The rate of $15 per fathom for the undercutting stope is also a low estimate for breaking by hand, taking into account the high rate of wages ruling during 1880.

THE MADISON.

At the Madison Capt. Joseph Snell continues work with a small force of men in the east vein in the north end of the mine, about 350 feet below the surface. The two veins are perhaps branches or splits of a main fissure, which will probably intersect at about the fifth level. The men are now working in the fourth level. It is expected that at the line of intersection rich copper ground will be found. Experience in the Lake Superior copper mines indicates that this conjecture is almost certain to be verified. The juncture of branches, contracted places in the lode, occasioned by bends or angles, are sure to be productive portions, and it is on their faith in such a result that the hope of the Madison people is based. The mine is on the W. ½ of Sec. 19, T. 58, R. 30, in Keweenaw County, though the company owns 2,000 acres of land, about 1,500 acres of which is valuable wood land. The mine lies south of the greenstone, and is worked in a fissure vein, and has been more or less worked since 1852; a good deal of money has been expended in times past at this mine, but no profit obtained for the company. There is no stamp mill now on the property, but the little Montreal River furnishes a moderate supply of water here, as at the other mines on the south side of the range in this neighborhood, for operating a mine. About 4,000 tons of stamp rock have accumulated, but no copper has been shipped from the mine in the last year.

The first organization was effected in 1852 under the title of the Summit Mining Company, which company having failed, a reorganization was made in 1859 as The Madison Mining Company. A second failure resulted in the organization of the present company, in 1879, with a capital stock of $1,000,000, divided into 40,000 shares.

An assessment of 25 cents per share was made in 1881. The present officers are Chas. LeSier, President, Detroit; John W. Betcher, Secretary and Treasurer, Boston; Joseph Snell, Agent, Hancock, Michigan.

THE CENTRAL.

Next in order of the active mines in Keweenaw County, and operating south of the greenstone, is the Central, which for a number of years past has continued the leading mine in production, of those of Keweenaw County; the only mine, in fact, since the days of the Cliff, that has regularly returned dividends to its stockholders. The location comprises the E. ½ Sec. 23, T. 58, R. 30, and the fissure vein, in which the mine is worked, was discovered, (in 1854) as is described very fully in the report of 1880; in the following year the vein was worked and yielded copper in value considerably in excess of the total cost of working;—the first instance of the kind that has occurred. Since that time the value of the copper sold from the mine amounts to upwards of $7,000,000, and the stockholders have received in return for an original outlay of only $100,000, the net sum of $1,664,000. Surely a good showing.

Never, until now, since the opening of the mine has there been a cessation in the occurrence of the great masses of copper for the production of which the Central has so long been famous. The mine has attained considerable

depth—about 2,000 feet vertical—but has, as compared to many other leading mines, a limited lateral extent. The drifts above the 100-fathom level extend nearly to the greenstone, and this space above that drift and north of No. 4 shaft proved very productive ground; but below the hundredth level, the copper has all been obtained from within the limited space between No. 4 and No. 2 shafts, which are distant apart about 600 feet. Below the hundred and twentieth level no ground has been stoped north of No. 4, and but very little south of No. 2 shaft. An inspection of this ground, that has proved so productive in copper, shows that it has a pitch to the south as it goes downward, at an angle of, perhaps, 20° from the vertical. The hundred and twentieth, hundred and fortieth, and hundred and sixtieth levels have been pushed to the north a few hundred feet, but the great space, in these lower levels, between No. 4 shaft and the greenstone, is practically unexplored ground. In fact the Central Company has done very little exploring. The mining has been characterized by an abundance of masses in continuous succession, so that there has been very little opening done in advance of actual stoping. The ground opened was nearly all stoped out, so that now when the mine unexpectedly fails to afford its accustomed yield of masses they are confronted with the fact that there is little new opening, and also that the mine has been so little explored that a doubt necessarily arises as to the direction in which it is best to push forward. The necessity of acceleration in the matter of sinking and drifting has caused the management to procure and put into operation a compressor, which has been recently erected in a stone building constructed near the pump shaft. The compressor is a Rand duplex, 16x30, and they are now running five power drills, though the compressor has a capacity of 18 drills. Previously the drilling has all been hand work. A Burleigh drill was used, however, many years ago, in this mine, in sinking the incline shaft. They have sunk two lifts within the past year, and are going down to the third, so that the mine is opened to the 220-fathom level, and will soon be to the 230-fathom. In the 220 they have drifted north and south from No. 4 a distance of about 50 feet each way. The shafts go down vertically, but the vein inclines slightly to the east, so that the drifts are connected with the shafts by cross cuts. These cross cuts lengthen with each successive lift. The vein varies from a few inches to several feet in width, and while at present it carries but little copper it has a "healthy," "promising" look; but for the first time in the history of the mine there is no mass copper to be seen. The vein here, as elsewhere, south of the greenstone, is crossed by numerous amygdaloid beds, as well as by several conglomerate belts, the south one of which, probably, corresponds to the Calumet Conglomerate.

These amygdaloid "floors" and the south Conglomerate, which latter is, of course, the lowest underlying one yet reached, prove to be productive in copper for a limited distance east and west from the vein. The largest portion of the product now being taken from the mine comes from the south conglomerate and the "Osceola amygdaloid," so called from the fact that, assuming the conglomerate to be the Calumet, the amygdaloid occupies the same relative position to it here as the Osceola amygdaloid does to the Calumet lode in the mines at Portage Lake. The conglomerate has a width of about 4 feet, and is very rich for a distance of about 30 feet each way from the vein, when it ceases almost wholly to be productive. The character of the conglomerate changes abruptly; it is plain to observe the line of demarkation

between the copper bearing portion of the lode and the point where it ceases to be so.

The "man engine" is down to the 170-fathom level, and will be extended to the bottom of the mine during the present year. A couple of small hoisting engines are in use in the bottom of the mine in lowering the shafts. The product of the mine for the year 1881 is as follows:

	Barrels.	Tons.	Pounds.
Stamp work	668	448	670
Kiln copper	132	207	1015
Masses	163	295	760
Total yield of the mine		951	1445

The details of the work are as follows:

No. of feet of shafts and winzes sunk, 307 5-12, average cost per foot	$29 81
No. of feet of drifting on vein, 1,695 3-12, average cost per foot	11 84
No. of feet of drifting on conglomerate, 83 3-12, average cost per foot	12 65
Stoping on vein, 31 107-108 cubic fathoms, average cost per fathom	30 00
Stoping on amygdaloid, 1601 13-36 cubic fathoms, average cost per fathom	16 23
Stoping on conglomerate, 238 31-36 cubic fathoms, average cost per fathom	24 54

The total amount of ground broken in the drifts, shafts, stopes, etc., was 3,570 cubic fathoms.

The total number of tons of rock stamped was 20,549, which yielded 2 18-100 % of mineral. This includes only the stamp mill work.

The average yield of the mineral per fathom of ground broken was 537 pounds.

Stamp mill expenses were:

For labor	$7.599 96	
For 1,875 cords of wood	6,093 75	
Lights, oil, shovels, etc	173 92	
Repairs, fixtures, materials, etc	515 73	
Total expense		$14,383 26

Cost of stamping and washing per ton, 61 35-100 cents; the running time of 24 heads was 134 41-72 days.

The number of tons of rock stamped per head per 24 hours of running time was 6 3-10 tons.

Number of tons of rock stamped per cord of wood consumed was 10 96-100 tons.

The cost per ton for breaking and selecting the rock, and for tramming it to mill was 10 24-100 cents.

The working force of miners was 145.

The average contract wages per month were $51.34.

The average surface wages per month were $42.12.

The average number of surface men employed was 35.

The average number of stamp mill men employed was 14.

The average monthly wages of stamp mill men was $54.28.

Wheelers, laborers, timbermen, etc., working underground on company account, received in total for the year, $27,613.31.

Total amount of surface expenses for the year 1881 was $77,689.40. In this is included wages, hauling wood to fire holes, tramming, teaming to and from Eagle Harbor, freight, coal, timber, and all other expenses.

Construction account, including new compressor, building, and engine, drills, two new boilers in No. 2 engine house, labor, etc., etc., $22,462.43.

Total of team expenses, $1,991.75.

Total of underground labor, $7,192.86.

Total gross expenses for the year 1881, $216,062.01.

From which, deducting credits leaves a total of net expense of $209,363.83.

Dividend paid of $3 per share, $60,000.

Total dividends paid to December 31st, 1881, $1,664,000.

Total expenditures to December 31st, 1881, including dividends, paid, etc., $7,141,711.08, all of which has been met by the sales of the copper produced.

