock treated, 13,336 lbs. copper per ton, or	0.667 per cent
Gross value of product, per ton of rock treated	$1.9718
Cost per ton of mining, selecting and breaking, and all surface expenses, including taxes	.8373
Cost per ton of transportation to mill	.0347
Cost per ton of stamping and separating	.2689
Cost per ton of working expenses at mine	1.1409
Cost per ton of freight, smelting and marketing product, including New York office expenses	.2142
Cost per ton of running expenses	1.3551
Total expenditure per ton of rock treated	1.4282
Net profit per ton of rock treated (exclusive of interest earned)	.5436

AGENT'S REPORT.

Atlantic Mine, L. S., Mich., January 1, 1889.

JOHN STANTON, ESQ., *Treasurer Atlantic Mining Co., New York.*

Dear Sir—I herewith present the following report of operations at Atlantic mine for the year 1888:

There has been a falling off in the yield of the rock during the last six months. We have experienced the same before, but only for periods of one or two months. The difference is so small that it cannot be detected in the mine, nor by inspection of the rock on surface, but I believe that the rock in the vicinity of No. 1 shaft in the upper levels is leaner than that in the other parts of the mine.

No. 1 shaft has been put in operation down to the 7th level. We have been drifting and stoping in the 2d, 3d, 5th and 7th levels north and south, but have abandoned the 2d and 3d levels in order to ascertain if the yield of the rock will not be better in the lower levels.

No. 2 shaft has been extended to the 12th level, and the openings have been continued in the 8th, 10th and 11th levels north, with fair results. The 8th and 10th levels have been extended beyond No. 1 shaft, and we are rising to connect No. 1 shaft with the 8th level.

No. 3 shaft has been sunk from the 17th to the 18th levels, and drifting and stoping have been done in the 14th, 15th, 16th, 17th and 18th levels north, and in the 16th, 17th and 18th levels south. In the vicinity of No. 3 shaft we find our most productive ground.

No. 4 shaft has been put in working order from the 15th to the 16th levels, and we have continued drifting and stoping in the 11th, 12th, 13th, 14th, 15th and 16th levels, leaving pillars and arches for protection, as the hanging wall is very poor in the southern part of the mine.

It will be necessary to extend No. 1 and No. 2 shafts to the lower levels as fast as possible. The shafts, pump, skip-roads and railroads are all in very good working order.

SURFACE.

Everything has worked satisfactorily on surface, but some changes have been made. The 30-lb. rails have been removed from the trestle track and 50-lb rails substituted for

them. We have put in the necessary driving sheaves to use ½-inch wire rope on the trestle cars in place of the manilla rope. The road now runs very satisfactorily.

The large "Blake breakes" in the rock-house has been altered, so that the rock is crushed directly to a size suitable for the stamps, which is more economical than the use of two breakers of different sizes.

RAILROAD.

The railroad has been run cheaply during the past year, although the rolling stock and also the road have been kept in very good condition.

We have made eight trips per day to the mill, each trip taking 24 cars of five tons each capacity.

STAMPING.

Nothing of importance has been done at the mill. It has been operated very economically, and it is in very good condition.

There have been many repairs to the launders which carry water to the mill. A new bridge has been erected, and portions of the launders have been renewed.

It also became necessary to build a new dock to properly care for our coal and freight. This is now under way and will be completed before the spring.

CONSTRUCTION.

The hoisting machinary at No. 1 shaft has worked so well with the counter-weight arrangement, that we have altered No. 2 engine so as to work in the same way. We moved the engine house from the old stand to a spot 300 feet east of No. 2 shaft, built a new hoisting drum 12 feet in diameter, and a drum for the counter-weight of 11 feet diameter.

A new railroad in No. 2 shaft has also been built with 20-lb. T-rails, upon which the counter-weight runs, the weight of which is about the same as the skip in addition to one-half the weight of the rock.

In 1885 we purchased of S. E. Cleves & Son one-half of a duplex compressor 16½ x 30 inches. This year we have bought the other half, and it is working very satisfactorily.

It became necessary to add to the boiler plant that furnishes steam for the pump and compressors. We therefore purchased and put in place a large tubular boiler. For this we made an addition to the old boiler house 32x25 feet, which is built of stone and covered with a slate roof.

The present plant will furnish the necessary power for years to come.

To the rock-house machinery we have added one 17x24 inch "Blake Breaker," which crushes the rock directly to a size suitable for the stamps.

An addition has been made to the carpenter shop 16x18 feet, in which we have placed a planer.

There have been five additions made to dwelling houses.

At the stamp mill there has been added to the boiler plant one new tubular boiler, and to the boiler house an additional 16x60 feet. We have now ample steam capacity for the amount of rock we are treating.

In closing, I would refer you to the tables prepared by Mr. H. M. Rickard, showing the costs in the various departments, and to the maps filled out to date by Mr. F. McM. Stanton, showing the ground broken in the mine during the past year. The work has been carried on very smoothly during the year by my assistants, who have worked faithfully for the interests of the company.

Yours truly,

WM. TONKIN, *Agent.*

The following table gives the product each year:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1866	6	1,475	1878	1,132	1,592
1867		1,760	1879	1,152	1,822
1868	764	258	1880	1,170	1,195
1869	823	857	1881	1,264	9
1870	186	617	1882	1,315	1,708
1871			1883	1,341	197
1872			1884	1,586	1,585
1873	431	1,336	1885	1,791	533
1874	686	403	1886	1,751	1,670
1875	783	1,036	1887	1,820	1,865
1876	917	1,041	1888	1,987	972
1877	1,027	304			
Total				21,939	268

It will be seen that the product of 1888 was the largest in the history of the mine. The mine is no richer, only more rock was stamped.

Since the foregoing was written the announcement is made that Capt. Wm. Tonkin, who for so many years has been at the mine as mining captain and agent, has resigned, and Mr. Frank Stanton succeeds him.

THE HURON COPPER CO.

The Huron mine seems to me to be in better shape than ever before. Of course it must be classed among those mines that require favorable conditions in order to be worked successfully. It cannot be said that the conditions have been very favorable with the Huron except in the matter of management. It is very economically and skillfully managed, and this fact has enabled the company to surmount some embarrassing difficulties in recent years, in addition to the discouraging state of the copper market.

If it were a rich mine, yielding a larger percentage of copper to the fathom of ground opened, there would be no difficulty in overcoming the misfortunes that have been met with. But the average value of the lode is low—it must be extensively opened to find a sufficient amount of paying ground to stope. The machinery and buildings are old fashioned, but they have been repaired and remodeled so that they are as effective and as good as new. All the changes and improvements have been gradually made, as the circumstances of the company would permit, except in the case of reconstructing the dam,

when it broke away, rebuilding the stamp mill after the fire, and the purchase of new boilers to replace the one destroyed by explosion and to meet the increased demands for power. These expenditures had to be met, forthwith, *nolens volens*. But otherwise all improvements have been made so gradually as to be scarcely perceptible at the time, and yet one sees now that there has been great change for the better at the Huron. Everything is working nicely and under the stimulus of higher prices for copper the location has a smiling, prosperous look.

The mill, especially, impresses one favorably; no stamp heads work better with a uniform pound of 96 strokes per minute. Capt. Vivian has recently placed long timbers under the mortars to receive the blows, and finds that it has served to increase the effectiveness. He estimated that this change would add 20 tons per day to the amount crushed. He hoped to stamp 11,000 tons per month—27 days. Whether he has succeeded in accomplishing this result or not I do not know. The superintendent of the mill is Mr. William Vivian. There are four slime tables in the wash-house, each 15 feet diameter, and the fifth one is nearly ready to operate. Its place is near the roof, above the others, and will be used for finishing.

The following are summaries of the year's work.

Mining Expense, Labor, etc., Account and Cost.

No. of Men.	Mining Capt., Timbermen.	Miners on Day account.	Machinists, Engineers, Firemen.	Blacksmiths, Carpenters and Mining engineers.	Trammers and Laborers.	Total.
139	$9,276 55	$1,074 07	$7,634 46	$3,461 54	$33,939 82	$55,386 44

Statement of Shafts and Winzes Sunk and Cost of Same.

No. Men.	No. of Feet Sunk.		Average Price per Foot, Sinking.		Total amount paid for sinking Shafts.	Total amount paid for sinking Winzes.	Total.
	Shafts.	Winzes.	Shafts.	Winzes.			
8½	338 2-10	244 2-10	$17 24	$15 13	$5,333 08	$3,697 35	$9,030 43

Mining Expenses, Drifting, Cross-cutting, and Cost of Same.

No. Men.	No. of Feet Drifted.	Av. price paid per foot.	No. feet of Cross-cuts.	Av. price paid per foot, Cross-cut.	Total for Drifting.	Total for Cross-cutting.	Total Expense.
26½	2,618 5-10	$8 84	188	$9 00	$23,149 13	$1,692 62	$24,841 75

Stoping and Cost of Same.

Number Men.	No. fathoms stoped.	Average price per fathom.	Amount paid for stoping.	Total.
79½	7,868 50	$9.24	$73,471 91	

Sundry Labor, Mining Expense Account.			*Supplies, Fuel, Etc., and Cost of Same.*				
No. Men.	Special Contracts.	Total.	Supplies.	Wood, coal, teaming.	Total	Less profit on supplies charged to miners, transportation, hospital, etc.	Net total.
1	$115 65	$115 65	$8,706 90	$31,297 87	$40,004 77	$21,067 68	$18,937 09

Recapitulation of Mining Expenses.

No. Men.	Co. Account. Labor.	Sinking Shafts and Winzes.	Drifting. Cross-cutting.	Stoping.	Sundry Labor.	Supplies and Fuel.	Total.
	$55,386 44	$9,030 43	$24,841 75	$73,470 91	$115 65	$18,937 09	$181,782 27

Rock House Account.—No. Men, Etc.

No. Men, Co. Acct.	No. of Men, Contract.	Total No. of Men.	Tons hoisted to surface.	Tons dumped in mine.	Total tons of rock hoisted.	Tons rejected.	Tons sent to rock-mill.
109½	114½	224	1,545.04	895	155,399	44,719	110,680

Locality of Mining Contracts, i. e., No. 7 Level in which Work was Done and Amount of Work Done in Each.

Level	4	5	9	13	14	15	16	17	18	Total.
Feet drifted	81	.....	.....	.....	251	492.4	673 1	1,073.1	835	2,618.5
Fathoms stoped.	5	35.5	52	532.5	1,505.625	2,010.5	2,252.75	1,435.25	393.75	7,868.5
No. feet of cross-cut	.....	.....	.....	.....	.....	60.25	43.4	41	43.5	188
Winzes sunk	.....	.....	.....	52.3	110	82	.....	.....	.....	244.3
Shafts sunk	.....	.....	.....	.....	.....	.....	121.5	201.7	15	338.2

Surface Expense, Labor, Supplies, and Cost of Same.

No. Men.	Wages.	Teaming, Supplies, Wood.	Wagons, Sleighs, Harness and other repairs.	Total.	Taxes, house rent and other charges.	Net total.
20.5	$10,187 76	$2,379 84	$621 88	$13,189 48	$3,229 91	$9,959 57

Stamp Mill Expense. 2 Heads.

No. of Men.	No. Cords Wood and Tons Coal.		Cost of Fuel.		Cost of Foundry Bills.	Cost of other supplies.	Cost of Labor.	Total Cost
	Coal.	Wood.	Coal.	Wood.				
	tons. lbs.	cords.						
.....	2,504 1890	7,157	$10,657 18	$21,471 00	$1,803 25	$4,205 03	$13,964 45	$52,082 97

Statement Showing Results of Stamping.

No. of Days Run.	Tons Stamped.	Per Cent per Ton.	Pounds of Copper Produced.	Tons Stamped per Cord of Wood.	Cost of Stamping 1 Ton of Rock.
11,351¾	110,680	131	28,928.40	10.13	47.05 cents.

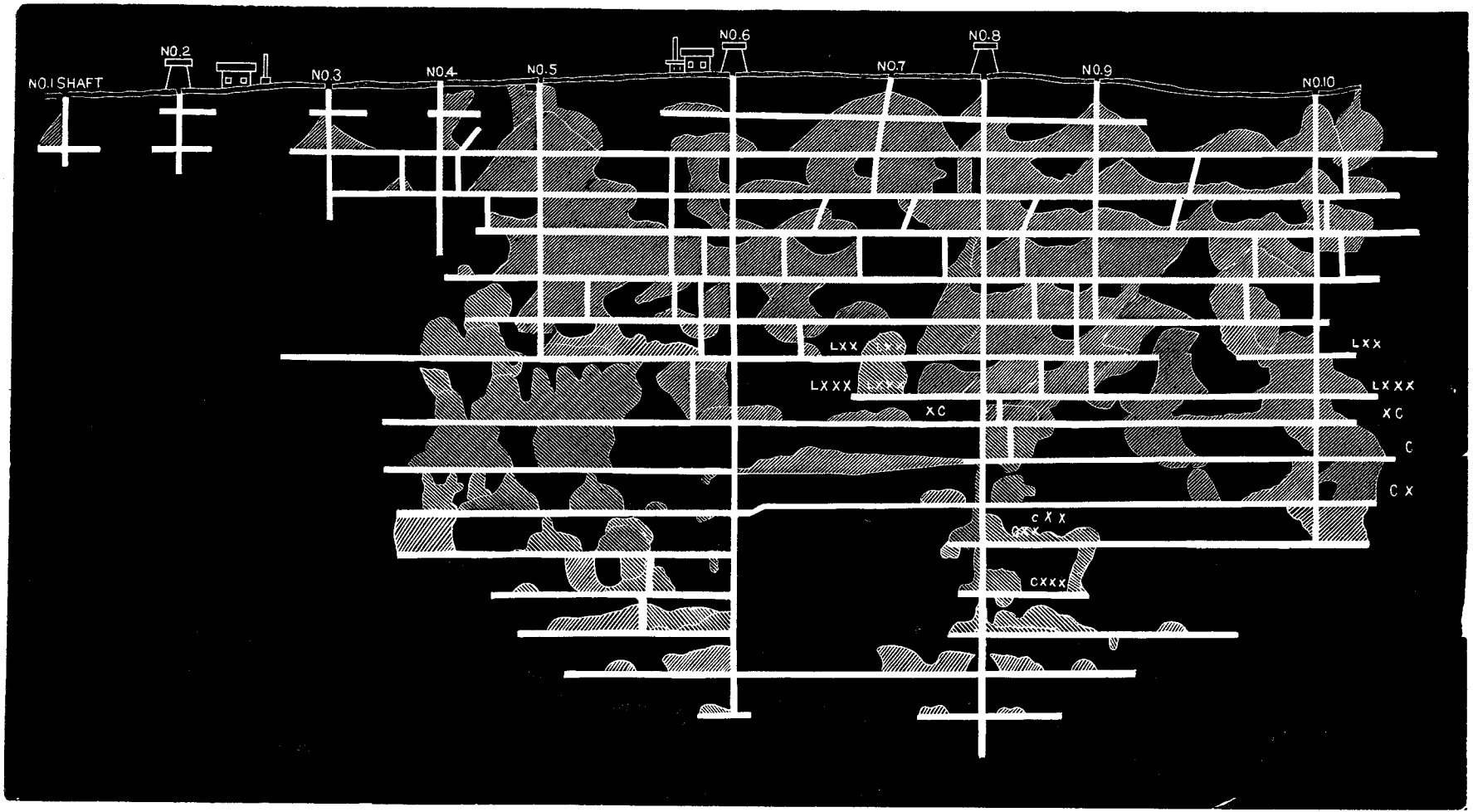
The following table of yearly products shows that this mine yielded more in 1888 than in any previous year.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	3	.....	1872	276	1,684
1856	12	.....	1873	237	1,883
1857	35	.....	1874	125	1,005
1858	24	.....	1875	31	1,289
1559	22	1,387	1876	31	1,857
1860	4	1,000	1877	41	161
1861	49	.....	1878	32	1,100
1862	69	1,305	1879	14	1,760
1863	69	206	1880	35	285
1864	50	1,745	1881	127	515
1865	238	11	1882	182	579
1866	.....	.....	1883	360	213
1867	683	1,164	1884	963	1,660
1868	740	80	1885	1,135	1,163
1869	841	863	1886	946	995
1870	42	183	1887	742	103
1871	134	1,453	1888	1,187	1,147
Total				9,542	806

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

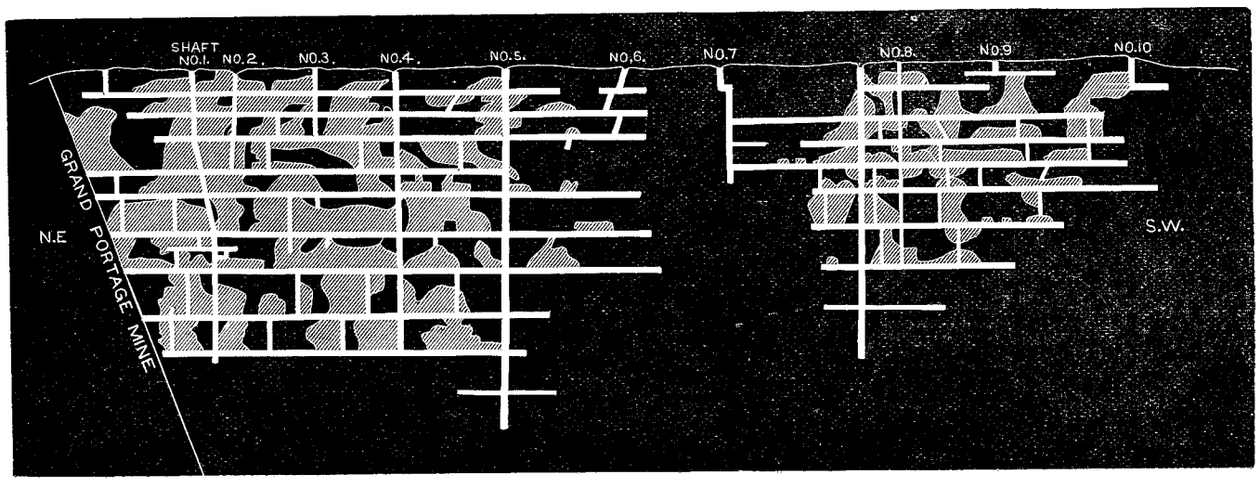
LONGITUDINAL SECTION OF THE HURON MINE, 1889.