The appearance of the vein at this date (March, 1882) is improving, and certainly looks, in the lower drifts, very promising, but the great masses which the mine has been wont to yield, and for the production of which it has so long been famous, have ceased to occur—a temporary suspension, let us hope.

The officers of the company are George A. Hoyt, President; John Stanton, Secretary and Treasurer, 76 Wall street, N. Y. Officers at the mine: James Dunstan, Agent; Samuel Bennett, Mining Captain; J. F. Robert, Clerk; Central Mine, Mich.

REPORT OF THE CENTRAL MINING COMPANY FOR THE YEAR 1881.

The directors present the following statement of the operations during the year 1881:

The production of mineral was 951 1445-2000 tons, and the quantity smelted was 978 1910-2000 tons, which yielded 72½ per cent, or 1,418,465 pounds of refined copper.

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

PRODUCTION IN 1881.

Copper sold, 1,418,465 pounds @ 17 14-100 cents		$243,194 15
Silver		1,109 62
		$244,303 77
Mineral at mine December 31, 1880 as, per last report, valued at	$22,536 38	
Mineral at mine December 31, 1881, 123 20-2000 tons, valued at	24,602 00	
Increase in value of mineral at mine		2,065 62
Net value of product of 1881		$246,369 39
Add balance of interest account		3,266 53
		$249,635 92

COSTS.

Working expenses at mine	$167,857 47	
Smelting, freight, and all other expenses	34,158 39	
Net operating expenses		202,015 86
Showing a profit of		$47,620 06
The surplus reported December 31, 1880, included 740,484 pounds copper, then unsold, valued at $129 534 70, but which only realized $117,569 39, the actual surplus December 31, 1880, being		343,079 14
		$390,699 20

DEDUCT.

Dividend February 25, 1881	$60,000 00	
Dividend August 1, 1881	60,000 00	
Amount expended for power drilling machinery in 1881	22,462 43	
		142,462 43
Making the net surplus December 31, 1881		$248,236 77

As shown in detail in the annexed statement of assets and liabilities, and from which a dividend of $2.50 per share ($50,000) was paid February 4, 1882.

The production during the year was about 25 per cent (320 tons mineral) less than that of the previous year, but the amount of work performed has been larger in every department, except the cutting of mass copper, and particularly in the line of opening, or development work, which has been prosecuted with vigor in the expectation of meeting with more productive ground.

The report of our agent describes in detail the appearance and yield of the mine at the various points which have been worked, and it will be seen that the vein in the vicinity of No. 2 shaft—the locality of the "chimney" or "ore shoot" which has yielded so largely for some years past—has been comparatively thin and poor from the 19th to the 21st levels, and the "backs" over the 20th and 21st levels have produced very little heavy copper. The average yield of the ground broken during the year has declined to 386 pounds per fathom, from 596 pounds per fathom in 1880, which fully accounts for the reduced production for the year.

The bottom openings appear to be opening a larger and more promising vein, and those most familiar with the mine believe that although we have encountered an unusually "thin and poor streak," the vein will expand again, and produce the heavy mass copper which has been characteristic of it.

A superior outfit of power drilling machinery has been provided, and was put in operation about the close of the year. Under the present conditions of labor, the introduction of this class of machinery has become a necessity, and its use will facilitate and cheapen the underground work, and enable us to open the mine with greater speed than heretofore.

For more detailed information we refer to the agent's report, and the financial statements herewith submitted.

GEORGE A. HOYT, JOHN J. CRANE, ROBERT PORTERFIELD,
JORDAN L. MOTT, WILLIAM C. STURGES, A. J. HATCH,
NEW YORK, April 3, 1882. *Directors.*

BALANCE SHEET CENTRAL MINING COMPANY, DECEMBER 31, 1881.

General expenditure to December 31, 1880		$5,168,229 44
EPPENDITURES IN 1881.		
Central mine		
Freight	$196,814 87	
Smelting	9,302 81	
Insurance	17,380 58	
Brokerage	1,413 75	
Expenses	912 18	
	5,149 07	$230,973 26
Real estate		20,988 25
Dock and warehouse		9,112 07
Dividends		1,560,000 00
Cash		17,301 12
Loans on call		70,000 00
Copper bills		14,105 82
Copper on hand, sold (293,341 pounds)		56,550 25
Silver on hand		1,109 62
Accounts receivable		442 84
		$7,148,812 67
Capital advanced by stockholders		100,000 00

SALES OF COPPER.

Sales previous to 1881	$6,794,234 51	
Sales in 1881	243,194 15	
Silver	1,109 62	
		$7,038,538 28
Interest received in 1881		3,266 53
Accounts payable		7,007 86
		$7,048,812 67

STATEMENT OF ASSETS AND LIABILITIES, CENTRAL MINING COMPANY, DECEMBER 31, 1881.

ASSETS.

At Mine.		
Mineral (123 020-2000 tons at $200)		$24,602 00
Merchandise in store		43,703 26
Supplies		44,812 60
Cash		2,258 96
		$115,376 82
In New York.		
Cash	$17,301 12	
Loans on call	70,000 00	
Copper bills	14,105 82	
Copper on hand, sold (293,341 pounds)	56,550 25	
Silver	1,109 62	
Accounts receivable	442 84	
		159,509 65
		$274,886 47
Balance of assets		$248,236 77

PERMANENT INVESTMENTS.

Mining plant, or implements, engines, stamps, houses, etc., valued at	$247,854 00
Real estate, being timber and other lands, not including mining location	20,988 25
Dock and warehouse at Eagle Harbor	9,112 07
	$277,054 22

LIABILITIES.

Indebtedness at mine	$15,089 40
Mine drafts	4,552 44
Accounts payable	7,007 86
Balance of assets	248,236 77
	$274,886 47

AGENT'S REPORT.

CENTRAL MINE, KEWEENAW COUNTY, MICH.,
January 1, 1882.

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

DEAR SIR—The following report is respectfully submitted for your consideration, and shows in detail the various expenditures for the year 1881:

GROUND BROKEN.

Sinking in shafts and winzes, 317 5-12 feet, average cost	$29 81
Drifting on the vein, 1,695 3-12 feet, average cost	11 84
Drifting on the conglomerate, 83 3-12 feet, average cost	12 65
Stoping on the vein, 31 204-216 cubic fathoms, average cost	30 00
Stoping on the vein, 1,601 13-36 sup. fathoms	16 23
Stoping on the conglomerate, 238 31-36 sup. fathoms, average cost	24 54

The total amount of ground broken in openings and stopes is 3,570 fathoms.

PRODUCTION.

	Pounds.
668 barrels stamp copper, weighing	897,670
132 hogsheads kiln " "	415,015
163 masses " "	590,760
Total	1,903,445
Or 951 1445-2000 tons.	
Average yield of mineral per fathom of ground broken	533
Average yield of ingot per fathom of ground broken	386

STAMP MILL.

The expenses at the mill were as follows:

Labor	$7,599 96
One thousand eight hundred and seventy-five cords of wood consumed	6,093 75
Lights, oil, shovels, etc	173 82
Repairs, materials, fixtures, etc	515 73
	$14,386 26

Tons of rock stamped	20,549
Yield of rock in mineral	2 18-100 per cent.
Yield of rock in ingot	1 58-100 per cent.
Cost of stamping and washing per ton	70 cents.
Running time of 24 heads	134 41-72 days.
Rock stamped per head in 24 hours running time	6 3-10 tons.
Rock stamped and washed per cord of wood consumed	10 96-100 tons.
Cost per ton of breaking and selecting rock and tramming it to mill	10 26-100 cents.

WORKING FORCE.

The number of men in the different departments of work, and their average wages per month, has been as follows:

		Wages.
Miners	145	$51 34
Surface men	35	42 12
Stamp men	14	54 28

The present force embraces 133 miners, 41 surface men and engineers, 14 stamp men and 8 mechanics, making with agent, clerks, and mining captain, 206 men employed by the company.

SINKING.

No. 2 shaft has been sunk from the 21st level to the 22nd level. The skip-road and pump have been extended in this shaft from the 21st to the 22nd level, and we are now sinking to the 23d level. A winze has been sunk from the 21st to the 22nd level, just opposite No. 2 shaft. The vein in this winze was small and poor for the first 20 or 25 feet, then it commenced to improve in size and richness. About 40 feet under the 21st level the vein widened to about 5 feet in thickness, showing good stamp, barrel, and small masses of copper. There is a small mass of copper showing in the south end of the winze, with about one ton of it exposed. I am of the opinion that when we get the 22d level opened for stoping south of this winze, we shall find this a good block of copper ground.