Scale: 300 feet to an inch.



LONGITUDINAL SECTION OF THE ISLE ROYAL MINE, 1889.

Scale: 300 feet to an inch.



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

Passing the Isle Royal, Grande Portage and Sheldon Columbian mines, which remain idle, and for descriptions of which reference is made to previous reports, we cross Portage Lake to the north side and come directly to the

QUINCY MINE,

which until recently ranked only second among the copper mines of the State, but has had to assume the position of third in rank, not through any falling off in the richness of the mine or in the annual profits of working, but simply from the fact that a new mine has come in to displace it from its time-honored place. The Quincy is as good as ever it was, but no amygdaloid deposit has yet been found that can vie with the Calumet & Hecla conglomerate in richness, and so the Tamarack leads it. The Quincy people are prepared to build a new stamp mill, which is all that is needed, I think, to put the mine abreast with the times. The old mill is obsolete. There is no sort of doubt but that the present mill greatly hampers the working of the mine, and increases the cost of the production. The amount of rock broken annually is limited to the capacity of the mill. The mill is made to do all it can, but the maximum of its work is away below the capacity of the mine to produce. The result is that there is left standing much good ground in the mine that is lower grade than that which is mined and treated. If the Quincy had a mill corresponding with those of other prominent mines, it is probable that the percentage of the rock treated would not be as high as it is, for the reason that far more of it would be stamped, and a portion of it much leaner than that now treated. The location for the new mill is a good one—on lot 3, Sec. 23, T. 55, R. 33. The company owns the land on both sides of the lake, at this end. They have built a dock 200′x32′, and have much other preliminary work done at the site. They have contracted for a Worthington pump, capacity, 8,000,000 gallons; Corliss engine 14″x36″—6 steel boilers, each 6′x16′, return tubular. The railroad from mine to mill, called the Quincy & Torch Lake, is six miles long, 3-ft. gauge, and an almost uniform grade of 80 feet to the mile, with no sharp curves. The grading, etc., is about completed, except for the space of 3,000 feet across the Franklin & Pewabic properties.

The vertical depth of the mine is 2,240 feet, or 2,980 feet on the inclination of 52°. They are straightening No. 4 shaft. It is fish-bellied—that is from the 60th level to the 180th, the line of the shaft is the arc of a circle,

concave upward; in future, when completed, the track will follow the chord of the arc, and thus will be a great improvement in this important shaft. The work is proceeding at several points, which must finally align accurately. Messrs. Emerson & Bailey do the engineering, and there will be no difficulty as to the outcome of the work. The maximum ver-sine of the curve of the line of the old shaft is 42 feet—that is, the greatest distance from the old shaft to the line of the new one.

The map of the mine is marked up, and that, with the published report of the company give all the facts that are of interest.

The company has paid 40 dividends amounting to an aggregate of $4,970,000. The two paid in 1888 equal $360,000, and a further dividend paid in July, 1889, will bring the total up to $400,000.

Quincy Mine Report.

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

The product of the mine was 7,762,945 pounds, or 3,881 945-2000 tons of mineral, yielding about 83 3-10 per cent, or 6,367,809 pounds of refined copper, for which has been realized the gross sum of		$1,014,315 38
Realized from sale of silver		4,173 04
		$1,018,488 42

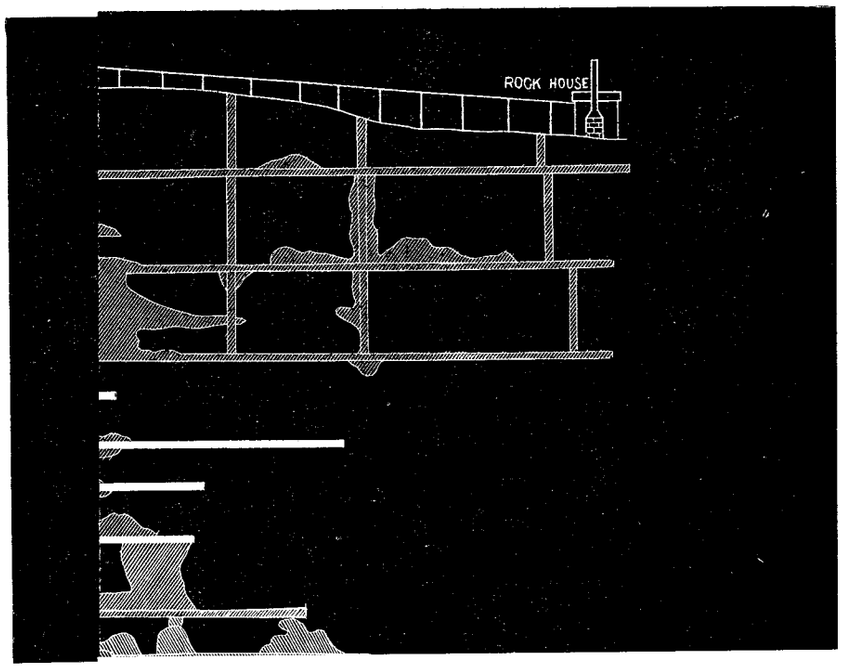
The expenses of the year are as follows:

Running expenses at mine	$360,485 39	
Building and construction account	33,433 01	
Quincy & Torch Lake Railroad	67,117 37	
Machinery contracted for	75,000 00	
Smelting, transportation and all other expenses	106,841 84	
		$642,977 61
Leaving as mining profit		$375,510 81
There has also been realized during the year, from interest on loans		10,245 85
Received from real estate, Hancock		500 00
Making the income of the year		$386,256 66

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

January 1, 1888		$536,509 75
Add earnings of 1888		386,256 66
		$922,766 41
Deduct dividend of February 15, 1888	$160,000 00	
Deduct dividend of August 15, 1888	200,000 00	
		360,000 00
Leaving balance of assets Jan. 1, 1889		$562,766 41

A dividend of $5.00 per share, or $200,000, payable February 15, has been declared, which, with dividend of $5.00 per share, paid August 15 last, makes total for the year $400,000.



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

THOMAS F. MASON, *President.*

New York, February 15, 1889.

GENERAL SUMMARY OF RECEIPTS AND EXPENDITURES OF THE QUINCY MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1888.

Receipts.

From capital stock paid in	$200,000 00
From proceeds copper and silver (10,221,448 lbs. copper)	19,202,774 83
From interest	136,512 31
From profit on sale P. L. & R. Improvement company stock, and other investments	79,637 16
From sales of real estate, Hancock, Mich.	58,450 43
	$19,677,374 73

Expenditures.

For expenditure on location previous to 1856	$42,097 98
For expenditures on Quincy vein, 1858, not now worked	55,000 00
For openings and explorations on 3,800 feet "east" or Pewabic vein, extending to Portage Lake, preparatory to future work	11,500 00
For real estate and permanent improvements on same, including dwelling houses, stamp mill, machinery, steam engines, railroad, dock, warehouse, and other buildings and roads	1,193,698 05
For mining and surface labor, expenses of smelting and marketing copper, and all incidental expenses	12,842,312 29
Balance carried down	5,532,766 41
	$19,677,374 73
By balance brought down, being receipts over expenditures	5,532,766 41
Deducting dividends declared, Nos. 1 to 40 inclusive	4,970,000 00
Leaving balance as per statement below	$562,706 41

STATEMENT OF ASSETS AND LIABILITIES EXCLUSIVE OF REAL ESTATE, MINE PLANT AND SUPPLIES IN USE, JANUARY 1, 1889.

Assets.

Cash at New York office, and copper		$579,045 73
Cash on hand at mine		6,902 24
Accounts receivable, since paid		33,035 00
		$618,982 97

Liabilities.

Drafts unpaid	$1,104 85	
Dividends unpaid	440 00	
Accounts payable in New York	13,475 00	
Accounts payable at mine	115,056 62	
		130,076 47
		$488,906 50
Add at mine, viz:		
Supplies per inventory on file	$61,182 67	
Farm account (horses, wagons, etc.)	11,895 93	
Accounts receivable	781 31	
		73,859 91
		$562,766 41

Less dividend payable February 15, 1889, $5.00 per share, $200,000.

SUMMARY FOR YEAR.

Average force employed	471 men
" number of miners	158 men
" wages of miners on contract, per month	$49 60
Yield of mineral per fathom of ground broken	842 lbs.
Yield of refined copper per fathom of ground broken	690 lbs.
Total rock mined	165,978 tons
Total rock hoisted	123,376 tons
Total stamp rock treated	117,514 tons
Yield of rock stamped	3.04 per cent. mineral
Product stamp mineral	7,141,570 lbs.
Product masses	621,375 lbs. 7,762,945 lbs.
Product refined copper	6,367,809 lbs.

AGENT'S REPORT.

QUINCY MINE, LAKE SUPERIOR, MICH.,
January 31, 1889.

During the year No. 2 shaft was sunk from the 37th to the 38th level. It passed through several bunches of mixed vein matter, and the last twelve feet was entirely in good copper ground.

The drifting done from this shaft was at the 37th, 36th, and 35th levels north. The 38th level was extended north from shaft a few feet only, but was driven south and connected with the drift from No. 4 shaft.

No particular change has been noticeable during the year as to the general character or quality of the vein in the new openings.

The first 160 feet to 180 feet of drifting in both the 36th and 37th levels was in very good copper ground, but the vein, for the remainder of the drifting was more bunchy and less productive. The 35th level showed only a narrow, low-grade vein. The 38th level was mostly in vein of full average quality.

The principal stoping done in this part of the mine was at the 37th and 36th levels north and south of shaft; and at the 35th level north of shaft. Some profitable stoping was also done at the 34th and 33d levels north and south, and at the 31st, 30th 29th and 28th levels north of shaft.

During the year No. 4 shaft was sunk from the 37th to the 38th level. It showed bunches of good stamp rock now and then, but the main copper-bearing vein is still east of it, and is reached by a cross-cut, as formerly.

The drifting done from this shaft was at the 38th level, north, connecting it with No. 2 shaft, and at the 37th, 36th, 35th and 33d levels south of shaft. The vein shown in the drift at the 38th level is rather narrow, but has short bunches of very rich rock. The drifts at both the 37th and 36th levels are mostly in good vein. The 35th level showed short bunches of very good vein, the drifting on the whole being in vein of fair average quality. The drifting at the 33d level was mostly in a narrow low-grade vein.

The principal stoping done in this part of the mine was at the 34th and 35th levels south, and at the 36th and 37th levels north and south of shaft. A little profitable stoping was also done at the 25th, 26th, 32d and 33d levels, south of shaft.

At the 38th level, just north of No. 4 shaft, a cross-cut was driven east 35 feet, when it intersected a vein carrying a medium quality of stamp copper for about 14 feet in width. Only a few feet of drifting, and but little stoping was done there. No other stoping than this was done at the 38th level.

In sinking No. 4. shaft, a great many years ago, it was allowed, somehow, to make a bow-shaped bend between the 9th and 17th levels, causing the shaft at the 13th level to warp back in the foot-wall side about 50 feet from its proper angle or slope. It became necessary, therefore, to straighten the shaft between those points, and the work is now being carried on without interfering at all with the rest of the regular mine work. This new work is being done in sections, by cross-cutting at different levels, and then by sinking and rising to make connections. Between the 16th and 15th levels an apparently large body of vein, rich in mass and barrel copper, was discovered. This will become available as soon as the new shaft work is completed. During the year the man-engine shaft was extended and put in working order from the 31st to the 33d level. In sinking this shaft between the 32d and 33d levels a block of very rich vein was met with, and so much of it taken out that stoping can be resumed there at any time without interfering with the shaft.

The diamond drill was not used much during the year. A few holes only were bored at the 36th level north and south of No. 2 shaft, but nothing of value was discovered.

There was not much extra work, or any extensive changes made around the mine during the past year. The most important improvement was the renewal of the man-engine gear and its foundations. The old gear having become worn out and unsafe, was replaced by a new and stronger one consisting of an 18-foot diameter "step gear" wheel a 22-inch pinion, and a 14-foot 12-inch shaft. This machinery now works very satisfactorily.

A large stone and cement cistersn 20x20x10 was built back of the hospital to supply the dwelling houses in that vicinity with water, and to serve as an additional safeguard in case of fire in that quarter.

Some further expenditures were incurred at the new rock house, by way of finishing it, which makes it now very complete in all its parts.

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

The old mill did excellent service last year in stamping 117,514 tons of rock, which is the best year's duty it ever performed.

Preparations for building the new stamp mill at Torch Lake were made as early in the season as circumstances permitted. Work was begun there in the month of August, and continued until the bad fall weather set in. During that time there was built a boarding house, which is designed for future use as a blacksmith, carpenter and cooper shop; a dock 200x32 feet, with an approach in the center 160x32 feet; an adit or watercourse 5½x6 feet, and 6 feet below lake level, was made from the lake to the site for the pump house, a distance altogether of about 600 feet. At the end of the adit a stone cement cistern or well, 50x7x17 feet was built. The boiler house and pump house were located and their foundations partly made. The excavation for stamp mill building which will be 120x200 feet. was made, and most of the stone foundations for the walls of building finished. Work will be resumed there as early in the spring as the weather permits. Most of the principal equipment for stamp mill plant has been contracted for, viz.: Two steam stamps of latest improved design, capacity of each at least 250 tons of rock per 24 hours. (A third stamp will be added later.) An 8,000,000 high duty pumping engine; one 14″x36″ Corliss engine; six 6′x6′ return tubular boilers; fifty-six iron jigs; timber, lumber, lumber, etc.

The stamp rock will be transported from the mine to the mill over the Quincy & Torch

Lake Railroad, which is now in course of construction, and is expected to be completed and in running order early this coming summer.

The road was duly organized in June last, under the laws of the State of Michigan. The surveyed line extends from the Quincy mine to a point beyond the new Quincy stamp mill, near the shore of Torch Lake, in Section 23, T. 55, R. 33. The road will have a gauge of three feet, and be about six miles in length, with an almost uniform grade of eighty feet to the mile. With the exception of a gap of about 3,000 feet (across the Pewabic and Franklin Mining companies property) the road is graded and most of the culverts built. Seven bridges will be required, the timber for which has been contracted for. The railroad iron and ties are on the ground ready for use, and track laying will commence in the spring as early as possible.

There are now being built for this road two 50-feet iron turn tables, one 32-ton mogul locomotive, four 28-feet flat cars, and one caboose, all of which will be shipped there by rail before navigation opens. The required number of 12-ton rock cars, another locomotive, and other equipment will be ordered later on, as needed.

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

All of which is respectfully submitted.

S. B. HARRIS, *Agent*.

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.
1861	2.55	1870	2.61	1879	1.80
1862	2.03	1871	2.29	1880	2.50
1863	2.75	1872	2.17	1881	2 88
1864	2.96	1873	2.60	1882	2.80
1865	2.60	1874	2.61	1883	2.85
1866	2.63	1875	2.44	1884	------
1867	2.74	1876	2.38	1885	2.70
1868	2.25	1877	2.11	1886	2.70
1869	2.48	1878	1.76	1887	2.97
				1888	3.04

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	153	772	1875	1,334	281
1859	178	1,114	1876	1,536	1,171
1860	970	414	1877	1,427	336
1861	1,218	852	1878	1,480	449
1862	1,153	218	1879	1,323	1,458
1863	1,115	1,737	1880	1,848	263
1864	1,251	586	1881	2,753	884
1865	923	1,500	1882	2,832	1,796
1866	1,172	1,000	1883	3,006	239
1867	1,013	1,000	1884	2,825	436
1868	727	1,000	1885	2,924	497
1869	1,208	1,365	1886	2,961	1,529
1870	1,248	1,777	1887	2,804	1,762
1871	1,204	1,501	1888	3,183	1,889
1872	1,334	1,134			
Total				50,047	1,702

PEWABIC MINE.

Of this mine there is nothing to be said. A decision was recently reached in the Supreme Court of the State adverse to the possibility of the existence of the company as a corporation. It seems that the mine must be ultimately sold, and probably both the Quincy and Franklin companies desire to own it. It would be valuable for either, and could be so divided as to be of great advantage to both.

THE FRANKLIN MINING CO.

has also had a prosperous year, having paid a dividend of $160,000. Its more recent prosperity is in strong contrast to its record of failure in former years. I am always well pleased to go about the Franklin location; it is a little old fashioned, may be (the machinery), but everything is orderly and the work is rapidly and economically done.

A Worthington steam pump 16x4x10 takes the water now from the lake, at the mill, to the mine, 7,000 feet distant. Also at the mill have a sand wheel 35 feet in diameter, which works very finely. It elevates the water

and sand from the wash-house into a launder that carries it a long distance away.

The mine has grown deeper rapidly, and to meet the increased demand for power, three new boilers have been added, and a fourth may also be required.

The rock is gathered from the three shafts into the bins over the railroad track, and the cars are filled very handily. I think that the arrangements for handling the rock are economical.

No. 2 shaft is at the bottom, to the 29th level—that is to the company's line, underground.

No. 3 to the 31st level, and No. 5 to the 30th.

No. 3 to No. 5 is 600 feet. The former can still be deepened two levels before the limit is reached.

No. 5 has been sunk from the 28th down, but not much has been done otherwise. The extreme distance that the mine is opened north of No. 5 is 550 feet in the 23d to 27th levels, thence to 30th the length of levels north of the shaft is 500 feet.

At the bottom, No. 2 is 300 feet from No. 3. No. 5 is 600 feet. The line of intersection of the lode with the limits of the property, inclines downward at about 50 degrees with the horizon.

I have much interesting detail of the work at Franklin mine in addition to what is given in the published report of the company.

Mining Expenses, Labor and Cost of same—1888.

No. of men.	Mining captains and timbermen.	Miners on day account.	Machinists and firemen.	Blacksmiths and carpenters.	Trammers and laborers.	Total.
131	$13,689 22	$1,933 02	$13,602 55	$3,338 64	$35,504 80	$68,068 23

Statement of Shafts and Winzes Sunk and Cost.

1888.	No. of men.	No. of feet sunk.		Average price per foot.		Amount paid for shaft sinking.	Amount paid for sinking winzes.	Total.
		Shafts.	Winzes.	Shafts.	Winzes.			
Average for year.	8½	364 1-10	80	17	$12 81	$6,192 56	$1,025 20	$7,227 76

Drifting, Cross-cutting and Cost of Same.