No. 4 shaft has been sunk from the 20th to the 21st level. We are sinking an inclined winze on the south belt of conglomerate, under the 20th level. The belt at this point is 3 feet thick and well charged with stamp copper. This winze is also going down on the course of the vein, and has shown a better vein than we have seen in the north part of the mine for a number of years. I think it will give us a good block of stoping ground, which will be available as soon as the winze has reached the 21st level.

DRIFTING.

The 19th level has been extended south of No. 2 shaft 207 6-12 feet. The vein was poor, but this level had to be driven to reach the south belt of amygdaloid, which was showing considerable copper in the 20th level.

The 20th level was driven south of No. 2 shaft 125 7-12 feet. The vein has been small and poor. The 21st level south of No. 2 shaft has been extended 204 3-12 feet. The vein has been very uniform throughout, carrying good stamp rock, but is only about 2 feet in thickness; the best portion of the vein, however, has been in the lower part of the drift, which leads us to think we are on the top of another "shoot" of copper, and that we shall find the vein larger and richer as we open the 22d level.

The 21st level has also been driven north of No. 2 shaft 432 3-12 feet through poor ground, and 157 11-12 feet north and 132 6-12 feet south of No. 4 shaft, the vein being small and poor. We have driven two cross-cuts from No. 2 shaft to the vein, one at the 21st level and the other at the 22d level.

No drifting has yet been done in the vein at the 22d level, but where the cross-cut passed through the vein it was about 4 feet thick, carrying good stamp and barrel copper.

STOPING.

The stopes in the back of the 18th and 19th levels have produced most of the mass copper the past year, and we have a small block of good ground yet remaining in the back of the 19th level.

The stopes over the 20th and 21st levels have given us good stamp rock, but as the vein has been small they have not yielded a very large amount, and the falling off in the product of the year has been caused by the failure of these two backs to yield the usual quantity of heavy copper.

The south belt of conglomerate has been good at every point where work has been done on it. It is about 3 feet wide and carries rich stamp rock for about 25 to 30 feet where crossed by the vein, and then becomes poor.

We have done some stoping on a belt of amygdaloid at the extreme south end of the mine, which is generally supposed to be the "Osceola belt." It is about 20 feet wide. The copper occurs in bunches, and some of it is very good, but the greater part of the belt has been poor, so far however, we have not done sufficient work on it to prove its value.

CONSTRUCTION.

During the past year we have built a stone building 48x48 feet with slate roof, for our new compressors, and have placed in No. 2 shaft about 2,000 feet of 6-inch pipe to convey compressed air to different parts of the mine, to operate the power drills. We are now working five power drills, and two underground engines to hoist rock from shafts and winzes, which will greatly lessen the general expenses, and enable us to open the mine much more rapidly than heretofore. The Rand Duplex Compressor and the power drills are working very satisfactorily.

We have added six copper washing machines to the stamp mill, besides several other minor improvements. All the machinery, both on surface and underground, is in good condition, with the exception of the foundation of the stamp mill engine, which will have to be replaced next summer.

Respectfully, JAMES DUNSTAN, *Agent.*

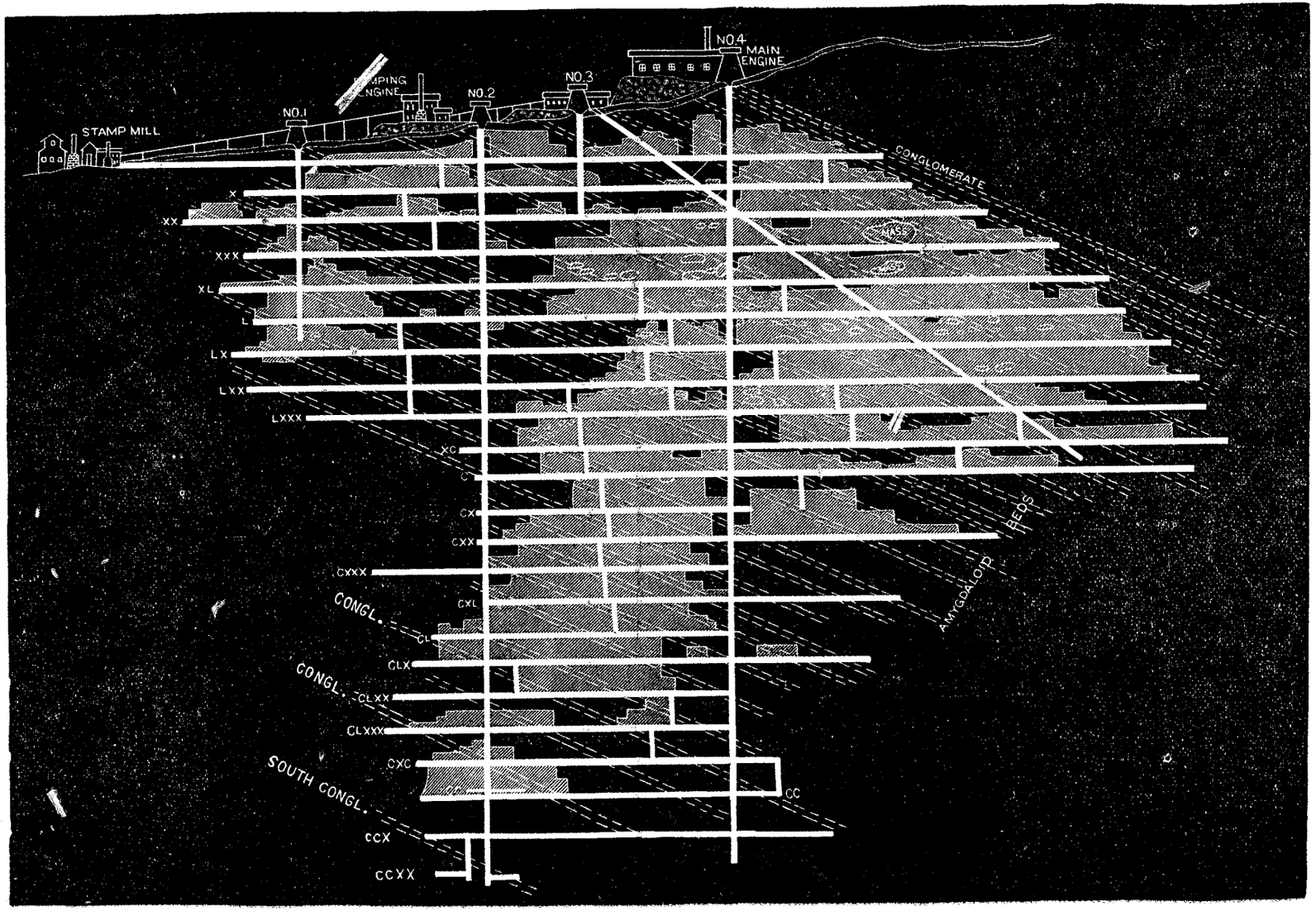
STATEMENT of Production, Cost, and Results from Central Mine, 1874 to 1881 Inclusive.

CENTRAL MINING COMPANY.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Product of stamp copper	1,270,503 lbs.	1,294,340 lbs.	1,298,242 lbs.	1,188,242 lbs.	1,011,750 lbs.	829,205 lbs.	899,977 lbs	897,670 lbs.
Product of kiln copper	381,349 "	381,160 "	538,723 "	508,491 "	641,279 "	455,340 "	387,682 "	415,015 "
Product of mass copper	812,008 "	731,937 "	969,218 "	1,120,129 "	1,064,083 "	1,038,497 "	1,254,901	590,760 "
Total product, mineral	2,480,860 "	2,407,437 "	2,806,183 "	2,816,862 "	2,717,112 "	2,323,042 "	2,542,560 "	1,903,455 "
Product of ingot copper	1,740,603 "	1,466,952 "	2,161,400 "	1,995,609 "	1,891,013 "	1,799,475 "	2,026,078 "	1,418,465 "
Percentage of mineral	72.45	70.82	71.22	71.39	71.	75.	76.6	72¾
Gross earnings	$366,208	$373,634	$425,026	$368,644	$301,212	$288,914	$362,976	$249,635
Total expenses	257,958	233,245	280,060	265,347	212,395	200,890	240,102	202,015
Per cent of expenses to earnings	70.44	62.42	65.89	71 43	70.51	69 53	66 14	80.92
Net profit	$108,250	† $140,389	$144,966	$105,297	‡ $88,817	§ $88,023	$122,874	47,620
Dividends paid	160,000	80,000	100,000	140,000	100,000	80,000	100,000	120,000
Surplus undivided	309,987 99	$322,087 03	367,053 03	332,350 04	315,318 82	332,220 39	355,094 45	¶ 248,236 77
Total mining cost of ingot copper per pound	11.58 cts.	12.32 cts.	9.84 cts.	10.27 cts.	8.71 cts.	8.97 cts.	9.55 cts.	11 83 cts.
Smelting, marketing and other expenses per lb.	3.24 "	3.49 "	3.11 "	2.92 "	2.52 "	2.19 "	2 30 "	2.41 "
Average cost per pound, marketed	14.82 "	15 81 "	12.95 "	13.19 "	11.23 "	11.16 "	11 85 "	14.24 "
Average sales of ingot copper per lb	20.81 "	22 56 "	20.86 "	18.36 "	15.84 "	15½ "	18.86 "	17.14 "
Tons of rock stamped	15,368	17,118	12,658	14,119 "	13,858	12,478	14,520	20,549
Average per cent of mineral in stamp rock	3.85	3.78	5.13	4.21 "	3.65	3.32	3 09	2 18
Stamp mill in operation	94¼ days.	91 days.	97⅓ days.	108 days.	106 days.	96 days.	125 days.	134 days.
Cost per ton stamping and washing	$1 07	86.76 cts.	$1 02	82.61 cts.	69.70 cts.	64 27 cts.	72.25 cts.	70 cts.
No. of fathoms broken in openings and stopes	2,636	3,226	3,251	3,269	2,712	2,537	3,267	3,570
Yield of mineral, per fathom	910 lbs.	746 lbs.	863 lbs.	862 lbs.	1,001 lbs.	915 lbs.	778 lbs.	533 lbs.
Yield of ingot copper per fathom	660 "	528 "	614 "	615 "	711 "	686 "	596 "	386 "
Average force employed	515 men.	212 men.	324 men.	242 men.	220 men.	211 men.	224 men.	194 men.
Average number of miners	161 "	158 "	184 "	195 "	175 "	168 "	179 "	145 "
Average wages of miners, per month	* $53 14	$52 65	$51 39	$49 80	$45 67	$47 05	$56 71	$51 34

* There was a decrease in the rate of wages per man in 1874, of miners, 18 per cent; of surface men, 14 per cent; and of stamp men, 12 per cent.
† Of which was expended for building and construction $48,289, leaving a net gain in 1875 of $92,099.
‡ Of which was paid for woodlands, $5,848.71, making net gain for year, $82,968 78.
§ To which add $3,114 realized on a claim charged off in 1876 as not collectible, and $5,763 75, amount received on account of redemption of Madison lands —making the net gain in 1879, $96,901 57.
¶ From which dividend of $50,000 was paid February 4, 1882.

VERTICAL SECTION OF THE CENTRAL MINE, 1882.

Scale, 360 ft. to one inch.



THE COPPER FALLS MINE.

The Copper Falls Mine does not seem to have been remarkably prosperous during the year. The outlook just now, however, is more favorable, owing to the occurrence of considerable mass copper in the fissure vein—Owl Creek vein—the old mine from which the ash bed is worked.

The main dependence of the Copper Falls Mine is the ash bed, but the ash bed lies very flat, having an inclination with the horizon of only 27° or 28°, and it is very lean, affording in favorable portions of it only 20 pounds of copper to the ton of the rock. If this were an average of the yield of the belt it could be worked at a profit, as is shown by the results achieved at the Atlantic Mine; but the ash bed, unlike the Atlantic lode, has great stretches of worthless ground, necessitating the opening of extensive drifts in order to even reach the moderately productive portions of the lode, and then the flatness of the bed renders necessary the shoveling of the rock over, down the foot wall to the drift.

At the beginning of the year but few miners were employed. The mine was well opened and considerable stamp rock had accumulated in the mine. In February, 1881, the number of miners was increased to 46 men; in March to 58, the total force then being 202 men. In July the number of miners was 38, and the total force was 182 men, of whom 21 were underground laborers —men passing rock, 19; trammers, 6; fillers, 7.

	Men.
In September the number of miners was	63
In October " " " " "	52
In November " " " " "	41

Also 16 underground laborers, 8 passing rock; 9 trammers, 3 fillers. The average for 12 months is 50 miners employed.

The mill is furnished with two Ball stamp heads, both of which were run up to the 6th of October last, since which only one has been operated. The highest number of tons of rock were stamped in April—5,250 tons—which gave a product of 52 tons, 1,530 pounds of mineral.

In June 5,100 tons were stamped, which yielded 50 tons 1,025 pounds of mineral.

The total number of tons of rock stamped during the year 1881 was 55,187 tons, which yielded 459 tons 310 pounds of mineral.

About 10 or 11 tons of the product was mass and barrel work, and the remainder was stamp work from the ash bed. It will be seen that the yield is less than one per cent of copper.

The expenditures for the year to December 31, 1881, were $171,878.48.

The addition to the mining plant for the year, which may be reckoned as permanent improvement, was $23,066.93, which sum, taken from the total expenditure, gives the cost of mining work, or what was really expended to produce the copper.

Total expenditure	$171,878	58
Permanent improvement	23,066	93
Leaving	$148,811	55
Total expenditures of company to December 31st, 1881	$2,550,668	21

Miners, working hand drills, received per month	$45 00
" " Rand " " " "	50 00
Trammers received per month, average	37 11

Laborers on surface received per month	$35 to $40
Underground laborers received per month	37 27
Miners passing rock	35 81
Miners filling cars, etc	39 68
Timbermen	48 00

They worked from three to nine power drills constantly.

The average cost per foot for sinking with power drills	$10 86
The average cost per foot for drifting with power drills	9 08
The average cost per fathom for stoping	13 99
The cost per foot for drilling holes	14⅞

This price varies with the size of the hole.

HAND DRILL WORK.

Total cost per foot for sinking shafts, etc	$11 65
Total cost per foot for drifting	10 33
Total cost per fathom for stoping ground	14 00

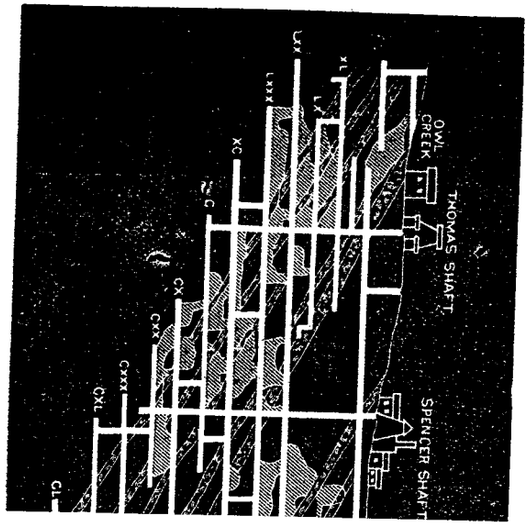
The rock is all run out of the long adit in trains of five cars, each train drawn by one mule. They are now, with one Ball head, stamping 150 tons of rock per day.

They are working 87 men in the mine now, and are 84 feet below the main adit and drifting north; below the adit they are only working in the ash bed. The old shafts below the adit being full of water, in the ash bed the mine makes but little water, and what there is drains out of the adit. The mine is down to the one hundred and tenth level, but the recent find of rich copper ground, in the fissure where it crosses the ash bed, is at a point only 85 feet below the adit, and 480 feet north of Spencer shaft. The adit is the 90-fathom level, and they are working below in the one hundred and tenth to find if the "rich shoot" continues down. The vein here widens out to 12 feet, and one mass now fully out is 10 feet in length, and will weigh several tons. They are also working in the ash bed 800 feet west of Spencer shaft. The west 200 feet of this drift is looking poor.

In about 200 feet further the drift will cut the Lower Falls vein, the first vein that was worked on the property, a mine having been started here in 1845, and considerable work was done, one of the four shafts that were sunk reaching to the depth of 208 feet. The vein was irregular, but bore tolerably well in places. The working was done in a trap bed, which was overlaid by and also rested upon sandstone. The vein was found to be split up and barren in the sandstone, underlying the trap, and after passing through the sandstone and reaching the trap bed, which succeeds it, the vein appeared to be lost, and some cross-cutting was done to recover it, but without success. The vein, however, was subsequently found on the surface, crossing the underlying bed. It is probable that the company will continue the drift until it intersects this vein. In this drift they also expect to cut the Dribble vein, which has been traced on the surface but has never been worked.