1888.	No. men.	No of feet drifted.	Av. price per foot.	No. feet cross-cutting.	Av. price per foot.	Am't paid for drifting.	Am't paid for cross-cutting.	Total.
Average for year.	27	2,290 2-10	$9 61	----------	----------	$28,742 43	----------	$28,742 43

Stoping, and Cost of Same.

1888.	No. of men.	No. of fathoms stoped.	Av. price paid for stoping.	Amount paid for stoping.	Total.
Average.	94	8,649 510-1000	$10 37	$89,731 81	$89,731 81

Statement Sundry Labor and Cost of Same.

Special contracts.	Extra labor, aside from contracts.	Man engine.	Surveys and maps.	Boiler repairs.	Total.
$90 00	$1,246 86	$4,439 34	$196 01	$1,264 88	$7,237 01

Statement of Supplies, Fuel, Etc., and Cost of Same.

1888.	Supplies.	Wood, coal and teaming.	Use of diamond drill, pd. Huron Co	Total.	Less profits on supplies.	Total.
Average for year.	$16,071 27	$29,288 77	$200 00	$45,560 04	$18,526 65	$27,033 39

Recapitulation of Mining Cost.

Co. Account. Labor.	Sinking shafts.	Drifting and cross-cutting.	Stoping.	Sundry labor.	Supplies and fuel.	Total.
$68,069 23	$7,117 76	$28,742 43	$89,731 81	$7,237 09	$27,033 39	$228,030 71

Rock Account, Men, Etc.

No. of men on Co. Account.	No. of men on contract.	Total No. of men.	Tons of rock hoisted.	Total tons rejected.	Tons of rock sent to mill.	Per cent of rock rejected
130	129	259	181,451	39,850	141,501	21

Statement of Labor and Supplies, and Cost of Same. Surface Expense.

No. of men.	Wages.	Teaming and supplies.	Wagons, sleighs, barness and other repairs.	Total.	Less house rent and supplies.	Net total.
37	$17,907 85	$4,663 25	$423 14	$22,985 29	$9,358 88	$13,625 46

Stamp Mill Expense, 4 Heads.

No. men.	No. cords wood.	Cost of wood.	Cost foundry bills.	Cost of other supplies.	Cost of labor.	Total.
57	9,528¼	$27,594 37	$2,295 46	$4,099 11	$22,454 48	$56,443 42

Statement Showing Results of Stamping.

No. days run.	Tons stamped.	Cost per ton.	Lbs. copper produced.	Tons stamped per cord of wood.	Cost of stamping one ton of rock.—Cents.
21½	141,500	$1 07	3,038,457	14.85	39 81

Excess of smelter weight over mine weight, 8,812 lbs.

Tram Road Expense, Cost of Running to Mill, Tons Delivered.

No. men.	Cost of labor.	Cost of fuel and supplies.	Total cost.	No. tons run over the road.	Cost per ton.
14½	$6,928 85	$1,555 96	$8,484 81	41,501	5.99 Cents.

Rock House Expenses, Cost of Breaking and Delivering Rock into Cars.

No. men.	Cost of labor.	Cost of supplies.	Total cost.	No. tons of rock.	Cost of breaking and delivering.	Cost per ton of rock hoisted.
39	$16,276 81	$423 11	$16,699 92	141,501	11.80 cents.	9.2 cents.

General Expenses, Insurance, Taxes, Agency, Etc.

No. men.	Agent and watchman.	Insurance.	Taxes.	Attorneys and discounts.	Electric lights.	Totals.
2	$4,599 96	$2,227 62	$2,837 11	$640 22	$98 00	$10,452 91

Office Expense.

No. men.	Checks.	Fuel, oil.	Stationery, telegraphing.	Total.	Credit, commissions.	Total.
2	$2,280 00	$85 75	$612 12	$2,986 87	$333 72	$2,653 15

Construction, Repair Expense.

Sand wheel.	Coal dock.	New boiler.	Total.
$4,722 41	$263 43	$1,000 00	$5,985 84

No. men.	Mining ex.	Surface expense.	Stamp mill expense.	Tram road expense.	Rock house expense.	General expense.	Office expense.	Construction repairs, expense.	Total.
411	$228,030 71	$13,626 46	$56,443 42	$8,484 81	$16,699 92	$10,452 91	$2,653 15	$5,985 84	$342,377 22

Stamp mill copper, total mineral.	Mass and barrel copper, mineral.	Total amount of copper.	Per cent.	Total ingot.	Cost of mineral per lb. at smelting works.
36,384 57	1,399,145	4,437,602	82.38	3,655,751	7.71 cents.

Cost ingot per pound, 9.36 cents.

Per cent ingot in rock stamped.	Per cent of mineral in rock stamped.	Lbs. ingot in ton of rock stamped.	Lbs. mineral in ton of rock stamped.	Per cent of ingot in ton rock hoisted.	Per cent mineral in ton rock hoisted.	Lbs. ingot in ton of rock hoisted.	Lbs. mineral in ton of rock hoisted.	Lbs. of ingot in fathom hoisted.	Lbs. of mineral in fathom hoisted.	Cost per ton.	Tons rock hoisted.	No. fathoms hoisted.
1.29	1.56	25.83	31.36	1.00	1.22	20.14	24.45	363	440	1.89	181,451	10,078

Total expenditure for the year at mine, $342,377.22; number of tons of rock manipulated, 181.451; cost per ton, $1.89, or less extra expense building sand wheel, coal dock, and new boiler $5,985.84, leaves mining cost $1.85 per ton.

Rock Account.

Number tons on hand in mine January 1, 1888	18,890
Number tons mined during year on contract	169,045
Number tons mined during year on company account	10,000
Total	197,935
Number tons hoisted during the year	181,451
Amount on hand in mine January 1, 1889	16,484
Number of acres of land owned	1,656.29

The following is the company's published report:

Franklin Mine Report.

Boston, *March, 1889.*

To the Stockholders of the Franklin Mining Company:

The directors present the following report of operations for the year ending December 31, 1888:

The mine produced 4,437,602 pounds of mineral, which yielded $82\frac{381}{1000}$ per cent, or 3,655,751 pounds of refined copper, from which has been realized an average price of 15.0754 cents.

Below is given a summary of the year's business:

Receipts.

3,665,751 lbs. copper, at 15.0754 cents	$551,119 53
Interest	891 43
Silver	2,727 28
	$554,738 24

Expenditures.

Running expenses at mine (including construction account) as per yearly cost sheet	$342,377 22	
All other expenses including smelting, freight, insurance, etc.	64,205 80	
		$406,583 02
Showing the income of the year to be		$148,155 22

The total amount of rock hoisted during the year was 181,451 tons.
The total amount of rock stamped during the year was 143,347.
Pounds of mineral in ton of rock stamped 31.36.
Per cent of mineral in ton of rock stamped, 1.56.

Captain Johnson Vivian is still in charge at the mine, and the good results obtained are largely due to his ability and untiring energy.

His report gives particulars of the work at the mine, states the present condition of the property, and the prospects for the coming year.

The usual financial statements are submitted.

For the directors,

D. L. DEMMON, *Treasurer.*

FRANKLIN MINING COMPANY—CASH ACCOUNT FOR YEAR ENDING DECEMBER 31, 1888.

Cash on hand January 1, 1888	$133,506 47
" received from sales of copper, 3,818,016 lbs., at 14.492 cents	569,706 29
" " " sale of silver	2,727 28
" " " interest	891 43
	$706,831 47
Contra.	
Cash paid dividends January 2 1888	$40,000 00
" " " July 2, 1888	80,000 00
" " mine agent's drafts	364,835 67
" " insurance	752 11
" " storage	691 40
" " smelting	36,764 32
" " freight	13,469 25
" " expense, brokerage, taxes	10,734 37
" on hand Dec. 31, 1888	159,584 35
	$706,831 47

D. L. DEMMON, *Treasurer.*

FRANKLIN MINING COMPANY—ASSETS AND LIABILITIES—DECEMBER 31, 1888.

Assets.		
Cash on hand		$159,584 35
Copper (sold)		55,813 17
Supplies at mine		90,978 10
Notes and accounts receivable		36,035 67
		$342,411 29
Liabilities.		
Drafts outstanding	$17,139 01	
Liabilities at mine	26,899 78	
Accounts payable	9,040 16	
		53,078 95
Surplus December 31, 1888		$289,332 34

From which a dividend of two dollars per share, or $80,000, was paid January 1, 1889.

D. L. DEMMON, *Treasurer.*

OFFICE OF THE
FRANKLIN MINING COMPANY, HOUGHTON CO.,
Hancock, Mich., January 10, 1889.

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

DEAR SIR—The following report of our operations for the year ending December 31, 1888, with map of the mine, which has been carefully surveyed and marked up to date

showing the extent of the openings, stopes, etc., with inventory of supplies, tools, real estate, and machinery, also tabular statements giving in detail the cost of each department of our works, is respectfully submitted.

SURFACE.

To facilitate and cheapen the handling of coal at the lake, we have erected some trestle work on or near the dock, and made some change in the tram-road from the bottom of the incline road to the landing, which has reduced the cost of transportation of coal from the lake to the mine five cents per ton. All necessary repairs to buildings, fences, roads, etc., have been made, which gives this department about the same appearance as it had a year ago.

MACHINERY.

The new Corliss engine referred to in my last annual report was started for regular work on the twenty second day of January last, and continues to run very smoothly and satisfactorily. Seven of the old two-flue boilers have been removed, and three of the fire-box pattern substituted therefor. Another of the same kind will be added in February next, which will doubtless supply all the steam necessary for our present machinery for many years. All our plant is in good repair, and has run without any hindrance of importance.

STAMP MILL.

The amount of rock treated was 143,347 tons, which is 6,207 tons more than was stamped for 1887. All things considered, the mill is in fair condition, and with proper care it will treat all the rock the mine can furnish for many years. Since the harbor lines have been established by the United States government in Portage Lake, the depositing of sand from our mill beyond said lines has been prohibited, consequently it became necessary to elevate the sand twenty-five feet higher, a year sooner than we expected to do so at the date of our last annual report, to enable us to carry it where there is sufficient room without encroaching on the harbor lines, for which we have erected a sand-wheel thirty five feet in diameter, with 1650 feet of launders, through which the sand is carried into the bay opposite the village of Ripley. With this arrangement the sand question is settled for many years. The wheel is operated by a 16x30-inch cylinder engine, which was provided for that purpose a year ago.

MINING.

The openings made are as follows :

Drifting on the main lode	2,364 7-10 feet.
Drifting on east lode and cross-cuts	625½ "
Sunk in shafts	364 "
Sunk in winzes	80 "
Total	3,434 2-10 feet.

The amount of rock hoisted was 181,451 tons, which is 7,577 tons over the output for 1887. The rock rejected was 38,104 tons, or 21 per cent of the amount taken out of the mine. The cost per ton of rock hoisted was $1.89, which is two cents in excess of the cost for last year, which is owing to the extra construction expense and increase of wages. The percentage of ingot copper in the rock hoisted is one per cent, which is a decrease of 12-100 per cent from 1887. This was caused by the falling off in value of the ground in the south part of the mine. No. 3 shaft has been sunk from a point

thirty feet below the 29th level to the 30th. This opening is still in the foot side of the main lode, consequently nothing can be said in relation to the value of the lode at this level until it is reached with a cross-cut, which will be done about the first of February. The lode at the 30th level, north of this shaft, which has been opened 240 feet, is not very productive; it contains some stamp copper, but will not pay to stope. The 29th level has been extended north 420 feet, all of which will pay to take out, except about 75 feet near the shaft. The twenty-eighth level, for a distance of 270 feet north of shaft, has exposed a large amount of good stoping ground. No. 5 shaft has been sunk from the 28th to the 30th level, all of which is in the hanging wall trap. At the bottom level the lode is in the foot wall, 25 feet from the line of the shaft, which has been exposed by cross-cut and opened at this level 65 feet. The lode at this point is about fifteen feet wide, and showing all grades of copper in good paying quantities. Drifting in this part of the mine has been done at the several levels from the 26th to the 30th level to the extent of 600 feet. The lode in these openings with but little exception will pay a good profit. There is a large amount of ground opened in this part of the mine that will yield as much copper per fathom *as any we have had in any part of the property for the last ten years.*

EAST LODE.

From time to time, for the last four or five years we have been exploring each side of the main lode with a diamond drill without the least success until July last, when we discovered, at the 30th level, 47 feet east of the main lode, an amygdaloid, 20 feet wide, bearing stamp and barrel copper in paying quantities. This lode has been opened at this level 288 feet, which has exposed some good stoping ground for at least 200 feet in length. The last eighty feet opened is not showing anything of value. In sinking a winze from the 30th to the 31st level some very rich stamp and barrel copper was met with. At the 31st level this lode has been cut into with a cross-cut which has shown it to be copper-bearing for fifteen feet in width. Some good stamp rock and some barrel copper is being taken out at this point daily. At the 29th level this lode has been intersected with a cross-cut, and opened on its line 128 feet. On the whole it is less productive than it is in the levels below, but some portions of it will afford some fair stamp rock, and will doubtless pay to stope. There is a large amount of ground ready for stoping on this lode that will yield in ingot copper *above the average of the main lode.*

PROSPECTS FOR 1889.

If the present appearance of the mine continues, and all runs smoothly and regularly, as it has done for the year just past, our product for the ensuing year will doubtless be about 2,200 tons, and our expenses will not be materially increased, if any.

My assistants, Capt. Thomas Dennis, who is in charge of the underground department, Mr. Arno Jaehnig, the clerk, and Mr. James Moore, the chief engineer, continue to promote the best interest of the company in the same faithful manner as they have done for many years. Yours respectfully,

J. VIVIAN, *Superintendent.*

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	3	699	1873	183	.....
1858	56	1,104	1874	23	1,790
1859	116	1,211	1875	583	800
1860	157	1,860	1876	963	641
1861	783	43	1877	1,169	1,817
1862	733	645	1878	1,299	1,528
1863	639	684	1879	1,414	1,703
1864	605	1,335	1880	1,168	466
1865	779	1,481	1881	1,338	1,932
1866	819	994	1882	1,632	120
1867	701	455	1883	1,744	1,308
1868	737	1,326	1884	1,882	1,697
1869	779	970	1885	1,999	1,172
1870	589	.....	1986	2,132	297
1871	300	1,000	1887	1,975	1,832
1872	186	.....	1888	1,827	1,751
Total				29,568	61

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.

THE PENINSULA COPPER MINE

is again active—in the list of producers. After many years of idleness, a company was organized in 1882 that opened up the mine, built a new stamp mill and operated for two years. Since 1884 the mine has been practically idle.

Some work was done in 1886, but of little significance or value.

The estate comprises 2,560 acres, situated in Sections 7, 8, 9, 10, 11, T. 55, R. 33, W. and the mine, which was first worked in 1860, is in a conglomerate belt, identical with the Allouez.

It was formerly known as the Albany & Boston, but the belt is undoubtedly the Allouez conglomerate, and the mine presents the same characteristics as are found at the Allouez and at the conglomerate mines in Keweenaw county.

There are limited portions—so-called copper-shoots—that are very rich; but also, comparatively, a great deal of barren ground. It is only to be ascertained if there is enough good stoping ground to render it a paying mine under fair conditions.

The high price of copper in 1888 afforded the stimulus for the renewal of activity. Accordingly in June last the pumps were started. The plan is to open the mine more extensively than it has been done heretofore with the view to selecting the paying ground and avoid that which is the reverse. At the time I visited the mine in January last, they were sinking the two shafts. No. 1 was below the 6th level and No. 2 below the 7th. The former at that date was 550 feet deep and the latter 600 feet. The first level is opened a length of 1,700 feet. The 2d, 3d, 4th and 5th levels are about 900 feet long, the 6th 300, and below that only sinking has been done.

The present officers are H. Z. Turell, Secretary and Treasurer; A. A. Spendlow, President, New York; W. A. Dunn, Superintendent, Houghton, Mich.

Capt. Dunn has commenced to drive a cross-cut east in the 4th level, 90 feet west of No. 2 shaft. The purpose is to find the Calumet & Hecla conglomerate. When I saw it the cross-cut was in 300 feet. It will be continued for 1,000 or 1,500 feet further, if necessary. The land is crossed by all the important lodes in the country. The bearing of the formation seems to be N. 40° E., and the dip 52° northwesterly. The length of the lode within the company's lines is 5,100 feet.

At the time of my visit the force employed was about fifty men.

The stamp mill was built in 1883, and has two improved Ball heads, 16″ cylinders, 10″ shafts, 48 iron frame, Collum washer. The mill is 1,386 feet from the rock house, with which it is connected by an inclined track which rises from the rock house to the mill 46 feet.

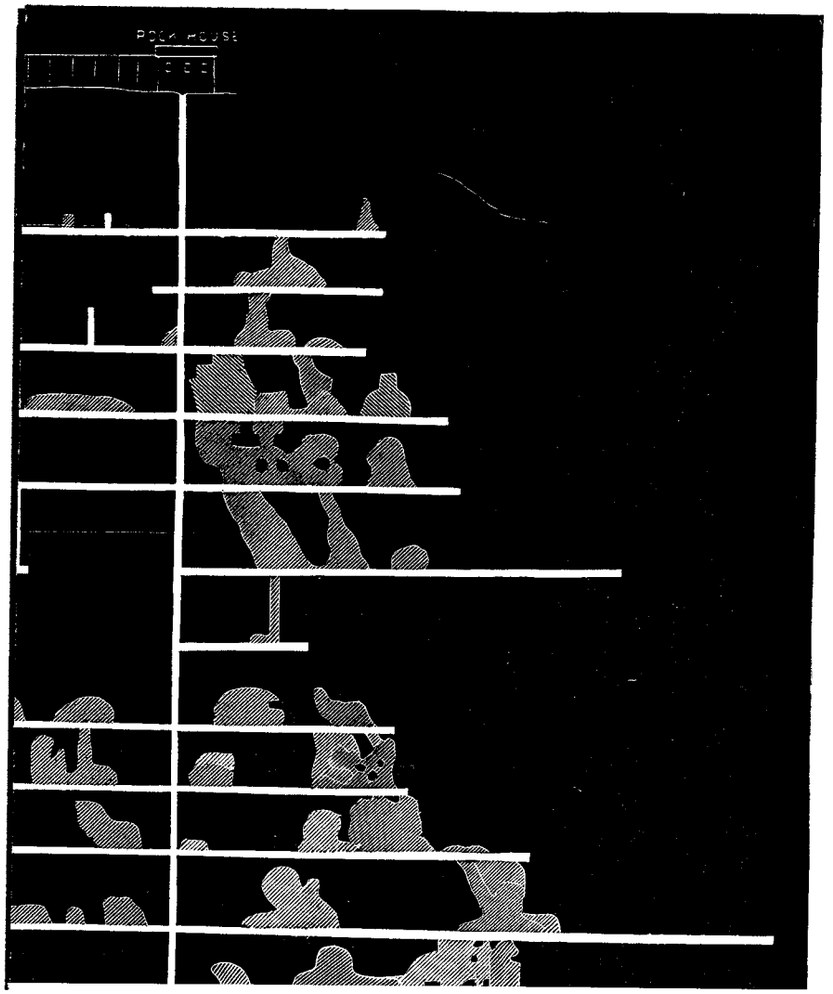
Capt. Dunn purposes to start the stamp mill by and by, but for a time he will only push the cross-cut and the openings.

The lode is a wide one—14 feet to 25 feet wide; a very coarse conglomerate. The location is pretty well provided with buildings. If the price of copper keeps up I do not see why the mine may not be successfully worked. No doubt some hope is based on the probability of cutting the Calumet & Hecla conglomerate.

The mine has yielded 1,543 tons 1,071 pounds of copper.

THE OSCEOLA

is an interesting mine to examine; its record is one of the most instructive of any in the country. I think it safe to say that there has been a larger amount of sinking and drifting—opening work—done in the Osceola mine than in any other mine in the State in the same length of time. The company has been successful. The mine has been a profitable one, but this result has



been largely due to the excellent management. The mine yields copper in a fair ratio, that is, the rock mined and treated in the mill yields a fair percentage of copper; but to get this a vast deal of non-productive ground has to be gone through. The Osceola is a very irregular, bunchy, amygdaloid belt. It is sometimes so pinched and trappy as to be difficult to follow. The best portion of the mine has been at the north end adjacent to the Calumet & Hecla. But I have heretofore described the mine with sufficient fullness, and although I went under ground in the Osceola recently, I did not discover anything different from what it formerly appeared except that the ground at the south end is improving; but there are good stopes all through the mine in every level from the 5th down.

They are now sinking the "Opechee shaft" away at the south end of the mine, and some remarkably rapid work has been done. As, for instance, in December, this shaft—double skip—was sunk 80 feet with one drill at a cost exclusive of timber, etc., of $8.00 per foot.

The company's published report is so full and explicit that it is better to give it in full, and that with the map conveys all necessary information.

Osceola Mine Report.

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

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1874	468		1882	2,088	782
1875	665	303	1883	782	2,128
1876	846	1,737	1884	2,123	1,630
1877	1,382	777	1885	969	1,169
1878	1,352	1,998	1886	1,780	786
1879	1,589	1,387	1887	1,791	1,723
1880	1,691	1,387	1888	2,067	320
1881	2,089	1,876			
Total				23,045	534

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

The product of mineral was 4,833,543 pounds, which at 85.53 per cent. gave 4,134,320 pounds of refined copper, for which has been realized the gross sum of	$621,275 14
Interest	675 17
	$621,950 31

The costs have been:

Running expenses at mine		$404,204 35	
Smelting, transportation, and all other expenses of selling copper		75,669 07	
			479,873 42
Showing a mining profit of			$142,076 89
The balance of assets, January 1, 1888, was		$235,516 15	
There has been expended in mine plant during the year	$22,907 89		
Deduct dividend of January 16, 1888	50,000 00		
Deduct dividend of June 15, 1888	50,000 00		
Deduct dividend of September 15, 1888	50,000 00		
		172,907 89	
			62,608 26
Making the balance of assets January 1, 1889			$204,685 15

It is doubtless well known to our stockholders that this company, as well as nearly all of the other copper producers of the world, has sold its production of copper for about three years to "La Societe Industrielle et Commercaile des Metaux de Paris," at 13 cents per pound, and in addition such sum as shall be equal to one-half of the net profits realized above this price on resales thereafter made of said copper. This sale was consummated April 20th last, and expires December 31, 1890, and, as a guarantee, a letter of credit in favor of this company was opened by "Comptoir d'Escompte de Paris," with J. & W. Seligman & Co., of New York, for $520,000. Thirty days before May 1, next, a similar letter of credit is to be furnished, and the same is true of the year following. Up to this time this letter of credit has been reduced to about $410,000, by deliveries of copper unsold. On resales, of course, the credits are not drawn against.

The high cost of our copper the last year, as compared with the previous year, will be noted. This was owing to the falling off in the quality of our rock in August, September, October and November. If one will take this report and compare it with that of the previous year he will see that under the head of "summary" the amount of refined copper per ton of rock in 1888 was 22.59 lbs., as against 24.68 lbs. in 1887. An average for the six years previous to 1887 gives 25 pounds as the amount of refined copper in each ton of rock stamped. In addition to the foregoing reason for high cost of copper, considerable development work was done, which was not profitable, but necessary. For further details regarding these matters we refer you to Capt. Daniell's report herewith submitted. It gives us pleasure, however, to state that the mine began to improve in November, and in December the amount of refined copper to the ton of rock stamped was 27.12 lbs., and January of this year will do equally as well, consequently we have reason to believe that the year 1889 will show better results than 1888.

It has been intimated in former reports that our smelting arrangements were quite unsatisfactory, and that plans for improvement in this direction were contemplated. We can now say that these plans are approaching completion, and we expect to begin smelting with the Tamarack-Osceola Copper Manufacturing Company early next summer. The furnaces now being erected by the said company are of the latest pattern, and we firmly believe that not only shall we make a considerable saving of cost in this department, but that the quality of the copper will be superior to anything we have been able to produce hitherto.

We call your attention to the treasurer's report, from which you can see that the financial affairs of the company are in a good condition.

JOSEPH W. CLARK, *President.*
ALBERT S. BIGELOW,
CHARLES VAN BRUNT,
GUSTAV STELLWAG,
GEORGE F. BEMIS,
JOHN N. DENISON,
JOHN DANIELL,
Directors.

ASSETS AND LIABILITIES.

Assets.		
Cash in bank at Boston		$24,855 32
Cash on hand at mine		1,383 20
Supplies on hand at mine		29,356 78
Fuel on hand at mine and stamp mill		12,312 08
Accounts receivable at mine		33,658 94
Bills receivable at Boston		120,527 50
3,000 shares stock in Tamarack-Osceola Copper Manufacturing Co.		15,000 00
250 shares Hancock & Calumet R. R. stock		25,000 00
Copper on hand, 272,733 pounds, since sold		39,549 19
Total assets		$301,643 01
Liabilities.		
Drafts outstanding	$28,435 33	
Accounts payable at mine	37,414 65	
Bills payable at Boston	29,921 88	
Dividends uncalled for	1,186 00	
Total liabilities		96,957 86
Balance of assets January 1, 1889		$204,685 15

STATEMENT OF RECEIPTS AND EXPENSES OF ALL KINDS FROM SEPT. 25, 1873, TO JAN. 1, 1889.

Receipts.		
From capital stock, 50,000 shares, $25 a share, full paid		$1,250,000 00
From 936,002 lbs. copper 1874 at 23 37-100		218,736 92
From 1,330,313 " 1875 at 22 77-100		302,862 96
From 1,693,737 " 1876 at 20 57-100		348,333 25
From 2,774,777 " 1870 at 18 19-100		504,636 93
From 2,705,998 " 1878 at 15 53-100		420,340 14
From 3,197,387 " 1879 at 17 79-100		568,689 89
From 3,381,061 " 1880 at 19 15-100		647,487 19
From 4,176,976 " 1881 at 17 77-100		742,585 84
From 4,179,782 " 1882 at 17 70-100		739,458 26
From 4,256,409 " 1883 at 14 96-100		636,846 83
From 4,247,630 " 1884 at 12 82-100		544,651 02
From 1,939,169 " 1885 at 10 75-100		208,558 65
From 3,560,786 " 1886 at 10 51-100		374,144 13
From 3,583,723 " 1887 at 11 86-100		424,936 85
From 3,134,320 " 1888 at 15 3-100		621,275 14
46,098,070 " total at 15 84-100		$7,303,544 00
From sales of silver to date		32,439 04
From interest receipts to date		36,886 04
From 360 shares Hancock & Calumet R. R. stock		36,000 00
Total receipts		$8,658,879 08

Expenses.

Running expenses prior to 1888	$5,485,072 67	
Running expenses during 1888	479,873 42	
		$5,964,946 09
Construction expense prior to 1888	$714,536 44	
Construction expense during 1888	22,907 89	
		737,444 33
Real estate		588,836 70
Dividends prior to 1888	$1,022,500 00	
Dividends during 1888	150,000 00	
		1,172,500 00
Exploratory work		15,466 81
Total expenses		$8,479,193 93
Balance of receipts January 1, 1889		$179,685 15
Add 250 shares Hancock & Calumet R. R. stock		25,000 00
Balance of assets January 1, 1889		$204,685 15

Details of Mining Expense.

Shaft sinking 534.8 feet at 18.54	$9,915 79	
Winze sinking, 712.8 feet, at 11.23	8,004 30	
Drifts, 2,933.6 feet, at 6.59	19,326 59	
Stoping, 12,069.12 fathoms, at 11.19	135,133 00	
Tramming	39.124 58	
Timbering, labor, materials and supplies	6,418 68	
Extra work	1,335 10	
Supplies, fuel, labor, etc., for air drills	35,283 25	
Supplies, fuel and labor for engines	37,524 85	
Mining superintendence and company account, labor	19,782 44	
Blacksmith, machinist and carpenter labor	2,482 70	
	$314,331 28	
Less profit on supplies	36,393 00	
		277,938 28

Other Expenses.

Rock house	$20,089 92	
Surface labor, supplies, etc.	2,998 03	
Incidental expense, including taxes	6,240 94	
Office labor, supplies, etc.	5,515 55	
Transportation	28,596 73	
Stamping	62,824 90	
		126,266 07
Total running expenses		$404,204 35

Construction Costs.

New engine and boiler house at Opechee	$3,929 63	
New compressor and building	14,107 24	
Dwelling houses at mine	3,195 73	
Stamp mill construction	899 46	
Dwelling houses at stamp mill	775 83	
Total construction costs		$22,907 89
Total expended at mine		$427,112 24

Summary.

Rock stamped	183.036 tons.
Product of mineral	4,833,543 lbs.
Product of refined copper	4,134,320 lbs.
Yield of refined copper per ton of stamped rock	22.59 lbs.
Yield of refined copper per cubic fathom of ground broken	359 lbs.
Yield of mineral per cubic fathom of ground broken	420 lbs.
Percentage of mineral in stamp rock	1.32 per cent.
Percentage of refined copper in stamp rock	1.13 per cent.
Cost per ton of rock hoisted	$1 95
Cost per ton of rock stamped	2 21
Refined copper, cost per pound at mine	9.78 cts.
Cost of smelting, freight and all other expenses	1.83 cts.
Total cost per pound of refined copper laid down in New York	11.61 cts

Superintendent's Report.

Opechee, *February 8, 1889.*

To the President and Directors Osceola Consolidated Mining Company:

Gentlemen:—I beg to submit the following as a report of our operations for the year 1888.

Our expectations for the year, expressed in last report, were not met. The stopes very unexpectedly fell off in yield, and as is usual when working in lean ground, we found the lode narrow. This last materially enhanced the cost of breaking rock. The difference in yield, comparing with the preceding year, in rock hoisted, was one pound of ingot copper per ton. The rock stamped shows a difference against us of over two pounds of copper per ton. It cost nine cents per ton more to manipulate stamp rock. Smaller credits for work done at stamp mill, and the reason before given, costlier stoping, accounts for this.

We hoisted 207,292 tons of rock, and sent to mill 183,036 tons—the proportion discarded being less than usual. The e figures show that 11,516 fathoms of ground were broken and treated. The product was 4,134,320 lbs. ingot copper, or 359 lbs. per fathom —nearly 20 lbs. per ton of rock.

The opening work underground for the year foots up as follows:

Shafts	534.8 feet.
Winzes	712.8 "
Levels	2,933.6 "
	4,181.2 feet.

Sinking of shafts for the year, and their depths at the end of the year, is shown below.

Shaft.	Sunk.	Depth from surface.
No. 1.		1,387.1 feet, 18 feet below 15th level.
" 2.	120.1 feet.	1,995.9 " 20 " 22d "
" 3.	97.2 "	1,995.5 " 20 " 22d "
" 4.	156.5 "	1,853.2 " 20 " 21st "
Opechee:		
No. 5.	161.0 "	575.0 "

The different levels have been extended as follows:

11th level, 20 feet.	19th level, 212 feet.
16th " 173.6 "	20th " 511.9 "
17th " 331.6 "	21st " 711.3 "
18th " 345.7 "	22d " 627.1 "

I will briefly refer to the character of the ground opened at the different levels and shafts.

No. 2 shaft in sinking to the 22d level was generally below the most productive part of the lode, in the foot wall part of it.

Occasionally it showed some good patches of copper rock, but as a rule it would be rated as poor. Recent sinking has shown the hanging wall of the lode in the shaft, and we have had moderately good copper ground.

The 22d level was drifted north of No. 2 shaft 52 feet. The lode here is narrow and lean. The 21st level, north of No. 2 shaft, has been extended 120.4 feet. The lode here is comparatively soft, and is very nearly average quality. Communication between No. 2 and No. 3 shafts has been made at 22d and 21st levels. The 22d level opened copper ground for its whole length, some of it being quite good. Stopes now at work are above the average, both in width of lode and productiveness. The 21st level afforded a good deal of stoping ground, but the lode is bunchy, and on the whole is not above average.

No. 3 shaft at 21st level was in the hanging wall trap. In sinking the lode was found in the line of the shaft, and has continued to present bottom. We find fairly good ground for copper. The lode is of average width, and is quite promising.

Drifting 22d level south of No. 3 shaft 53.2 feet showed some fairly good ground near the shaft, but later not very good. The 21st level south of No. 3 shaft has been drifted 110.6 feet. Judging from the level over we expected good ground here, but have so far seen nothing of value. Lode is narrow. Later, when communication is effected with No. 4 shaft, this ground will be tested by stoping, and above the poor bar, copper ground will no doubt be found.

The dip of the lode near No. 4 shaft has been quite irregular. In sinking the shaft we have been wholly in the hanging wall trap, and again in the lode more than once. In present bottom the lode is exposed and it is good for copper. The 21st level north of No. 4 shaft, like the same level south from No. 3 shaft, has been poor. This is no unusual occurrence, and we shall not hesitate to test the ground by stoping. The 20th level south of No 4 shaft has been drifted 334.1 feet. Ground of much promise is laid open here the full length, the last 125 feet drifted showing a very good lode, and the advanced breast is good. The 19th level south of No. 4 shaft has been extended 164.5 feet. The lode has been good all the way from shaft to present end. The 18th, 17th and 16th levels, extended respectively 345.7 feet, 331.6 feet and 173.6 feet, have all been good for copper. Short, poor bars have been encountered, but all the ground opened is better than average quality. Both 18th and 17th levels are nearly 600 feet from shaft. These openiugs afford such proof of the extension of our better ground south that we could not hesitate about sinking Opechee shaft. As will be seen by reference to the section and plans of the mine, our stoping has been scattered a good deal through the different levels. We could have drawn more heavily on the ground south of No. 4 shaft to good advantage, but our hoisting facilities at that shaft have been wholly employed.

For the last three months our stopes have shown quite an improvement, and appearances today would warrant the expectation of a continuance, but I would hesitate after last year's experience to lead you to anticipate anything materially better than we have averaged, for changes come very suddenly. Whatever may be the outcome, the mine is now showing very well. I do count this year in getting our rock broken cheaper than last year. A greater width of working ground will ensure this.

Opechee shaft, or No. 5 shaft, has been unwatered, enlarged to size for two skip roads, and sunk 161 feet. It was down, at the close of the year, about 580 feet from the surface. Last month it was sunk 80 feet. The intention now is to sink to 12th level, and communicate at that depth with our main workings. In sinking we find a little copper, but the character of the lode does not indicate long courses of copper ground. Deeper, there is no doubt but that we will encounter as good ground as we have in the mine. We shall push the sinking as fast as possible, feeling that it is a matter of great importance to attain sufficient depth to draw a part of our product from this shaft, which, ultimately, I have no doubt, will be *the* shaft of the mine.

Work on the west amygdaloid was discontinued early in the year. There is copper still to be found there, but the irregularity of its occurrence is most perplexing, and for some time we could not feel assured we were taking it out at a profit.

Through the rock houses we passed 207,292 tons of rock, aud discarded 24,256 tons. 183,036 tons were sent to the mill. Cost of handling, on account of increased quantity, was a little less than the preceding year, 9.68 cents per ton.

The mill stamped 183,036 tons beside 9,978 tons for Tamarack, and 19,425 tons for Kearsarge mine, in all, 212,439 tons, at a cost for the whole of 37.9 cents per ton. Mineral product from mill was 4,545,941 lbs. In addition we got barrel work 287,602 lbs., or a total product of 2,416 1543-2000 tons mineral. This afforded 85.53 per cent. ingot.

Construction account is comparatively heavy on account of our erecting a new air compressor. The machine is provided with compound cylinders, steam and air. It works very well, reducing our expenditures for fuel. The capacity is equal to running 16 drills.

At Opechee, besides providing the necessary equipment for shaft sinking, pumping, hoisting, etc., we have built eight dwellings for employes. One house has been erected at the mill, and we have purchased three dwellings from former employes.

Detailed statement of accounts prepared by Mr. Reeder, our clerk, and plans by Mr. Klepetko, our engineer, should accompany this.

Everything has run regularly during the year. My assistants have faithfully and intelligently given the company their best services.