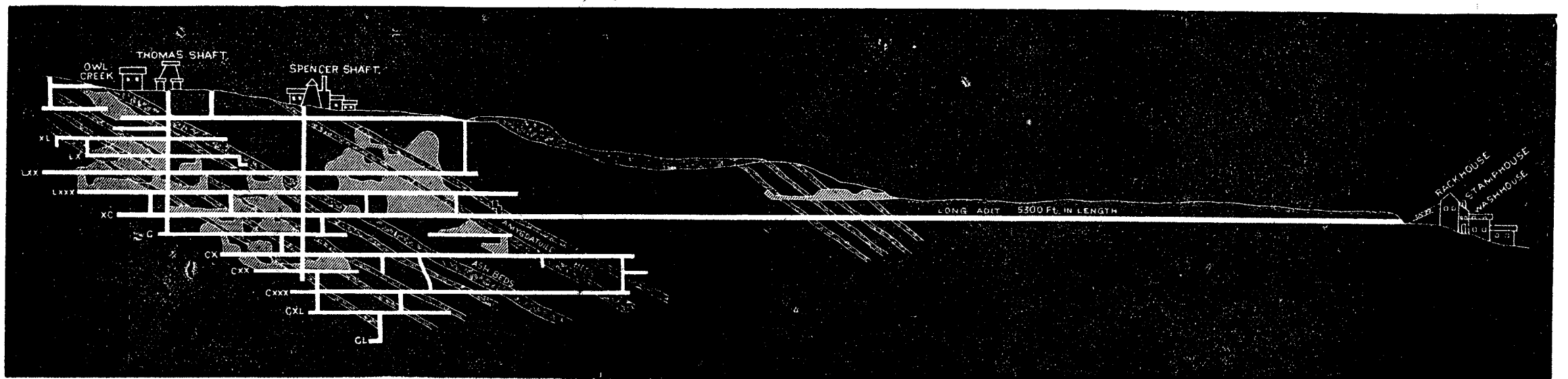
The number of shares is 20,000, which in 1877 were increased in value to $50 each, making the capital stock $1,000,000. The officers have issued a call for a meeting of the stockholders to increase the number of shares to 40,000, probably making them $25 each, leaving the capital stock as it is. This will make the number of shares and the value of each correspond with those of most other companies.

The officers are: David Nevins, Jr., President; John Brooks, Secretary and Treasurer, Boston, Mass. B. F. Emerson, Agent, Copper Falls, Mich.; Wm.



LONGITUDINAL SECTION OF THE COPPER FALLS MINE, 1881.

Scale, 500 ft. to one inch.



Jacka, Mining Captain, Copper Falls, Mich.; D. W. Twoly, Assistant Clerk, Copper Falls, Mich.

THE ASH BED MINING COMPANY.

The treating of the ash bed rock by the machinery now in operation at the Ash Bed Company's mill is an important departure from the ordinary stamps, etc. The method at the Ash Bed consists simply of a system of breakers, rollers, jigs, and grinders manufactured by Samuel Hodge, Riverside Works, Detroit.

From the breaker the rock is passed between a pair of iron rollers that crush it to the size of 3-16 of an inch. Thence it passes over a pair of jigs, thence to a sifter, that has a lateral motion; the jig takes out all the fine portions and the coarser pass to the sieves, and thence to a second set of rolls, which reduce the lumps to the size of a quarter of an inch. The jigs operate in water as at other mills, and separate the lumps of copper.

From the second pair of rollers the product passes in succession to two sets of jigs, four in all, each 4 feet by 2 feet 6 inches, and thence to automatic sifters, working laterally as a fanning mill sieve. The sand passing through the sieves is ground with the material that passes over the sieves, the latter being first ground by itself, and the two coming together pass through a Hodge grinder, which consists of the frustum of a cone revolving in a sheath of the same form, working to a degree of closeness sufficient to secure the requisite fineness to the sand. The revolving and the stationary surfaces are also properly grooved, as in the manner of grinding surfaces. The jigs are made a foot longer than ordinary to give the sand more time to settle. No trouble is experienced by copper clinging to the rollers; a stationary scraper removes all adhering particles. After passing through the grinder a succession of jigs completes the separation.

The machinery has been in operation since June 1. The old stamp mill was burned the last day of April and a new one erected on the same site, was completed and got into operation June 1st. No slime tables are used; none are needed, as by this method the making of slime is avoided.

The yield of copper has been 98-100 % ingot. The product is all trammed out of the adit, which is 1,350 feet in length, and the stamp mill is distant from the mouth of this adit about 208 feet to the north.

The adit cuts three prominent parallel lodes, the lower of which is the best; they are 10 feet to 12 feet apart. The adit goes in on a narrow fissure vein that yielded little or no copper; in the mine the vein splits into two branches, and an adit runs in on each. The adit is about 150 feet vertically below the outcrop of the ash bed, and 300 feet below, on the lay of the bed. The water is supplied from a dam, and is brought in a launder to the mill. But little work has been done on the deep adit that is designed to reach the lake shore. In the mine about one half of the ground that is opened is left standing, as it is too poor to stope; but the poor ground, as does the productive, occurs in bodies by itself, so that there is no trouble in selecting. The purpose of the company is to test the ash bed and find out, if possible, how much can be got out of it, and the cheapest way to get it. Ball's stamps pound up the rock too fine. Much of the copper, if it could be separated of the size in which it occurs in the bed, is in sufficiently large pieces, but the stamps reduce it to small particles, and then the trouble is to separate them from the sand. The

stamps make all fine copper where but little naturally exists, and it is difficult to save it. Ball stamps, on the ash bed, make 25 % of slime in addition to the fine particles which they make that are separated by the jiggers. It is certain that some method better than stamp can be devised for the ash bed, and possibly the method now being tried at this company's mill, or a modification of it, will accomplish what is desired.

The company works about 25 men, running only day shift. The mill works up 25 tons per day, of rock, and it costs $2.75 per ton to mine and treat the rock. Mr. Delano, the agent, hopes to reduce the cost to $2.50 per ton. This result could, undoubtedly, be reached if a compressor and power drills were used.

The deep adit has been, in former years, driven in about 500 feet, but the present company does not contemplate continuing the work here on this vein, but to transfer it to the west vein, which is three-fourths of a mile to the west of the present mine.

A mine here was opened twenty years ago by four adits driven in at different heights in the vein, the lower one being but a little above the lake.

The main reason for selecting this vein in preference to the one now worked is that it comes a mile nearer the lake shore, or rather that the lake, because of a bay or curve in the shore line, comes a mile nearer the mouth of the adit at the west vein than it comes to the present mine, and as the intention is to place the mill on the lake shore, the matter of distance becomes important; other things being equal, nearness to the lake must naturally govern the choice; but the company has not fully decided upon any definite course, and in this they evince wisdom; better make haste slowly, fully test all the new methods, and find in this way, if possible, how the ash bed may be worked to a profit before incurring an enormous expenditure upon an uncertainty and end up finally, after a few years' trial, in disastrous failure.

The ash bed at the Petherick, the former name of the mine, is as good as at any point at which it has been opened, and now at the beginning of the career of the new company, it may as well work out a solution to the problem of how best to operate the great deposit.

The company has obtained 19½ pounds of ingot to the ton of rock, which at 17 cents per pound would give $3.33 per ton, and if the cost of mining and separating etc., can be reduced to $2.50 per ton there would be a profit of 83 cents per ton; but anyhow, if 500 or 600 tons per day can be regularly mined and treated, which shall yield 98-100 % ingot copper, the work can be done at a profit.

The total product of mineral for the year has been 25,310 pounds. The output was greatly cut short by reason of the burning of the stamp mill. The company has no indebtedness. The total expenditures for the year have been $39,090.99.

The construction expenses were $31,212.02, which latter includes getting ready to resume work, etc., at the beginning of the year.

The mine adjoins the Copper Falls, lying next west from it. The property originally constituted a portion of the Copper Falls estate, having been set off from it in 1861 to organize the Petherick. The present company, under the name of Ash Bed Mining Company, was organized in 1877.

The capital stock is $1,000,000, divided into 40,000 shares. There are about twenty dwellings on the location, and some other buildings. The company's estate consists of 1,100 acres of land in sections 2, 10, 11, 14, 15, and 23, T. 58 N., R. 31 W.

The officers are Wm. P. Hunt, President; W. C. Coffin, Secretary and Treasurer, Boston, Mass. M. A. Delano, Agent, Phœnix Mine, Mich.

THE ST. CLAIR COPPER COMPANY.

The St. Clair Copper Company continues work, but with no very encouraging outlook. The mine is in a fissure vein, south of the greenstone and east of the Phœnix. The main shaft is down 390 feet, vertically, below the surface, to the fourth level, the shaft at the bottom being 1,010 feet south from the greenstone. The mine is crossed by a "false slide," which in the fourth level is 375 feet south from the greenstone, and in the first level it is 145 feet to the south, thus dipping at an angle of about 45°, while the formation dips at 28°.

The best copper ground is between the false slide and the greenstone, though some stoping is now being done south of the slide. The vein is a narrow one, but otherwise looks well.