Yours very truly,

JOHN DANIELL, *Superintendent.*

THE TAMARACK MINE

occupies a large measure of public attention. No company has been more richly rewarded than the owners of this mine, and none better deserves the recompense.

I find very little to add to what I have heretofore written. I have been to the bottom of the mine and through it twice during the past winter, and find it to be as interesting and valuable as ever.

Heretofore it has been impossible to keep the mine greatly opened, since the length of the mine has been so short, and the desire to make as large a product as possible, have caused the stoping to be kept well up with the opening. Now, as greater depth is attained, the lower levels are of much greater length, and there can be an increase of product without crowding the work.

But the most important fact is that No. 2 shaft is completed down into the mine. Heretofore the mine has had but a single shaft. Three cages to be sure but simply worked in compartments of the one shaft. Now there are two independent shafts, each with three compartments. No doubt they all, officers and men, feel easier. Half a mile down into the earth with but a single artificial avenue of escape, and that a vertical one, straight up from the bottom. No. 2 is directly north from No. 1,731 feet, and will intersect the lode 2,600 feet from the surface. The engine house has been built at No. 2, and the machinery provided. In January the shaft was sunk 93 feet, and they hoisted in same month, in No. 1, 17,000 tons of rock.

The Tamarack company is an educator in mining work and keeps in the advance. In the past year it has introduced the solid foundation in No. 3 stamp head, and as a result it is safe to say that no more stamp heads will be put up with the time-honored spring bottom. Men in mining, in metallurgy, in everything in fact, greatly reverence custom. A process or method or way of doing any sort of work that has the sanction of authority, is sure to be followed and slow to be relinquished. Somehow it came to be considered as necessary that spring timbers should be put under the stamp heads to receive the blow; otherwise, it was maintained, that the shaft would become crystalized and break. Of course with a spring bottom the blow must be far less effective, but nevertheless it has been assumed that this drawback must be borne, because the shaft would break if the bottom were solid.

The Tamarack company, last summer, had No. 3 stamp head built with a solid iron bottom, and the result of the work has been watched with great interest. It is found to crush far more rock than either of the others, and not the least injury to shaft or other portion of the machine is observed. It is surprising to stand by this stamp and find no jar, while the others, on the old plan, make everything shake. The anvil to receive the blow contains forty-six tons of iron, and the head has crushed 322 tons in a day.

The Tamarack company is the owner of a large estate, and may, in time, rival the Calumet & Hecla as a producer. It has already begun the work of sinking two additional shafts in the west half of section 11, a mile north of the mine. These shafts, 3 and 4, will have to be sunk to a depth of about 4,000 feet to reach the conglomerate. I have not the data to make the exact estimates.

It is an entirely feasible undertaking, and there is scarcely a question but they will open into ground equally productive with any in this lode.

At No. 2, the drum is 30 feet diameter; engine 45″x7 feet. A "tail rope" will be attached to the cage. The shaft—No. 2—has not reached the conglomerate yet, but has intersected a cross-cut driven from No. 1 shaft. Its

length from the surface to this cross-cut is 2,202 feet. The work has been in progress about three years, and the average monthly descent has been 60 feet.

The cross-cut was made for the sole purpose of coming under the shaft, and the intersection corresponded exactly with previous estimates, proving the correctness of Mr. Frank Klepetko's engineering.

The following is taken from the company's report:

The officers present the following report of the operations during the year ending June 30, 1888:

The production of mineral was 13,607,224 pounds, which at 76.36 per cent, gave 10,389,867 pounds of refined copper, for which has been realized the gross sum of		$1,448,943 88
The costs have been—		
Running expenses at mine	$412,723 53	
Smelting, transportation, and all other expenses	184,515 54	
		597,239 07
Showing a mining profit of		$851,704 81
Add balance of assets July 1, 1887		25,445 26
		$877,150 07
Deduct dividend No. 1, paid April 1, 1888	$120,000 00	
Deduct amount expended in mine plant during the year	150,985 95	
		270,985 95
Making the balance of assets		$606,164 12

We feel that the results of last year must be very pleasing to every stockholder. The promise of producing copper at a cost of six cents a pound has been more than realized. In fact, we can safely say that the figures of cost shown above have never before been equaled by any copper mine in the world. Our third head of stamps has been in operation less than two months; we think it proper, therefore, to call the attention of the stockholders to the fact that these low figures of cost were obtained from the running of but two heads of stamps; that when the mine is sufficiently opened to warrant the running of four heads of stamps, say in two years time or less, even these figures will be materially lessened. Comparing the diagram annexed with that attached to last year's report, the amount of mine work accomplished during the year, and the small amount of ground necessary to take out, to produce over ten millions of pounds of copper, can be easily seen, and gives one somewhat of an idea of the life of the mine, for it should be remembered that the diagram referred to is a section of but eighty acres out of 1,160 acres of land belonging to the company.

We made our first dividend of $3 per share in April, our second of the same amount in July, and the third, of $5, will be paid in October. We hope and expect to continue quarterly with $5 per share, making for the future $20 a share annually; leaving, we trust, a respectable surplus.

To total cash assets, June 30, 1888		$690,306 30
To total liabilities		84,142 18
Balance of assets		$606,164 12
Total receipts from all sources	$2,839,831 33	
Total expenditures	2,283,667 21	
Balance of receipts		606,164 12

DETAILS OF MINING EXPENSE.

Underground Expense.

Shaft sinking, 110.80 feet, at $20.00	$2,216 00	
Winze sinking, 366.40 " 11.60	4,249 15	
Drifts, 3,339.24 " 9.56	31,938 47	
Stoping, 5,920.00 fathoms at 11 86	70,215 21	
Tramming	28,846 12	
Timbering, labor, materials and supplies	37,222 36	
Extra work	5,566 87	
Supplies, labor, fuel, etc., for air drills	29,306 88	
Supplies, fuel and labor for engines	33,823 21	
Mining superintendence and company account labor	36,736 85	
Blacksmith, machinist, and carpenter labor	4,284 64	
		$284,405 76
Less profit on supplies, etc.		19,247 00
		$265,158 76
Other expenses—Rock house, surface, office, stamping, etc.		147,564 77
Construction account, total		150,985 95
Total expended at mine		$563,709 48

Summary.

Tons of rock stamped	144,412
Product of mineral	13,607,224 lbs.
Product of ingot copper	10,389,867 lbs.
Yield of refined copper per cubic fathom of ground	1,228 lbs.
Yield of refined copper per ton of rock stamped	71.95 lbs.
Percentage of refined copper to rock stamped	3.60
Cost of refined copper per pound at mine	3.97 cts.
Cost of smelting, freight, commission, and Boston expenses	1.78 cts.
Total cost of copper per pound in New York	5.75 cts.

The following is taken from report of Superintendent Daniell, June 30, 1888:

Results must be considered satisfactory. Compared with the previous year the output of rock from the mine was largely increased and the copper product more than doubled. Much less rock proportionately was discarded as poor from the rock house, and we obtained from what was sent to mill over 1 per cent. of ingot more. Each fathom of conglomerate rock broken and treated afforded 1,228 lbs. ingot against 831 lbs. in the previous year, a difference of 397 lbs. in our favor.

With an increased out-put the cost of handling rock has been lessened, the cost of stamp rock for the year being $2.86 per ton. This from a mine so deep as ours, continually increasing its force, and necessarily employing much labor untrained to our requirements, is at least doing fairly well.

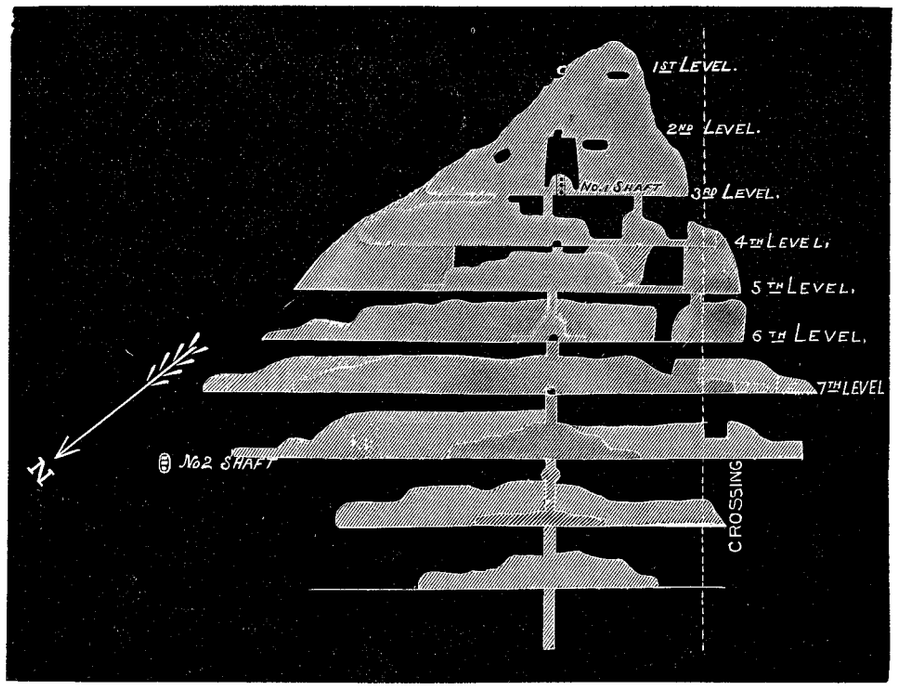
During the year No. 1 shaft has been sunk 110.8 feet, making the depth 2,570 feet from surface, and 22.5 feet below 9th level. The 10th level has nearly been reached since, and cross-cutting from the shaft will soon be under way. Two headings are now being run from a winze at 10th level, one towards the shaft, the other towards the conglomerate. It will require three months to get in good running order at 10th level, so as to break and send rock to surface from the conglomerate from that depth.

Opening work for the year foots up as follows, viz.:

No. 1 shaft sunk	110.8 feet.	
No. 2 shaft sunk	771.4 "	
		8882.2 feet.

LONGITUDINAL SECTION OF THE TAMARACK MINE, JAN. 1, 1889.

Scale: 300 feet to an inch.



Winzes, conglomerate	366.4 feet.	
Winzes, country rock	132.6 "	
		499.0 feet.
Levels, conglomerate		1,988.4 "
Cross-cuts		1,350.8 "
Total		4,720.4 "

There is nothing to indicate any decline in the size or richness of the lode, and we then can only infer that we are but entering on a very prosperous career.

The quantity of rock handled for the year was 162,945 tons; 10,590 tons, from openings in country rock, were stowed underground, much of it in back of 4th and 5th levels; 152,355 tons were sent to the rock house, and 144,412 tons to the mill, the quantity discarded as poor being 7,943 tons. The quantity of rock hoisted from the conglomerate workings equals 8,461 fathoms of ground. Mineral produced, 13,607,224 lbs., at 76.36 per cent equal to 10,389,867 lbs. ingot. Boulders smelted without stamping, 302,223 lbs. Ingot in stamped rock equals 3.597 per cent.

No. 2 shaft was sunk for the year, 771.4 feet, making the depth June 30th last, 1,402.8 feet. In the last two months 164 feet have been sunk, making the depth to date from collar of shaft, 1,566.8 feet.

We have done good work in sinking recently; last month 85 feet. A cross-cut at 2d level has been drifted from vicinity of No. 1 shaft towards No. 2, and is now within 100 feet of being under it. If we maintain late rate of sinking, early in April next we shall effect communication between the cross-cut and shaft, and this is a matter of great importance to us. Communication made, we shall use all diligence to carry the shaft to the bottom of the mine. Next year, then, we expect to be in position to materially increase our rock output, and this from what we consider is the best part of the mine.

Hoisting plant for No. 2 shaft has been ordered, and will be ready for erection early next spring.

The quantity of rock mined last year was larger than we anticipated a year ago, and in excess of the capacity of our stamp mill until we got No. 3 head ready to work—11,203 tons were treated for us in Osceola Mill, 133,209 at our own. Cost of stamping was 55.15 cents per ton. In Tamarack mill, 53.06 cents. We can do better than this, without doubt. The cost of stamping, after No. 3 head was started, was less than 50 cents per ton. In matter of duty our mill has done good work. There was no delay from imperfect machinery. Early in May, No. 3 head was started up. In construction of this, the use of oak spring-timbers to support the mortar and mortar-block have been discarded. Solid bed of iron, about 45 tons, has been substituted, apparently with perfect success and good results. The years average duty shows 216 tons of rock stamped for 24 hours' running time. In the last two months we got over 230 tons from each head in 24 hours.

Our construction work continues to be important. At stamp mill we put in an additional head of stamp, with jigging machinery, slime tables, etc., and added an additional boiler. We spent about $5,000 in bringing in the water of the Hungarian river. Probably this will give us water for three heads of stamps, without pumping, for four months in the year, and sufficient for one head much of remaining time. The water comes into the mill through a pipe which gives 200 feet of pressure, and this we regard as an important protection in case of fire.

THE TAMARACK, JR.,

is a creation of the original company. The estate consists of three "forties" in section 11, E. ½ S. E. ¼, and S. E. ¼ N. E. ¼, sections 11, 56, 33. The work of sinking two shafts is progressing favorably. May 1st, No. 1 has a depth of 775 feet, having progressed at the rate of 63 feet per month. No. 2 is at a less depth.

In company with Capt. Daniell I made an inspection of the location in February last, and was well pleased with all I saw. Probably in two years the mine will be producing copper. The land was set off from the old company on an equitable basis. No. 1 had cost, when at the depth of 476 feet, $23,663.-87, and No. 2—305 feet deep—had cost $18,810.88, being $61.68 per foot. The total expenditure up to January 1, 1889, at mine was $107,119.48.

No. 1 shaft is 3-compartment, same as No. 1, Tamarack, while No. 2 is 4-compartment. They are 800 feet apart. The estimated outlay to sink these shafts and to equip them is $800,000. A plant has been erected at each shaft to suffice for the work of sinking. But if the mine proves to be as anticipated more powerful machinery will be finally required. The sinking was begun just a year ago, May, 1888. Preliminary work began in March previous.

Capt. John Daniell, General Manager of the Tamarack, Osceola, etc., mines, also superintends the Tamarack, jr. The mining captain is John Cruse; A. C. Bigelow, Secretary and Treasurer, J. W. Clark, President, Boston.

The Tamarack company has other irons in the fire. It is carrying on other industries that are of much importance to the country. At Dollar bay, on the north side of Portage lake, the company has engaged in the manufacture of copper wire and sheet copper, etc., and is carrying on the business extensively. They have a large saw mill and are making also the finished products of lumber used in building.

Besides these they have works nearly completed for smelting their copper. Hereafter the copper produced in the Tamarack, Osceola and Kearsarge mines will be smelted at the company's works.

All these industries are conducted by the Dollar Bay Improvement Company, the chief officers of which are the same as those of the mines above mentioned.

From Hancock, now, along the north side of Portage lake, and the west side of Torch lake is much activity. Stamp mills and smelting works, etc., employ a large number of men, and this locality has become a busy one. The dwellings, public buildings and places of business are unusually good. Altogether it is a pleasant and prosperous portion of our State.

THE CALUMET AND HECLA MINE

has occupied a larger measure of public attention of late than ever it did formerly. Much interest has centered in the fire that has prevailed for so long in the mine, and the effect which this misfortune to the company would have on the copper production of the country and on the price of the metal in the markets.

The fire, which is not yet out, started on November 29 last—Thanksgiving night—in No. 3 Calumet shaft, and eight men, whose names are known, were destroyed. Since that date—five months—no copper has been produced in what is known as the Calumet and Hecla mine proper. The product has all come from the South Hecla, or Black Hills mine as it is called, which is in the same deposit, but more than half a mile south, next to the Osceola.

The Calumet and Hecla mine, as its name implies, is a consolidated company. The Hecla mine on the south in Sec. 23, and the Calumet on the north; the dividing line is the section line between sections 23 and 13, T. 56, R. 33. The shafts are numbered from this boundary each way, 1, 2, 3, etc., Calumet, and 1, 2, 3, Hecla. In the Calumet there are five shafts, and in the Hecla 4—that is, in the original Hecla, but further south, in the Black Hills mine, are 9, 10, 11 and 12, besides shafts 7 and 8, which are sinking. The total length of the mine, from the south end to the north line of Sec. 13, measured along the conglomerate belt, is about 14,000 feet. What has been deemed barren ground between the Hecla and Black Hills mine is rapidly approaching the line of production. The Black Hills shoot of copper passes through it and is reached in the Tamarack mine. Nos. 7 and 8 shafts will soon be in this productive ground, when the Black Hills mine will have a greatly increased length. The present fire began in No. 3 Calumet shaft in the 6th level. It was thought at the time of its occurrence that it would soon burn out, and would not be likely to spread; but it has proved to be a far more serious matter than was anticipated. As to the origin of the fire, the chief officers of the company declare that it was set on fire, and a reward of $10,000 is offered for the apprehension and conviction of the perpetrator of the crime; but after five months the incendiary has not been found.

The majority of mining men, I think, are of the opinion that the fire resulted from the friction of the rollers in the shaft. There is a good deal of movement in the ground; it swells and expands, and pinches the timbers, causing the shafts to become smaller, requiring that they be constantly trimmed, etc. The tracks get displaced slightly, and tend to bind the rollers

that are laid in them to support the heavy wire rope that draws the skip. This rope, running down at the rate of 1,500 feet per minute sometimes, I am told, generates sufficient heat to ignite a roller if it happens to be bound so that it will not revolve. Incipient fires of this origin have occurred, not only in the Calumet, but in other mines. The mine being so large, with so many shafts, and down to such a depth—39 levels—that there is great opportunity for the circulation of air; also, it is a network of dry pine timber, and, in the old levels, cedar lagging, which burn like tinder.

In February last I was at the mine when the officials expressed the opinion that the fire was all out. Communication between No. 5, which is the shaft furthest north, and the rest of the mine was shut off by stopping the levels at No. 5, and the work of freeing the mine of water by bringing it up in the skips and with pumps was begun. The coverings had been taken from over the mouths of the shafts, or so adjusted as to secure a circulation of air that should free the mine of noxious gasses. Men had descended No. 4 shaft to the 22d level, and gone through to No. 3, etc. So that at that time, early in February, it was expected to be hoisting in Nos. 4 and 5 Calumet and No. 3 Hecla in a few days. But the draft introduced to get rid of the foul air, served to ignite smoldering flames, and the mine was speedily ablaze again, since which time the shafts have been closed, and various devices resorted to to extinguish the flames. Many holes have been bored from the surface into the mine to the portions where the fire exists, and sand, dirt and water run down. For many months the mine was closed down in 1887, and until June 1, 1888, when they again began to hoist, and continued to do so until November 30, when the fire now existing broke out.

The mine was again opened on May 1, 1889, and the officers think that the fire is out.

There is always something new to be seen at the Calumet and Hecla in the way of machinery. The fine stone engine house at the Hecla is by far the best in the country. The new hoisting machinery is a marvel to behold. I do not know where one will find any so beautiful. The hoisting machine house is 68′x112′, and attached boiler house 68′x72′, both of stone, iron roof. The stack is 200 feet high, 20′ outside diameter, 9′ 4″ inside. Three hoisting engines, 3 conical drums, 26′ diameter at large end, will coil 5,400 feet of rope each.

The shafts at South Hecla, in February, were at 14th level, 6 and 7 were at the 5th level, corresponding to the 7th level in the old mine, or about 500 feet down on the lay of the formation—37½°. The skips used hold 2½ tons of rock, except in No. 4, Calumet shaft, where the skips are larger, hold five or six tons.

The South Hecla proves to be surprisingly rich; in places it is 20 to 30 feet wide, and all good. The wider portions are the richest.

The three new hoisting engines for 1, 2 and 3 Hecla shafts are called Gratiot, Houghton and Seneca. The cylinders are 18″x48″ and 27¾x90″.

Shafts 3 and 4, Calumet, are to the 39th level, No. 1 to 27th, No. 2 to 26th level, and No. 5 is 42 feet below the 34th. The Hecla shafts are all to the 39th level.

In No. 5 shaft in 33d level they drifted north 250 feet, 150 feet of which was good ground. In the 34th the ground has proved first-rate as far as they went north and all the way south to No. 4 shaft. Above the 33d the ground between No. 4 and No. 5 was poor, thence in 33d and in 34th it is first rate.

This feature is an encouraging one for the Centennial and Tamarack jr. The vein is 13 feet wide and all good.

The only shafts that have produced any copper since November 30, last, are 11 and 12, and the double shafts 9 and 10, Black Hills mine. Fortunately this mine was well opened up when the first fire occurred and the company has been able to keep up its product.

The company has 3,000 names on its pay roll; ordinarily it has 4,000.

An important undertaking by the Calumet and Hecla is the sinking of a downright shaft, which was begun near the close of 1888. It is located in the village of Red Jacket, and is named the Whitney, after the general manager. Its location is in the S. W. ¼ N. W. ¼ of section 14, near the north line of the 40 acres and at about 400 feet east of the west line. It is in the vertical plane through the axis of No. 4 shaft. Its depth will be, to reach the conglomerate, 3,325 feet. It is a 6-compartment shaft, 14′x22½′. Why it should be made so large I don't see. A much smaller shaft will hoist all the rock that can be got to it. Thus there are five vertical shafts in progress in the vicinity of Red Jacket to reach the Calumet and Hecla conglomerate, besides the two already down, and the Whitney will perhaps be the shallowest of any.

An important transaction by the company, recently, was the purchase of the S. W. ¼ of the S. W. ¼ of section 14—40 acres, known as the Mettalline, for $500,000. By reference to the map its importance will be readily seen.

At the stamp mill they are not able to work full capacity owing to the fire in the mine. There are 11 heads in the Calumet mill and 7 in Hecla, all Leavitt improved. They are experimenting with solid iron bottom to stamp head, and express the intention of adopting this change.

In the great boiler house at the mills are ten boilers, 90″x35′. A new pumping engine will be added; also an additional sand wheel 53 feet diameter. The one now in use is 43 feet. The new one will be in same building with the other. The weight of the new wheel, it is said, will be 400,000 pounds, that

is with its load of sand and water. Its estimated capacity is 30,000,000 gallons of water and 2,000 tons of sand each 24 hours. The Calumet mill will have 374 jigs and 44 slime tables, while the Hecla mill has 238 jigs and 28 slime tables.

The new pump will be called the Michigan. An 185-lb. pressure boiler has been placed at the water-works. The smelting works of the company also at Lake Linden, not far from the stamp mills, are admirably arranged.

Total number of tons of rock stamped in 1887	654,055
Total number of tons of rock stamped in 1888	763,728

The company returned to the shareholders in 1888, $20 per share, making a total to July, 1888, of $32,350,000.

Table of product of Calumet and Hecla mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1867	657	1,173	1878	12,626	1,128
1868	2,549	375	1879	13,135	943
1869	6,157	1,771	1880	15,837	1,239
1870	7,030	1,584	1881	15,680	781
1871	8,111	590	1882	16,026	1,528
1872	8,081	183	1883	16,562	1,045
1873	9,424	265	1884	20,236	1,585
1874	10,062	1,225	1885	23,623	1,990
1875	10,736	1,954	1886	25,259	220
1876	10,845	732	1887	23,008	123
1877	11,284	468	1888	25,147	1,721
Total				299,104	1,281

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

The following table is of value, since it shows the amount of rock stamped each year and the percentage of its yield in refined copper, as given to me from the company's books:

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	1882	344,132	4.59
1876	259,935	4.37	1883	372,570	4.45
1877	247,935	4.55	1884	435,352	4.63
1878	271,000	4.66	1885	535,820	4.32
1879	284,715	4.61	1886	598,522	4.22
1880	331,313	4.75	1887	654,055	3.52
1881	340,080	4 61	1888	763,728	3.28½

The lower percentage of the last two years is due to the fact that most of the rock has come from the Black Hills mine.

THE CENTENNIAL MINING CO.

has resumed operations. The company owns Sec. 12, joining the Calumet and Hecla on the north and crossed by the conglomerate and other belts. many years ago, the Schoolcraft Co., the predecessor of the Centennial, worked quite extensively for the times, in the conglomerate, but found it poor. The Centennial Co. subsequently opened a mine in the Osceola amygdaloid, but the undertaking did not prove successful.

Recently a reorganization has been effected, the sum of $400,000 raised, and preparations made for sinking a deep shaft. The work is under the charge of Capt. J. Vivian, and was begun Dec. 22, 1888. The plan is to go down with No. 4 shaft, which is 700 feet deep, on the dip of the formation—38°—100 feet further, and then cross-cut east to the Osceola amygdaloid, and explore and work that belt somewhat.

But the chief purpose is to sink No. 3 shaft in the conglomerate until it enters good copper ground. No. 3 is the most southerly shaft, and it is believed that the unexplored ground between it and No. 5 Calumet shaft may contain a rich "shoot of copper," which will be cut in No. 3, by sinking it. Also, in the bottom of No. 5, the conglomerate, 150 feet north of the shaft, is 13 feet wide and very rich, in the 33d level, while above, it does not hold copper. It is a reasonable supposition that this shoot of copper, as it lies very flat, extends into the Centennial ground. Anyhow, the only way to find out, is to sink the shaft, and if there is a rich shoot of copper they must intercept it.

In all, in the old Schoolcraft mine, in the conglomerate, there are five shafts, numbered from the south. No. 1 is to the ledge; No. 2 to 1st level, 120 feet deep, and 330 feet north of No. 1; No. 3, 450 feet deep, to the 5th

level, and is 375 feet north of No. 2; No. 4 is 700 feet deep—90′ below the 5th level—570 feet north of No. 3; No 5 is 360 feet north of No. 4, and is simply a little way into the ledge. It is in wet ground, and is said to have shown some copper.

Capt. Vivian expresses the intention of continuing a drift, which is already 430 feet north of No. 4, the whole length of the property. He wants to explore the surface. He purposes, I believe, to put in a Ball head into the old stamp mill, and to produce enough rock to keep it going.

Capt. Vivian is putting the old machinery in order to do all the exploring, etc., contemplated.

There are sufficient dwellings, buildings, machinery, etc., for present needs. At the time of my visit, the force employed was 50 men, and they were chiefly engaged in freeing the mine of water.

The officers are: H. A. Stevens, Pres.; D. L. Demmon, Sec. and Treas., Boston; Johnson Vivian, Agt.; James Taylor, Mining Capt.

THE WOLVERINE MINE,

it was announced some time ago, would be worked by Mr. N. F. Leopold, of Chicago, who, it was said, had leased the mine. But I visited the property recently, and discovered no indications of coming activity. Everything about the mine has gone to ruin. Destructive forces, human and otherwise, have been busily engaged.

There are two shafts—No. 1, 500 feet deep, to the 6th level, and No. 2 to the 5th. A map of the mine and fuller description will be found in report of 1882. James Wall, Calumet, Mich., I think, represents the property. It was reported that Mr. Leopold would pay ten per cent royalty, with an option to purchase, running two years, at $90,000.

The mine is in the N. ½ N. E. ¼ of Sec. 7, 56, 32 adjoining.

THE KEARSARGE,

an old organization, or at least the name has been applied to this property a long time. It has come to the front as a producing mine, and has been, lately, yielding rock that holds a good percentage of copper. It is a very peculiar looking amygdaloid, dirty brown color, and the copper contained looks like the rock surrounding it. It is bunchy, like all amygdaloids, that is, they found pockets that yielded two to three per cent of copper, but now, in the bottom, it is very poor, or was so about the first of March. The shafts, 1 and 2, are to the 6th and 8th levels, respectively, 470 feet apart, but the

best ground has been above the 2d level. Some pretty fair copper rock in vicinity of No. 2 shaft in the 4th and 5th levels, none at all in 7th and 8th. The shafts are connected in all the levels, but not much stoping has been done. The shafts are, No. 1, 720 feet deep, No. 2, 800 feet deep; or if same datum is taken, No. 2 will be 820 feet deep. They incline 40° and 41½°, and are now in the hanging wall, though formerly in the lode. The deposit is a very irregular one; it twists about exceedingly, and is thus difficult to follow. One important fact is worthy of note. The mine, before the end of the year, will have yielded enough copper to return all that has been expended, so that the stockholders will be nothing out pecuniarily. The officers are, Charles Van Brunt, President; A. C. Bigelow, Secretary and Treasurer; John Daniell, Agent; J. D. Hoskins, Mining Captain and Superintendent. A branch of the Calumet and Hecla R. R. extends to the mine, and the rock is sent to the Osceola mill to be treated, using one stamp. The company began to produce copper last August.

The following is a summary of the company's report:

The operations of the Kearsarge Copper Mining company in 1888 show this general result:

Mineral product 946,876 pounds, yielding at 86.83 per cent 829,185 pounds refined copper, sold for		$137,609 71
Interest receipts		1,458 65
Assets Jan. 1, 1888		56,479 56
Total		$195,547 92
Expenditures.		
Operating	$72,554 60	
Smelting, freight, etc.	10,579 43	
Total	$83,134 03	
In mine plant	18,173 79	
		101,307 82
Assets, Jan. 1, 1889		$94,240 10
Assets.		
Cash at Boston		$7,303 75
Cash at mine		562 68
Supplies at mine		1,630 73
Bills receivable		44,449 75
250 shares		25,000 00
Copper on hand, 560,885 pounds		43,046 03
Total		$122,082 94
Liabilites.		
Drafts outstanding		$11,536 68
Accounts payable		16,312 16
Total		$27,842 84
Balance of assets Jan. 1, 1889		$94,240[illegible]

SUPERINTENDENT'S REPORT.

OPECHEE, *February 12, 1889.*

To the President and Directors Kearsarge Mining Co.:

GENTLEMEN—The following is a report of our operations for 1888.

Development work underground and construction work at surface engaged our attention for more than half the year. There was more delay than we anticipated in getting our rock house ready for handling rock. We sent the first rock to Osceola mill August 15th, making the first product of importance that month. A few tons, coming from the openings principally, had been previously sent to the smelting works. In figuring the yield from the mine, no account has been taken of rock or copper produced prior to commencing regular production. The following figures show the whole situation for the year:

Produced prior to stamping	7,632 lbs. mineral.	5,800 lbs. ingot.
" after stamping	949,096 lbs. "	823,385 lbs. "
	957,628 lbs. mineral,	829,185 lbs. "

Yield of mineral was 86.6 per cent ingot, probably higher than any other mine in the region. Since we commenced stamping we have handled, altogether, 24,250 tons of rock, the equivalent of 1,347 fathoms of ground, the yield of ingot being 611 lbs. per fathom, or about 34 lbs. per ton of rock handled. It is needless to remark that with such a yield we can produce copper very cheaply.

The underground openings for the year foot up as follows:

Shafts	239.6 feet.
Winzes and rises	628.1 "
Levels and cross-cuts	1,691.7 "
	2,559.4 feet.

Of the drivage, 250 feet would be cross cuts driven from shafts to reach the lode, and through the lode to test its value.

No. 1 shaft has been sunk for the year 52.2 feet It is now 10 feet below 6th level, and 660 feet deep. No. 2, shaft sunk 187.4 feet. This is now down to 8th level and about 790 feet from the surface.

Drifting at the several levels is as follows:

1st level	88.1 feet.
3d "	26.3 "
4th "	225.7 "
5th "	330.2 "
6th "	807.0 "
7th "	214.4 "
Total	1,691.7 feet.

From all we see during the past year there is no doubt but that the two amygdaloids referred to in last report are separate lodes, each containing its course. The eastern one, on which most of our work is done, continues as irregular in course in the deeper levels as was before noted. The number of crossings and faults that we encounter, which invariably throw the lode, are in excess of anything seen in the district, and have much to do with the disturbed character of the ground we meet with. The influence of some of these should grow less as we get deeper.

As we find opportunity, we keep testing points of promise in the different levels with varying success, but on a whole satisfactory results. Today, so far as I can judge, we have as much copper ground in sight as was counted on when we began stoping. I would like to speak more confidently of our late opening work, but it seems to me that we must get below or beyond the disturbed and broken ground that we have been developing at 6th and 7th levels before we can count on anything really good in the bottom of the mine. Ours is not an unusual experience, for most of the mines of the district have had their poor streaks. We have quite a reserve of copper ground, and it must be expected that we shall use all diligence to find more before this is exhausted. The lode makes very rich ground, and if only a small proportion of what we shall open proves good, we can not only maintain our position, but better it in matter of production.

Rock house work is very cheaply done, the character of the rock making but little wear and tear. Transportation of rock by the H. & C. R. R. costs us 20 cents per ton. Service to date has been quite satisfactory.

Stamping 19,425 tons of rock at Osceola mill has cost us 50 cents per ton.

The principal construction work of the year was the erection of rock house, floor space 40x65 feet, at No. 1 shaft, and the connecting trestle with No. 2 shaft. Later we put in a new boiler, and have built 11 log dwellings for employés.

Our business has run very smoothly, the assisting officers being anxious to secure success.

With this you will receive mine plans and details of expenses, which I trust will be satisfactory.

Very respectfully yours,

JOHN DANIELL, *Superintendent.*

The Kearsarge is the last mine in Houghton county. About a mile further north we cross the line into Keweenaw county, and come to the

ALLOUEZ MINE,

which has been the scene of a good deal of renovating work, lately, greatly to the improvement in appearance of the location and to the advantage of the mine. The dwellings have been repaired and repainted; a new "dry" built; the hoisting machinery relined at No. 1; boilers repaired; new stone engine house built at No. 1 shaft 44′x40′ and 26′ high, built up from the solid ledge; two engines, each 24″x48″; drum 12′ diam., with arrangement for taking up the rope attached to counter balance. I have been at the mine and have taken full notes, but since my visit the company has issued a very full report, and on looking it over I think it covers all that need be said.

Allouez Mining Company's Annual Report.

The directors present the following report of the operations during the year 1888:

Receipts.

314,198 pounds copper (product of November and December)			$43,092 57
Assessment No. 19			79,674 00
Balance of interest account			744 80
			$123,511 37

Expenditure.

Running expenses at mine (November and December)		$37,490 35	
Repair account		86,104 39	
Construction account		22,755 85	
Purchase of store building		2,000 00	
Tax on copper of 1887		331 88	
Expenditure at mine		$148,682 47	
Freight	$1,439 83		
Smelting	3,451 46		
Brokerage	226 42		
Insurance	46 47		
Expense	3,128 41		
		8,292 59	
Total expenditure			156,975 06
Excess of expenditure over receipts			$33,463 69
The balance brought forward from 1887 was			48,497 97
Leaving balance Dec. 31, 1888, of			$15,034 28

as shown in detail in the annexed statement of assets and liabilities.

The operations during the past year have been mainly confined to renovating and making additions to the plant, and getting the mine into condition for regular work.