The plan now is to sink from the 40-fathom level an inclined shaft on the "slide," and to hoist by means of a small engine placed underground to this level, and tram thence along it to the shaft, and thence up to the surface. The product is mostly in small masses, from a few pounds to a thousand pounds' weight—mainly of a size to constitute barrel work. The product of the year to December 31st, 1881, was 121,393 pounds of refined copper. What little stamp rock is obtained is very rich, yielding 4 % to 5 % of copper.

The rock house and stamp mill are nearly new, having been rebuilt after the fire, which consumed the former ones in the fall of 1880. The mill is now idle, undergoing repairs. It contains 12 heads of Gates's stamps. The total expenses for the year were $21,133.73; the construction account amounted to $5,000. The number of men employed is about 25.

No indebtedness has been incurred, as the product has sufficed to meet the outgoes; in fact the expenses have been kept within the income. The expenses run about $1,800 per month.

The estate consists of 133 acres on Sec. 29, T. 58, R. 31. The stock is largely held by Lake Superior men. The officers are John Brooks, Secretary and Treasurer, Boston, Mass. M. A. Delano, Agent, Phœnix, Mich.

The capital stock is $1,000,000, divided into 40,000 shares.

THE OLD PHŒNIX.

The Old Phœnix Mine is just now attracting a good deal of attention from the fact that there has been recently exposed in the bottom of the mine, in the 150-fathom level, what seems to be an immense mass of copper. This mass forms the entire west wall of the drift for a distance of nearly 40 feet, leading north, and commencing but a short distance from the foot of the incline shaft. The mass extends below the bottom of the drift and above the top, to what distance is not known; neither has it yet been determined as to how far it extends to the west, into the wall by the drift; but struck with the hammer it has a solid ring, and is, apparently, an enormous boulder of pure native copper of, possibly, several hundred tons weight, though of course it may prove to be a mere slab of metal—instead of having 6 feet or 8 feet of thickness, may prove to be only as many inches.

The Phœnix was noted, in former years, for its yield of great masses. The

mine once afforded a mass of 600 tons weight, so that it is not an unreasonable conjecture that a like fortune may again award the owners, who have so long and patiently labored and waited for a return that their faith has well deserved.

Heretofore in the Phœnix the occurrence of a great mass has usually been followed by a succession of them, and this fact adds to the interest with which the new find is regarded.

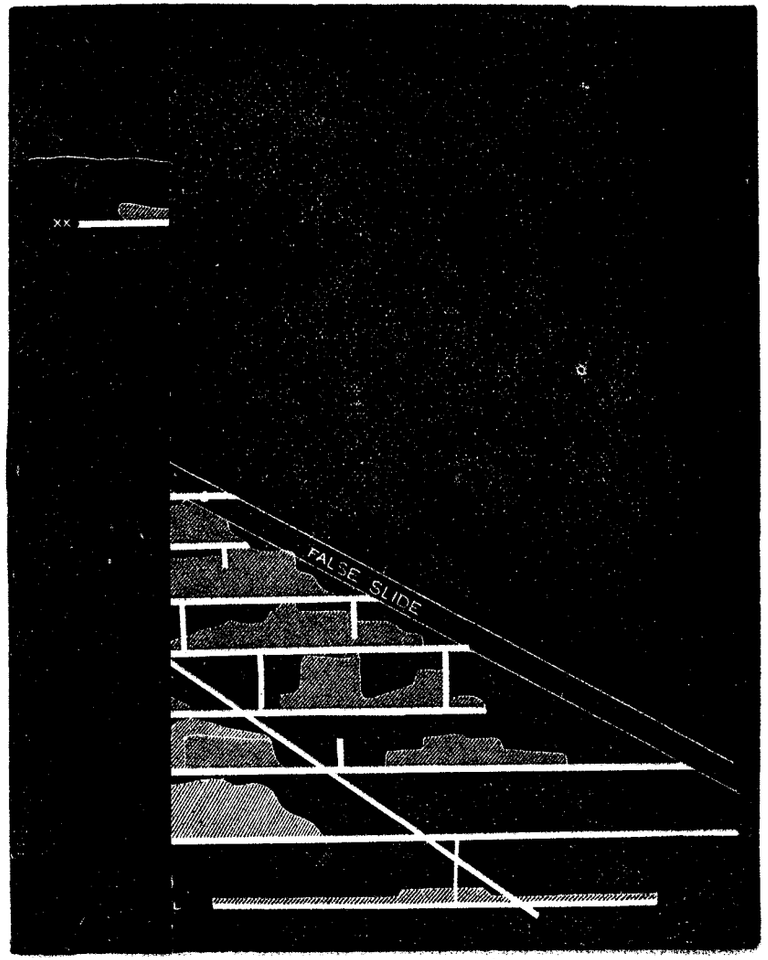
For several years the Phœnix has scarcely held her own; but in past years the mine has yielded a great deal of copper, sufficient, at times, to place the affairs of the company in a very prosperous condition. At present the outlook of the mine is favorable. In addition to the mass above described, the vein in the lower levels, and at the south end of the same drift in which the mass is found, has a "healthy," "promising look."

The mine is down to the 150-fathom level, and as far down as the 120th level, it is worked up to the greenstone under which the mine extends. Two lifts have been sunk within the past year, and the 140th level has been driven 760 feet south from the inclined shaft, commencing at a point 150 feet south of this shaft; for the rest of the distance to the breast of the drift two-thirds of the ground has been stoped away. From this level, near the incline, a winze has been sunk to the 150th, and from it a drift has been extended south 175 feet, and north 200 feet, passing the incline and going 75 feet beyond. This winze was sunk in remarkably good copper ground. The incline is the main working shaft and it is a fine one, heavily and handsomely timbered, and straight as an arrow. It extends down into the mine a length of 2,100 feet, and is laid with T rail, nearly perfect in alignment and smoothness. The bottom of this shaft is about 1,200 feet vertically below the surface. At the time of my visit to the bottom of the mine the men were engaged in placing timbers across the drift at the top, commencing above the foot of the incline, for the purpose of forming a floor from which to begin to take out the back of the drift to the north and above the copper mass. The timbering in the Phœnix mine is exceedingly well done. It would seem incredible to a novice, that great logs 3 feet in diameter and 18 feet to 25 feet in length, can be taken down under ground 1,200 feet, and then moved to the required spot and hoisted to a height of 12 or 15 feet above the bottom of the drift, and put in place, one after the other—horizontally or inclined—to form a floor or a roof, and laid with as much regularity as the joice or the rafters in a building.

In one respect the copper mass is conveniently placed. It is close to the shaft and therefore may readily be transferred to the skip and hoisted to the surface; but, on the other hand, working it out will greatly widen the opening and render it very difficult to timber the shaft as it is carried downward. The shaft, preserving its straight course, is sometimes upon one side of the vein and sometimes upon the other, and, again, as it now is, at the bottom, directly in the vein.