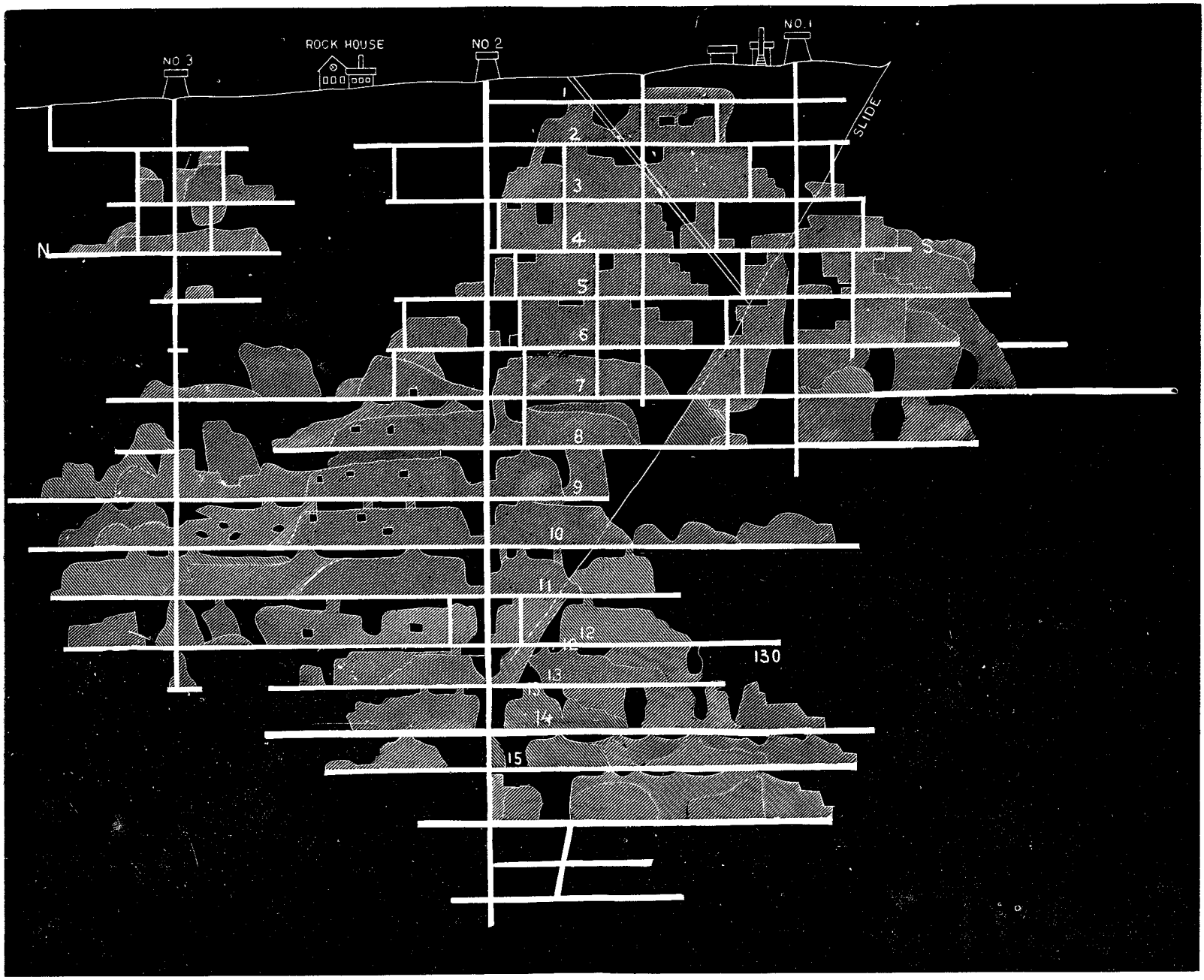
The amount of work necessary to be done has far exceeded expectations; the dilapidated condition of the machinery and buildings, owing to neglect of repairs by the late lessees, rendering a large expenditure unavoidable in order to fit the machinery for economical work and the buildings and dwellings for occupancy.

In prosecuting the underground work it was found that the two working shafts were in such bad condition that retimbering from top to bottom in a thorough manner became necessary, and that they needed some enlargements, in order to admit of hoisting larger "skips" or rock cars that were used when these shafts were started. In addition to the cost of this work, the prosecution of the openings in the mine was seriously retarded thereby on account of the necessary suspension of hoisting while the shafts were under repairs.

It was found necessary to remove from No. 1 shaft the pumping and hoisting plant heretofore employed at that point. Having been originally of poor construction, it had become only fit for the "scrap pile." As this shaft will command the most productive part of the mine, it was determined to equip it with a modern and effective plant of sufficient capacity to perform all the work required for many years. This will soon be in operation and be of material service in keeping the mill supplied with rock.

ALLOUEZ MINE—LONGITUDINAL SECTION, 1889.

Scale: 300 feet to an inch.



The cost of repairs and other work is shown in detail in our agent's statement herewith submitted. While amounting in the aggregate to a larger sum than could have been anticipated, yet we can see no way in which any part of it could have been avoided. If a mine of this character is to be made profitable, a large quantity of material must be mined and treated at low cost, and this cannot be done without proper facilities. These include not only an equipment of adequate capacity, but sufficient extent of openings underground to admit of a proper selection of "pay ground." While we have not yet arrived at the point where we can make selection to the best advantage, yet the openings are being pushed as rapidly as possible, and we expect to have, in a few months, the mine well opened and everything in good working order.

The stamp mill was started November 1, but has not yet been supplied to quite its full capacity. The lessees having cleaned out everything in sight that carried copper, the earlier openings were unavoidably in poor ground, and, even with the best selection we could make, the yield of copper has been much lower than the average of former years and that which we look for in a short time, as we penetrate further into the better ground now opening in the lower levels (17th and 18th) which are showing at this time especially promising ground.

The store buildings on our mine location, heretofore owned and occupied by Watson & Walls as a country store, having fallen into the hands of their creditors, were purchased by us for the sum of $2,000. A stock of provisions and general merchandise must be maintained in proximity to the mine, and the possession of these buildings gives us the opportunity of securing supplies for our work people, as well as a rental in payment for the privilege of selling the goods, that will soon reimburse us for the outlay.

For further information we refer to the report of our agent at the mine, and the statements herewith submitted.

By order of directors.

JOHN STANTON, *Treasurer.*

ASSETS AND LIABILITIES OF ALLOUEZ MINING CO., DECEMBER 31, 1888.

Assets.

Cash	$5,700 18
Copper on hand	23,134 29
	$28,834 47
At mine	27,219 02
Total assets	$56,053 49
Liabilities	41,019 21
Balance of Assets	$15,034 28

STATEMENT OF EXPENDITURE AT ALLOUEZ MINE FOR THE YEAR 1888.

Repairs to Buildings, Machinery, Etc., and Preliminary Work.

Underground Work	$10,419 60
Fuel, timber, rails, etc	27,808 17
	$38,227 77
Shaft house and connections	3,345 53

No. 2—Engine house	$7,191 02
Rock house	3,546 30
Dry house	614 03
Railroad	5,412 74
Stamp mill	11,127 99
Dwelling houses	5,082 39
Dam on Hill creek	2,403 73
General surface expenses	5,177 37
Expense account	5,570 22
	$87,698 89
Less rents, 10 months	1,594 50
Total charged to repairs	$86,104 39

Construction Account

Machine shop	$4,881 70
Pump and air pipes	1,273 99
No. 2, hoisting engine (additions)	4,299 70
No. 1, hoisting engine	15,230 86
Covering boilers	750 00
Dry house, stamp pipe	319 60
Total construction account	$22,755 85
Building account, store	2,000 00

Running Expenses, November and December.

Mining	$9,166 90
Power drills	2,655 18
Mining captains and other labor, etc.	9,323 66
	$21,145 74
Less profits on supplies	2,240 00
Net Total	$18,905 74
Hoisting	2,980 48
Selecting and breaking rock	3,565 34
Railroad	1,263 05
Surface expense	674 57
Transportation to smelting works	519 05
Expense account, less credits	1,160 30
Stamp mill	9,156 32
	$38,224 85
Less rents in November and December	734 50
Total running expenses in November and December	$37,490 35

General Summary of Expenditures for 1888.

Running expenses, November and December	$37,490 35
Repairs, etc.	86,104 39
Construction	22,755 85
Buildings	2,000 00
State tax on copper produced in 1887	331 88
	$148,682 47

Agent's Report.

Allouez Mich., *February 20, 1889.*

Upon resumption of work by the company, in a limited way, after the mine had been in posession of a party of tributers for nearly three years, it became necessary to open new ground as speedily as circumstances would permit, no available stoping ground having been left to us except a small block in the back of the 16th level. south of No. 2 shaft.

No. 2 shaft has been sunk from the 16th to to the 18th level, a depth of 201.6 feet in an unproductive lode, not unexpected, however, the ground in proximity to the shaft having been poor in the level above.

The ground broken through the year was:

Sinking shafts	244.6 feet.
Driving levels	1090.3 feet.
Stoping	1419.15 cubic fathoms

Both No. 1 and 2 shafts were found in bad working condition, and were both mostly re-timbered and new-tracked with steel rails. They are now in first-class working order.

The whole surface plant with hardly any exception, and all our dwelling houses, needed a large line of repairs, and in some cases rebuilding. The time required for it extended into October, and in some cases to the end of the year. As a result, necessarily, considerable money had to be expended to put the plant again in good working order. I may say that this has been accomplished, and when the new hoisting machinery for No. 1 shaft, now on the ground and in course of erection in a well-built stone building, is set to work, it will give us easier and first-class hoisting facilities. The machine is provided with 24x48 inch cylinders, will be first motion, and have counter-balance car to offset the weight of skip. It will prove an economical engine.

As stated before, fully ten months of the year were wholly devoted to a general overhauling of the plant and to the prosecution of such openings underground as we were able to do without any hoisting machinery in shape to use. Before shutting down the mine on failure of lessees, one of the boilers at the hoisting works exploded, completely demolishing it and the boiler house. The three remaining boilers were totally unfit for further duty without extensive repairs. Such repairs to two of them, together with rebuilding boiler-house, repairing engine and foundation and adding two new boilers, consumed most of the past summer. The hoisting plant is now in very good shape, doing better duty than ever before.

The result of the two months productive operations did not fully meet our expectations. The cause is mainly attributable to the low percentage of rock stamped, of which a large part came from the openings, and to an insufficient supply of rock for the mill for full duty. It will be borne in mind that the openings were not extensive enough to enable us to obtain good results at the outset. In addition, some of them, viz., at the 17th and 18th levels were in unproductive ground up to the end of the year.

The oulook for the present year is quite encouraging. As we gain in our underground openings results will improve. I confidently look for a larger output in the near future. At the 17th level we have every reason to expect the rich stoping ground now available, continuous to the 16th level and for a length of at least 400 feet south, although it may not produce for its entire length the grade of heavy copper now exposed. The 8th level

will soon penetrate the same run of ground, and we confidently expect to find it well mineralized.

The ground south of No. 1 shaft holds out good promise for the future. The drifts at the 6th and 8th levels show better copper courses today than at any time since the resumption of operations. In a short time the skip track will be completed for No. 1 shaft. It must be our aim to extend new openings with all possible diligence. The character of our lode is such that only with a liberal amount of stoping ground to choose from can the best results be obtained.

The breach in our dam on "Hill's Creek" (occasioned by the sudden spring flood in 1885), has been substantially repaired. The supply of water for our mill from the two available streams has been ample to date, and we have not been called upon to resort to pumping. The tables of cost prepared by the clerk are in your hands and will show in detail the cost and result of operations during the past year.

I am indebted to my associate officers for the faithful performance of their share of the year's work.

Yours respectfully,

FRED. SMITH, *Agent.*

Table of Products.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1869	1	1,575	1881	736	1,007
1873	10	1,163	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	862	1,468
1878	565	1,146	1887	442	1,010
1879	715	1,452	1888	157	198
1880	658	471			
Total				10,546	931

In Keweenaw county only two mines have been worked the past year besides the Allouez. The Cliff remains idle, as does also the Phœnix, and the next in order is the

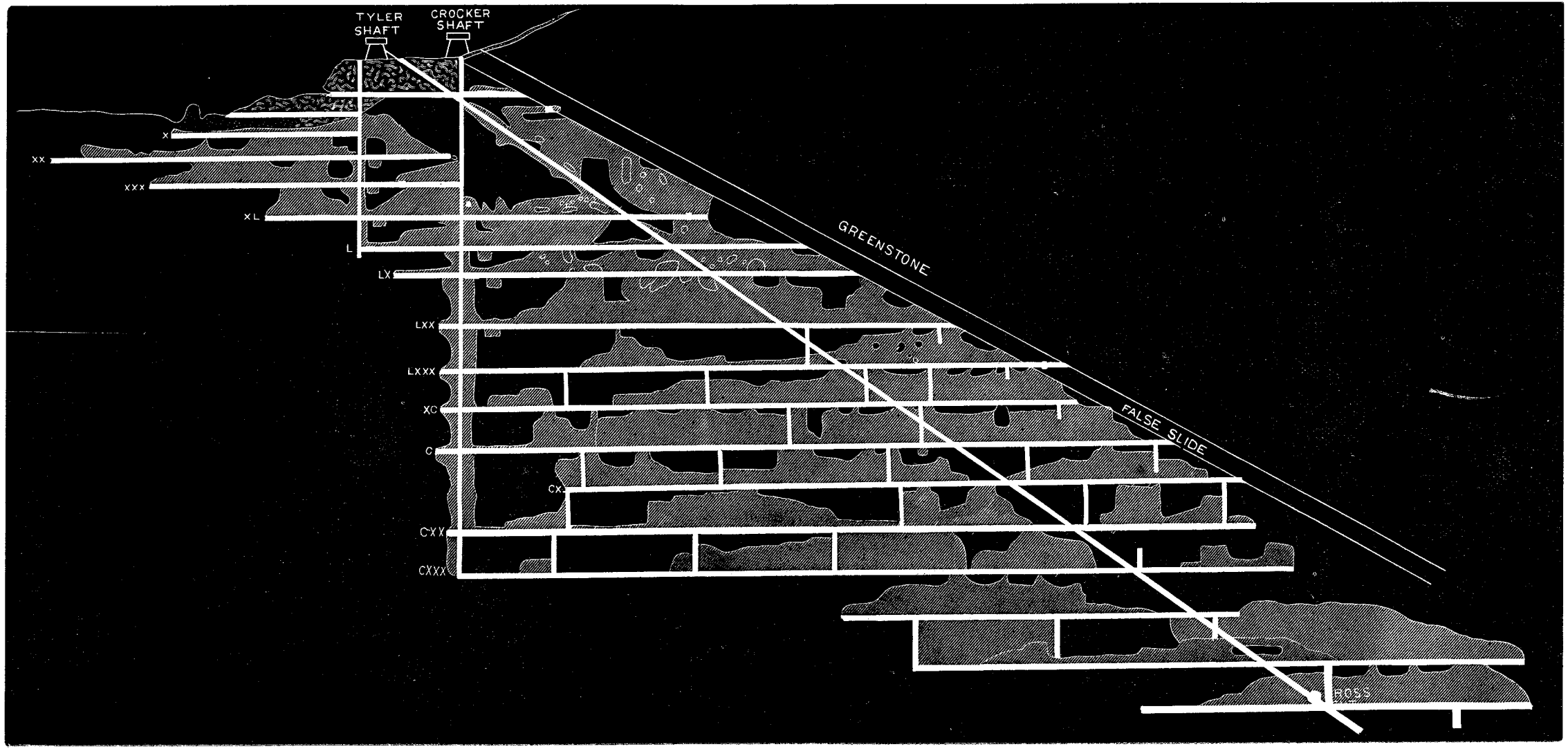
CENTRAL MINE,

which, notwithstanding its great depth, and the fact that it is the only fissure vein copper mine worked in the State, is still operated at a profit.

The mine is 2,700 feet deep, vertically down. I descended to the bottom recently with Capt. Bennett, and felt disappointed with the outlook. The mine is so different from the others, in amygdaloid and conglomerate belts. Sometimes the vein is a mere trace; sometimes showing no signs of copper; in portions affording only stamp rock, and occasionally yielding masses and

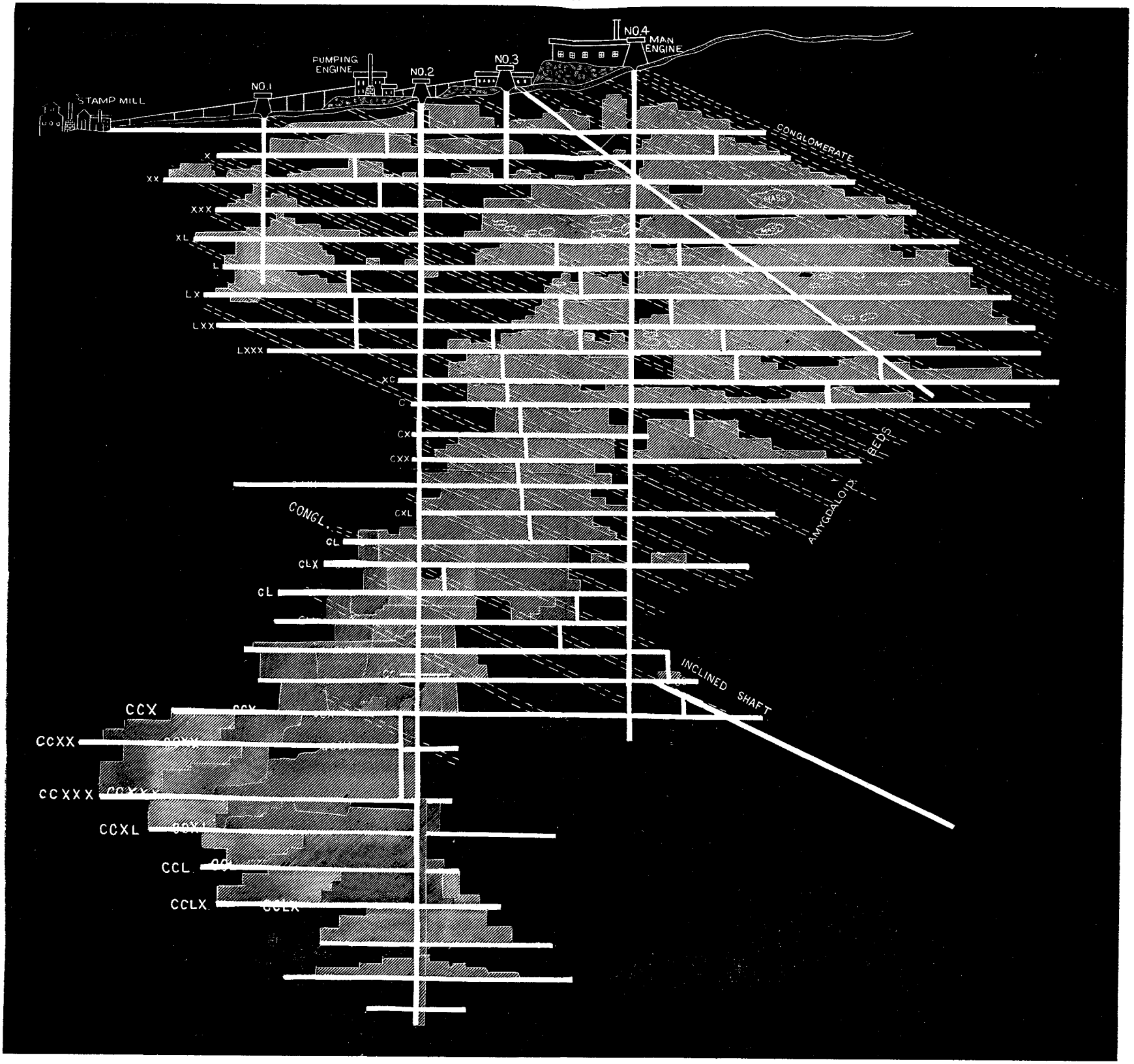
LONGITUDINAL SECTION OF THE PHŒNIX MINE, 1889.

Scale: 300 feet to an inch.



LONGITUDINAL SECTION OF THE CENTRAL MINE, JAN. 1, 1889.

Scale: 300 feet to an inch.



barrel work richly. To look over this well-built, comfortable village of 1,200 and more souls, with its churches and fine graded school building, etc., and realize that the entire basis of support is the small copper vein now worked at a depth of more than half a mile; that all the rock and timber coming out and going into the mine must traverse the one single skip shaft, might lead one to think that the support was a precarious one. But however unpromising the mine may look to one who descends into it, as the years come around it seems to hold its own and to give to its owners their annual dividend, and to the people of the location an assured and comfortable support.

Like nearly all mines, there is a good deal of necessary dead work—that is the greater part of the ground opened is worthless—but it must be tested in order to find the little that is good. The vein dips east, and the shaft keeps in the vein for a portion of the way from the surface down, after which it descends vertically, making a crook in the shaft. The drift east towards the Northwestern vein, 1,700 feet away, advances 45 feet per month. It follows the Calumet and Hecla conglomerate. The shaft is 6'x12'. Capt. Dunston wants to straighten it It needs to be overhauled. With the new machinery they can hoist very rapidly. The hoisting plant is not excelled by any in the copper region. It was built by E P. Allis & Co., and is provided with automatic safety cut off, so that if the engineer fails in his duty the skip will only ascend to the proper point. The disposition of this trap rock to swell and expand is noticeable in the Central mine. Even where the walls stand vertical, they will swell so as to crush the large stull timbers that span the space between them. When the vein is wide the rock tends te drop out from between the walls. Just before my visit to the mine a man was killed in this way—vein rock fell on him. The Central mine is in a fissure vein that crosses the formation at nearly right angles, and dips away slightly from the vertical, so that in the bottom level—29th—the cross cut from the shaft to the vein is 220 feet.

I took full notes at the mine, but Capt. Dunstan's report covers everything necessary to mention, and I add that in full.

Annual Report of the Central Mining Company.

The directors present the following statement of the operations during the year 1888:

The production of mineral was 1,142 795-2000 tons, which yielded about 79 53-100 per cent, or 1,817,023 pounds of refined copper.

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

Production.

1,817,023 lbs. copper, at 14 8-10 cents		$268,911 48
Silver		309 40
		$269,220 88
Add interest received		4,981 80
		$274,202 68

Costs.

Working expenses at mine	$155,244 11	
Construction account at mine	8,679 68	
Smelting, freight, and all other expenses	32,681 76	
Making the total expenses		196,605 55
And showing a net profit in 1888 of		$77,597 13
There has also been expended for purchase of "Eagle river" property 940 acres	$7,060 24	
Less amount credited real estate for stumpage on "Northwestern" and "Madison" lands	3,480 71	
		3,579 53
Making the net increase in assets		$74,017 60
The surplus from 1887, after payment of dividend, was	$221,486 19	
Less dividend paid August 1, 1888	30,000 00	
		191,486 19
Making the net surplus, December 31, 1888		$265,503 79

As shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of two dollars per share ($40,000) was paid February 1st, 1889: making a total of $70,000 in dividends on the year's business.

The production shows a small decrease from that of the previous year, and the increase of profits is due to the better prices obtained for our copper.

For further information we refer to our agent's report and the financial statements herewith submitted.

JOSEPH E. GAY,
WM. C. STURGES,
ROBERT PORTERFIELD,
JOHN STANTON,
Directors.

NEW YORK, March 25, 1889.

ASSETS AND LIABILITIES, DECEMBER 31, 1888, EXCLUSIVE OF REAL ESTATE AND MINE PLANT.

Assets.

Cash on hand	$24,772 41
Loans	142,040 00
Silver on hand	309 40
Copper on hand, sold	54,725 08
Accounts receivable	3,058 48
	$224,905,37

At Mine.

Cash	$4,542 59	
Merchandise in store	28,701 10	
Supplies	36,404 08	
		$69,647 77
		$294,553 14

Liabilities.

Agent's drafts	$2,326 28	
Indebtedness at mine	17,216 68	
Accounts payable	9,506 39	
		29,049 35
Balance of assets		$265,503 79
Less dividend, February 1, 1889, of		40,000 00

SUMMARY OF RECEIPTS AND EXPENDITURES OF CENTRAL MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1888.

Receipts.

Capital stock paid in	$100,000 00
Copper sold, including silver	8,673,494 31
Profit on timber sold	79,011 75
Total receipts	$8,852,506 06

Expenditures.

Net expenditure for mining operations, buildings and machinery, smelting and marketing copper, and incidental expenses	$6,672,691 75	
Net cost of "Madison," "Northwestern," and "Eagle river" lands	24,310 52	
Total expenditures		$6,697,002 27
Balance of receipts		$2,155,503 79
Deduct dividends paid		1,890,000 00
Net surplus December 31, 1888		$265,503 79

(As shown in statement of assets and liabilities on preceding page.)

AGENT'S REPORT.

KEWEENAW, CO., MICH., *January 1, 1889.*

JOHN STANTON, ESQ., *Secretary and Treasurer, New York:*

DEAR SIR—The following report of operations at our mine during the year 1888 is respectfully submitted:

Ground Broken.

Sinking in shafts and winzes, 224½ feet, average cost	$20 25
Drifting on vein and cross-cuts, 1,637 2-12 feet, average cost	7 46
Stoping on vein, 2,361 16-36 sup. fathoms, average cost	13 44

Stoping on plats, etc., 400 cubic fathoms.

The total amount of ground broken in openings and stopes is 3,346 cubic fathoms.

Production.

930 bbls. stamp copper, weighing	1,266,150 lbs.
99 hhds. barrel copper, weighing	351,010 lbs.
225 masses copper, weighing	667,635 lbs.
Total	2,284,795 lbs.
Or 1,142 795-2000 tons.	
Average yield of mineral per fathom of ground broken	683 lbs.
Average yield of ingot per fathom of ground broken	543 lbs.

Expenditure at Mine.

The total expenditure for the year is as follows:

Mining and surface expenses	$140,878 47
Stamp mill expenses	15,418 53
Taxes	3,306 65
Construction account	8,679 68
	$168,283 33
Less rents received	4,359 54
Total expenses	$163,923 79

SINKING.

No. 2 shaft has been sunk from the 28th to the 29th level, and a cross-cut driven from the shaft to the vein about 200 feet. A winze has been sunk from the 28th to the 29th level. While sinking this winze the vein in places has shown good copper, but at the bottom it is small and poor. We are now sinking both the shaft and winze to the 30th level.

DRIFTING.

At the 29th level we have driven both north and south only a short distance, and thus far the vein has shown but very little copper, but I am looking for an improvement in these drifts every day, as in the bottom of the level above there is a good vein.

The 28th level is also being driven both north and south of No. 2 shaft. These drifts are looking very well at present. In the south drift the vein is about four feet wide, producing good stamp and barrel copper. The north drift is producing good stamp rock, but not so much of the heavy grade copper. These drifts are now extended north 313½ feet, and south 276⅜ feet.

We have extended the 27th level south of No. 2 shaft 61 7-12 feet, which has opened up some good ground, but at present it is poor.

The following levels have been extended south of No. 2 shaft as follows: 22d level, 118 10-12 feet; 23d level, 101 feet; 25th level, 22 8-12 feet, and 26th level, 23½ feet.

STOPING.

Our stopes the past year have not produced as well as we expected from their appearance in the early part of the year, and at the present time are not looking as well as we would like to see them, but this has always been characteristic of the "Central" vein. Most of the stopes are yielding good stamp rock, but have fallen off in mass and barrel work, but we have a good show of mass copper in bottom of 28th level, and as the stopes are worked up from the 29th level, I feel confident of striking good ground in these stopes in the near future. The greater portion of our mass and barrel copper

came from the stopes in the back of the 28th level, north and south. At the present time we are not cutting any masses, nor have we any large ones in sight.

We are driving a cross-cut at the 19th level from No. 4 shaft east, toward the "Northwestern." It is now in 352 feet from the shaft. We are driving it on a belt of conglomerate, supposed to be the "Calumet" lode, but it has so far shown no copper, but the main object is to cut the transverse veins passing through this property and the "Northwestern."

CONSTRUCTION.

We have expended considerable this year for construction. We have put in a "man engine" in No. 2 shaft from the 21st to the 26th level, at a cost of $4,025, and built a new store and warehouse which cost $3,200, and one new dwelling house costing $600, besides making minor improvements and repairs to old dwelling houses. We are using the old store for a carpenter and machine shop, which answers well for the purpose.

Respectfully yours,

JAMES DUNSTAN, *Agent.*

Table showing Product of Central Mine—refined Copper.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1856	32	493	1873	751	1,117
1857			1874	870	900
1858	71	1,011	1875	733	952
1859	84	312	1876	1,080	1,400
1860	125	1,370	1877	997	1,640
1861	70	139	1878	945	1,013
1862	133	1,972	1879	899	1,495
1863	278	1,548	1880	1,013	78
1864	381	1,855	1881	709	465
1865	346	1,200	1882	676	1,595
1866	574	1,842	1883	634	556
1867	678	745	1884	723	747
1868	1,353	1,827	1885	1,078	1,408
1869	903	1,801	1986	1,256	886
1870	663	1,156	1887	1,099	1,133
1871	716	662	1888	908	717
1872	623	56			
Total				20,355	1,890

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

THE COPPER FALLS MINE

is situated opposite the Central mine, on the other side of the range. The mine itself looks about as usual, but the development work is more advanced

than it has been sometimes, and in many things there is improvement. Capt. Moyle, the agent, deserves much credit for the manner in which he has pushed the work.

The mine is entered by an adit from the north driven on a fissure vein on what is called the ninth level. After reaching the ash-bed, which is the amygdaloid deposit that is mined, the locomotive turns west, in which direction the mine has been opened for a distance of upwards of 1,400 feet. Off to the west are two underground shafts, extending above and below the adit level. Each shaft is provided with a double track, so that a descending car helps, by its weight, to draw up another one on the parallel track. There is a hoisting plant at each shaft that supplies the additional force required. The same cars that are drawn into and out of the mine by the locomotive, also go up and down the shafts to the desired levels, and thence go to the stopes. All this I have fully described in previous reports, and only refer to it here in the most general way.

The deposit is opened a total depth of about 1,400 feet; 7 levels below the adit, and 9 above it—16 levels in all. They have gone in south on the adit vein 600 feet, where another bed is found in which they have drifted and stoped west 150 feet. Apparently, not as good as the ash-bed, though the latter is poor enough. The dip is 28° northerly, and about two-thirds of the deposit is considered as worth mining. The stamp mill was started in March, 1888, and in the succeeding ten months 103,505 tons of rock were treated, which yielded 778 tons, 1,650 lbs. of mineral, equal to about 76 per cent copper.

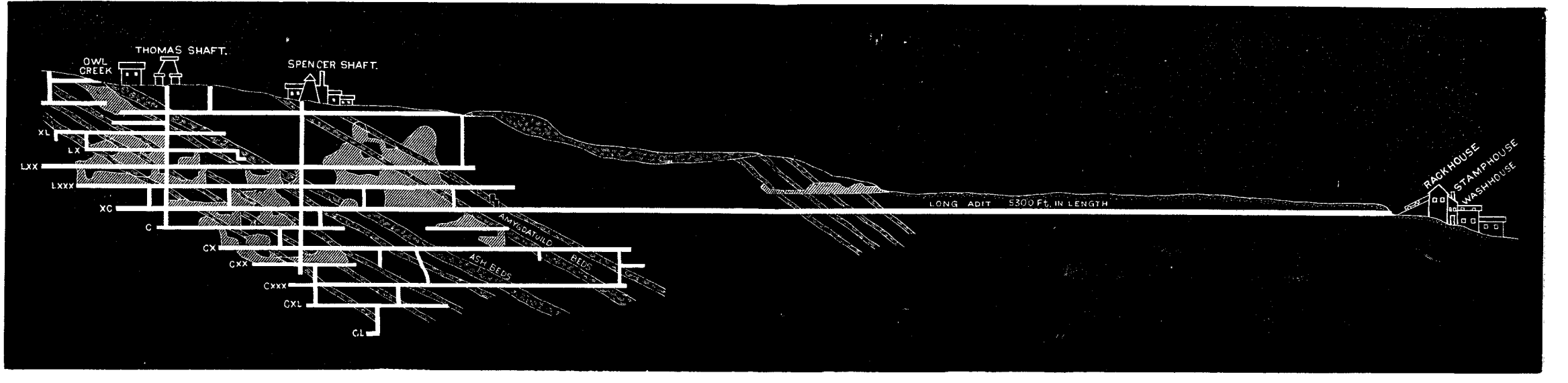
They sink No. 2 shaft and drift under No. 1, and rise up in it; work about 150 men—20 drills; only hoist during day shift. The inclined trestle on which cars were run up into stamp mill has been torn away, and the mouth of the tunnel and the yard track in front of the stamp mill is all covered over, as is the track leading into the car repair shop. I was at the mine on a very cold winter's day, and the agreeableness of this improvement was very noticeable. The formation is faulted in several places where veins occur, but none except the adit vein has ever been found to contain copper. The two veins west seem to be coming together, since at the 90 they are 700 feet apart, and at the 150 only 300, so Capt. Moyle states.

The 140 is opened 1,000 feet in length, and the ground is standing all the way up to the 130, for this length. The 150 is opened 400 feet in length, and they have sunk to the 160; the ash-bed is about the same at the bottom as elsewhere.

The new belt which Capt. Moyle found 610 feet south of the old workings on the main vein, was thought to be a great acquisition at first. It is harder,

LONGITUDINAL SECTION OF THE COPPER FALLS MINE IN THE OWL CREEK VEIN, 1889.

Scale: 500 feet to an inch.



more compact than the ash-bed. On west side there is a branch vein in which Capt. Moyle is still working. It has been quite rich in places, and still affords some copper—not promising ground, however. Capt. Moyle expresses the intention to drive the adit south to the greenstone, and thus he will cut all the belts lying north of it. The remaining distance to cut is 900 feet. If a good belt is found, it will have a large depth of "back," as it is 1,500 feet to the surface on the lay of the formation now at the end of the drift. The vein itself—the Owl creek—was in earlier days one of the richest ever found in the country, and may prove productive again, so that there is a double purpose in driving this adit—to prove the vein and to prove the belts that lie north of the greenstone. Among these, yet to be found, is the Pewabic lode.

The faults, before mentioned, are throws of the formation to the north, 65 feet. They cause additional expense in the drifting in each level.

The total expenditures from March to December 31st were $134,575.76; paid for sinking, per foot, $8.50; for cutting drift stopes, $9; stoping, per cubic fathom, $12; average wages—miners, $2.00 per day; total force, men and boys, 215.

General expense account, to December 31, 1888	$3,326,287 53
Cash in mining office	85 88
Real estate	66,500 00
Machinery	162,120 75
Supplies	26,239 16
Accounts receivable	1,932 87
Extraordinary expenses	641 45
Treasurer	$3,565,533 79
Account payable—liabilities at mine	182,773 85
Total	$3,565,533 79

In the expenses is included the work on Owl creek vein, which is strictly exploring work. The amount thus expended on the Owl creek vein was $5,152.78. Subtracting this amount, leaves the mining expense cost $129,-412.98, which dividing, gives the mining cost $1.25 per ton of rock. In this also is included 400 to 500 tons per month that are rejected in the stamp mill. Stamp mill cost, $29,448.31, which gives the cost per ton for treating, 28 cents. The coal has to be hauled from Eagle river with teams; also, the water has to be pumped twice, and the rock to be hoisted up into the stamp mill, 48 feet.

Construction account	$895 55
Net mining expense	134,575 76

In June, when there was plenty of water, the stamp mill cost was reduced to 24½ cents per ton, showing that if the mill had been located lower down,

on the lake, so that the increase of cost in pumping and the hoisting of the rock into the mill would have been avoided, the cost per ton for stamping would have been the lowest of any on the lake. The yield of the rock in copper is the lowest of any mine, being last year 56 per cent ingot, or 11.20 lbs. per ton. Pretty discouraging, as compared with the Calumet and Hecla conglomerate, which yields seven times as much.

Table of Product of Copper Falls Mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
Previous to 1855	158	.....	1872	260	862
1855	100	.....	1873	643	540
1856	104	10	1874	535	359
1857	153	1,305	1875	203	1,587
1858	151	1,852	1876	8	1,488
1859	173	174	1877	5	1,950
1860	255	818	1878	5	1,790
1861	280	11	1879	.....	.....
1862	299	299	1880	3	645
1863	159	1,348	1881	334	1,121
1864	179	808	1882	293	1,500
1865	235	.....	1883	402	.....
1866	568	1,169	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	590	.....
1871	239	883			
Total				10,355	133

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

THE CONGLOMERATE MINE

remains idle. Mr. A. P. Thomas has succeeded Chas. H. Palmer as Superintendent, the latter having gone to the west and assumed charge of the Butte and Boston mine.

The Conglomerate is an exceedingly well equipped mine in all respects; but I have dwelt on all this in former reports, and I find nothing new to add. The mine, which is an old one, has yielded 2,622 tons 1,880 lbs. of copper. George H. Lewars, Secretary, Philadelphia, Pa.

1882.		1
Tons.	Lbs.	Tons.
.....	429	.....
.....	.....	424
841	1,557	875
1,315	1,708	1,341
1	1,129	.....
16,026	1,528	16,562
676	1,597	634
33	53	5
293	1,500	402
367	219	111
.....	.....	.....
1,632	120	1,744
378	1,080	367
.....	.....	.....
182	579	360
2	1,625	8
17	1,447	.....
.....	.....	.....
.....	.....	.....
368	1,440	329
5	672	3
8	1,080	15
2	207	1
2,088	782	2,128
.....	.....	.....
741	666	585
268	1,177	256
2,832	1,796	2,006
51	936	30
41	1,554	.....
1	1,299	.....
43	1,126	62
.....	.....	3
329	1,651	594
.....	.....	.....
28,577	1,980	29,855
$10,522,416		$8.
20½ - 17⅞		18

lowing year.