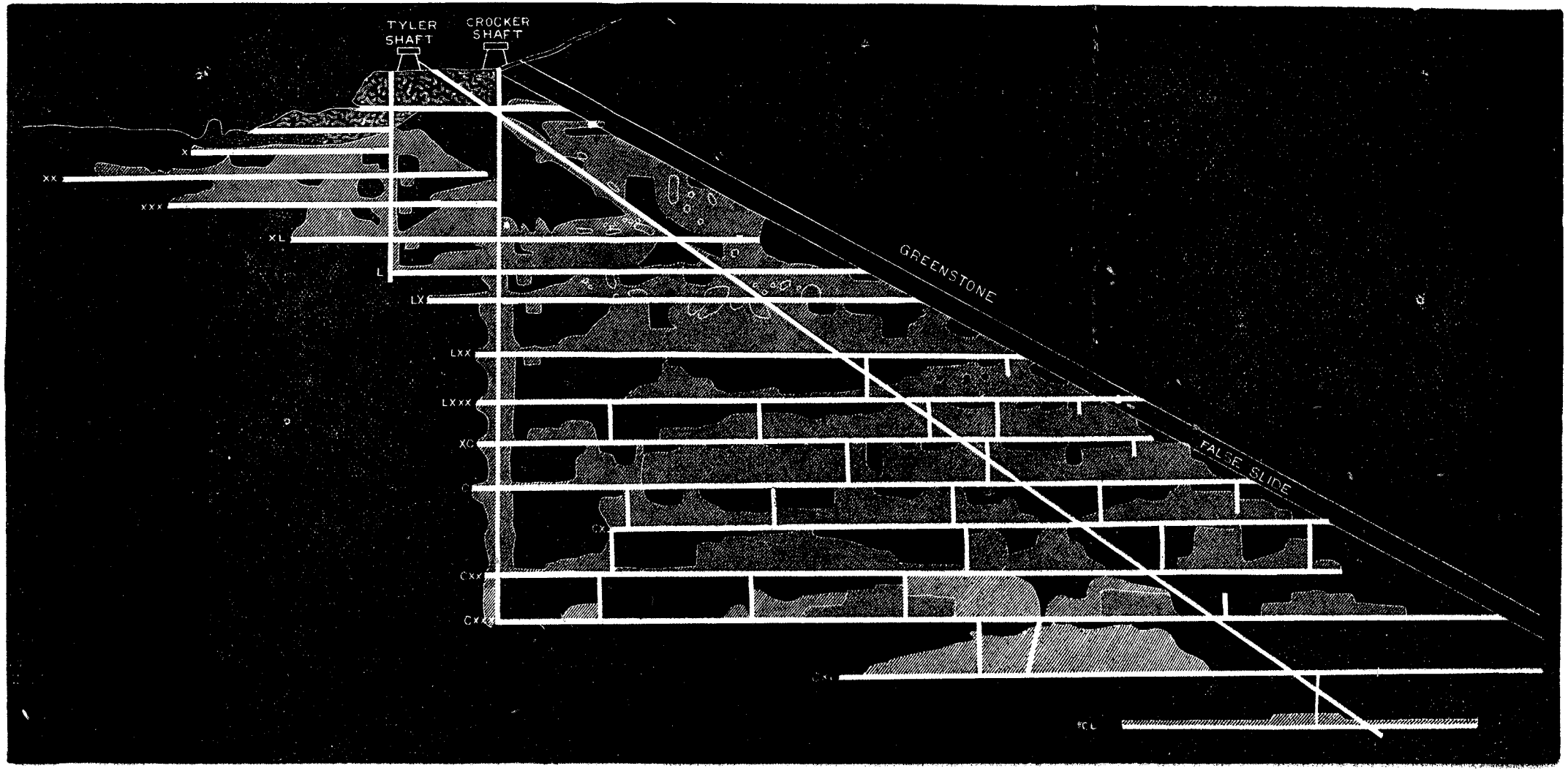
This shaft was a good piece of mining engineering. It was built in sections under the direction of the engineer, Mr. L. E. Emerson, and when the separate portions were driven to connect, they were found to be exactly in line. Lights placed at the center plumbs were exactly in line from the top to the bottom of the shaft. The gauge of the track in the shaft is 4 feet 8½ inches.

On the east side of the shaft, stairs extend from the surface to the bottom of the mine, and along the upright timbers which separate this passage way



LONGITUDINAL SECTION OF PHŒNIX MINE, JAN., 1882.

Scale, 300 ft. to one inch.



from the railway track, is now being fastened the pipes connecting with the compressor, which is to convey the air down into the mine for operating the power drills. In the 130-fathom level, on the east side of the shaft the air receiver—30 feet in length—is placed.

The product for 1881 is 301 tons of mineral. The average number of men employed was 120, of whom 65 were miners. The company is now putting in a compressor, temporarily, one borrowed from the Copper Falls Mine, which in time will be replaced by one of its own, now being made. The one now in will serve to operate five power drills, and these will soon be at work. Heretofore the drilling has all been hand work.

The average wages paid to miners was $47 per month; the average wages paid to underground workmen, other than miners, was $45 per month; surface men received $35 to $40 per month: miners pay for board, etc., $16 to $18 per month. Bituminous coal at the mine costs, per ton, $6. Assessments made in 1881, $1 per share.

In the old mine, north of the Greenstone, the company has kept a party of men at work during the year driving up on the deep adit, which starts from a point 90 feet above the lake, and is opened south on a fissure vein. The mine is called the B shaft. The vein is poor and affords very little copper, so that the driving of the adit is practically dead work. It is now in 2,820 feet from the mouth. The south end of the drift is about 150 feet vertically below the surface. No ultimate plan regarding this mine has been decided upon. The adit will be continued to the ash bed, or to intersect with the B shaft, which is sunk in the ash bed, and if the outlook is sufficiently favorable a stamp mill will be built on the Lake Shore and preparations made for working up a large amount of the ash bed rock. The distance from the mouth of the adit to the lake is one-half mile.

No company has met with greater reason for discouragement, and shown more faith in overcoming them, in its past history, than the Phœnix. With the exception of the Pittsburg and Boston it was the first company organized to work on the lake, and began practical mining as early as 1844, and has ever since worked continuously upon the original location. Not unfrequently its affairs have been at the lowest ebb and ruin seemed inevitable. Yet the crisis has been met, the funds contributed, the company again set upon its feet and started anew to arrive finally at a like termination. Its history is made up of fresh starts and renewed failures, and instead of the patiently waited for dividend the much enduring stockholder has been regularly called upon for a contribution. Whenever the mine has proved largely productive, and a surplus has accumulated in the treasury, the Robbins vein, or some other worthless receptacle, has absorbed the revenue and the stockholders had only to congratulate themselves upon a brief respite from the accustomed assessment. If their pockets were not replenished, for a brief period, they were not depleted.

The statement which has so frequently been made by the officers of the company, that "the property is a valuable one," is unquestionably true, and it is to be hoped that the stockholders may yet realize a practical verification of this statement, and be speedily rewarded for their patience and faith, by "finds" of the metallic richness for which search has long been made.

The company's estate lies in Sections 19, 20, 29, and 30, T. 58, R. 31, and comprises 2,477 acres of land. The principal mine—the old Bay State vein—is on the S. E. $\frac{1}{4}$ of Sec. 30. The officers of the company are Wm. P. Hunt,

President; W. C. Coffin, Secretary and Treasurer; office, Boston, Mass. M. A. Delano, Agent. Richard Bawden, Mining Captain, Phœnix, Mich.

The number of shares is 40,000; par value, $25 per share.

The following table shows the amount of sinking, drifting, and stoping done in the mine for each month during the year, and the monthly cost.

1881.	Feet of Sinking.	Cost.	No. of feet Drifting.	Cost.	No. of fathoms stoped.	Cost.
January	----------	----------	57 7-10	$643 30	112 1-5	$1,012 08
February	----------	----------	50 1-10	638 70	93 7-10	1,175 73
March	----------	----------	73	906 50	86 6-8	1,177 42
April	41	$860 00	----------	----------	93.88	1,284 09
May	35	788 00	6 7-10	53 60	53.83	735 88
June	43 2-10	900 20	11 6-10	92 80	109.77	1,532 57
July	36 9-10	799 30	18 9-10	158 10	85.22	1,298 47
August	16 3-10	577 50	52 1-10	353 60	63.42	897 09
September	16 7-10	584 50	77 2-10	524 00	78.79	1,214 45
October	27	945 00	85 9-10	585 90	103 2-10	1,687 76
November	14 3-10	545 50	62 6-10	516 70	103 1-25	2,085 99
December	16 6-10	415 00	60 6-10	596 65	87.81	1,755 18

CLIFF MINE.

At the old Cliff Mine little work of importance has been done during the year. The agent, Mr. O. A. Farwell, died June 22, 1881, and has been succeeded in office by Mr. D. D. Brockway. Mr. Farwell had resided in the copper region for many years—as Agent and President of the Phœnix, and then agent of the Cliff, and was widely known and much esteemed.

The mine is kept free from water, and some men are now working in the 80-fathom level, drifting east and west from the vein in No. 9 amygdaloid. It will be remembered by those who are familiar with the mine and with its past history, that these amygdaloid "floors," especially the one above referred to proved productive, and the working of it in some of the drifts resulted profitably.

The formation south of the greenstone is made up, in part, by these amygdaloid belts which sometimes have been found, near the vein, to carry copper in considerable quantity, but any extensive working of them has never resulted favorably. In the Cliff these beds were numbered in the order of their occurrence from the greenstone, and No. 9 was found to carry the greatest proportion of copper of any of the belts crossed by the vein in the mine. The company at the present time is exploring this belt. In the 80-fathom level the men have drifted east and west from the vein about 20 feet. They are working here two power drills, operated with a Rand compressor, which was put in last October.

In the 140-fathom level a few men are working a stope, 140 feet south from No. 4 shaft. It is the intention to push north to the greenstone in the lower levels and thus explore the large area of unknown territory, which lies in this direction. In the 200-fathom level the drift already extends to the north a distance of 1,300 feet from No. 4 shaft.

The management also contemplates sinking a shaft 300 feet south from the greenstone, and to carry it down to the bottom. Such a shaft, after reaching

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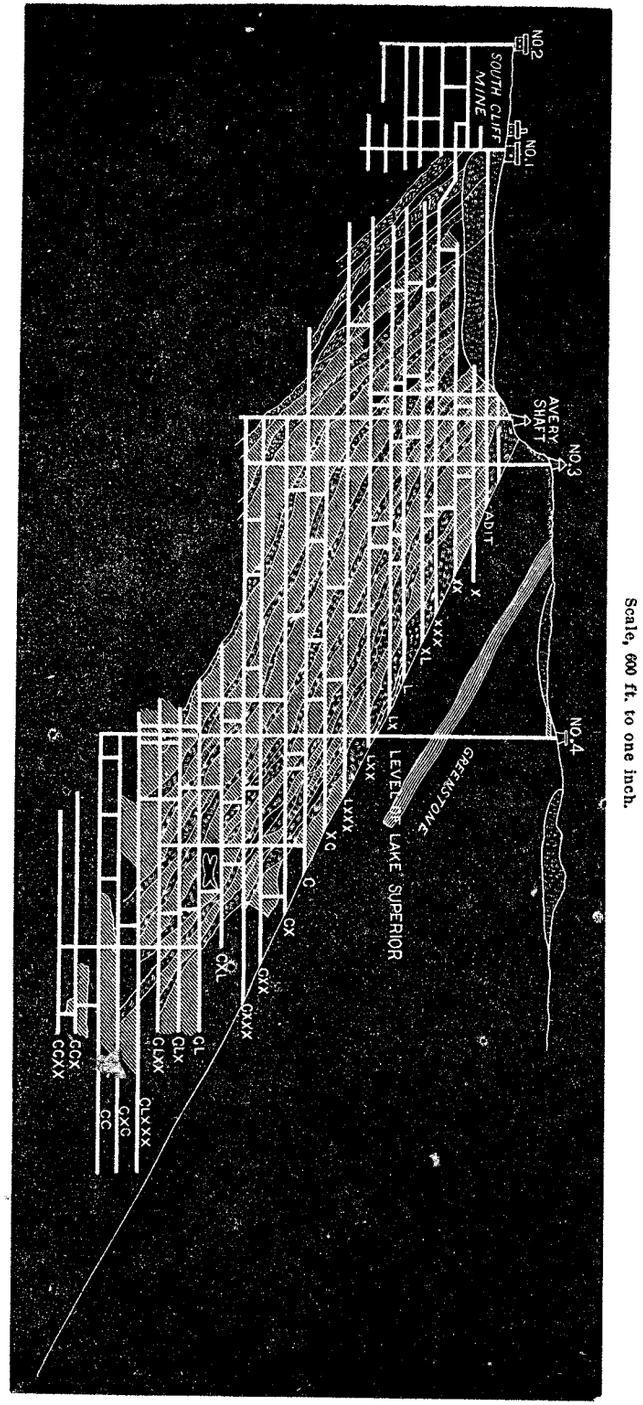


LONGITUDINAL SECTION OF THE CLIFF MINE, 1881.

Scale, 600 ft. to one inch.

the 80th level, would pass thence entirely through unexplored ground, and would possibly open a mine that would prove productive, lying between the North American or South Cliff, and the Old Cliff Mine.

Still one would think it were a cheaper and equally effective way to accomplish what is desired, to refit the old Avery shaft which, it will be remembered, is just south of the greenstone bluff, and goes down vertically to the 130th level, but below the 80th the drifts have not been extended to the south at all, except the 100th. In former times this ground was not thought to be productive, but it has never been tested to any great depth, and thus may, on further investigation, prove to be a valuable portion of the lode.

The company has continued the work on the ash bed, begun the previous year. Three shafts have been sunk about 100 feet deep. No. 2 is 700 feet east from No. 1 shaft, and No. 3 is 650 feet east from No. 2.

The Cliff is the oldest mine on Lake Superior, and once the most important one. It returned in dividends 2,000 % on all the money that the stockholders were called upon to advance, and was sold to the present owner, Mr. M. H. Simpson, of New York, for the sum of $100,000 in 1871. Since the stopping of work in 1870 by the old company, comparatively little has been done.

The mine is in a transverse fissure vein, which crosses the formation at nearly right angles. The mine lies south of the greenstone and is the only one that has a shaft down through the greenstone from the top of the range. This shaft is the one now used in hoisting.

The capital stock is $1,000,000, divided into 40,000 shares. D. D. Brockway, Agent, Clifton, Mich.; J. C. Trembath, Clerk, Clifton, Mich.

THE SENECA MINING COMPANY.

The Seneca Mining Company owns a large estate, lying in the range of the prominent lodes that have been successfully worked to the south, and the property is undoubtedly crossed by them; but unfortunately the formation is so deeply covered with drift, and withal the soil is so swampy that exploration is difficult and expensive. The property comprises Sec. 21, N. ½ and N. W. ¼, and N. W. ¼ S. E. ¼ of Sec. 22, and N. W. ¼ Sec. 23, and N. ½ and S. W. ¼ Sec. 28, and E. ½ Sec. 20, and E. ½ Sec. 29, and E. ½ Sec. 32, and S. E. ¼ of S. W. ¼ Sec. 32, all in T. 57, R. 32.

Many years ago some mining work was done on the property in the Kearsage conglomerate, and the work was abandoned. This work was on the N. E. ¼ of Sec. 32, and in 1880 it was deemed best by the present owners of the property to undertake further exploration. The location where this mining work is being prosecuted is now known as the Ahmeek.

A shaft has been sunk in the foot wall at a short distance from the old shaft, and been carried down to the fourth level, and in the second level a cross-cut has been made through the lode to the hanging wall, 70 feet horizontally, the lode being about 50 feet wide. A second shaft, No. 2, has been sunk 400 feet north from No. 1, and the two have been connected by a drift at the second level. In the first level no work has been done except to drift to the hanging wall and to connect with the old workings.

In the third level the only work done consists in cutting out a safety chamber for the men to resort to, to escape from the blasts.

In the 4th level a short drift has been made from No. 2 shaft.

The plant consists of a hoisting engine, used to hoist from both shafts; a pumping engine, and a Clayton compressor running four power drills.

Test pits have been sunk on the property in the Kearsage amygdaloid at a distance of 1,130 feet east from the mine. These pits are 50 feet deep through soil and quicksand; the ground being so wet it is found to be difficult to test the lode in this way, since, when the rock is reached, the blasts knock out the timbers and so let in the quicksand and dirt and fill the shafts.

It is contemplated to cross-cut from the mine to the amygdaloid, through the intervening rock, and thus obviate the difficulties arising from insecurity of the soil, and prove the ground. A few years ago this would have been a serious undertaking, but now, with power drills and high explosives, it is comparatively a simple matter; when the inducement is sufficient the length of the drift is of little consequence. The work thus far is for the purpose of exploration. No stoping has been done and no copper has been shipped, and it is not yet known whether the Ahmeek will become a mine or not.

The work is in charge of Capt. Daniels, the Agent of the Osceola. The business office is in Boston. J. W. Clark, President; A. F. Bigelow, Secretary and Treasurer.

The capital stock is $1,000,000, divided into 40,000 shares.

THE KEARSARGE MINING COMPANY.

The Kearsarge Mining Company owns the S. ½ of Sec. 6, and S. W. ¼ Sec. 5, T. 56, R. 32, and the E. ½, S. E. ¼ of Sec. 1, T. 56, R. 33, making a rectangle one and three-fourths miles east and west, and one-half of a mile north and south, comprising 460 acres of land.

The property is crossed by the several prominent lodes of this region, and adjoins on the north the now celebrated Wolverine Mine, and has upwards of 3,000 feet of extent of the lode which, just at present, is proving so wonderfully productive in copper.

If the Wolverine continues to open favorably the management of the Kearsarge will also commence work, and will open on the same lode—the Kearsarge amygdaloid.

They now have the matter under consideration, and it is likely that at least test pits will soon be sunk to uncover the lode. The capital stock is $500,000, divided into 20,000 shares. The business office is in Boston. Joseph W. Clark, President; A. S. Bigelow, Secretary and Treasurer.

The local affairs of the company are in charge of Capt. John Daniels, Agent of the Osceola.

THE WOLVERINE MINE.

No recent discovery in the copper region has attracted so much interest as does the so-called Wolverine Mine. The openings thus far made are showing so phenomenally rich that great curiosity is excited to see how long this extraordinary yield of copper will continue.

Two shafts have been begun, about 300 feet apart, and are only down about 40 feet from the surface, and already the shipment of copper has begun to the smelting works, enough having been obtained to more than repay all the expenditure that has been incurred, including a small hoisting engine and a compressor.

The property consists of the N. ½ of the S. E. ¼ Sec. 7, T. 56, R. 32, thus containing 80 acres of land, and adjoining the Kearsarge on the south. The length of the lode on the property is about 1,600 feet, and crosses the south line at about 850 east from the southwest corner, and bears north about 40° east, dipping northwesterly about 40°.

The work, thus far, has not determined the width of the lode; the shafts being sunk along the foot wall, and no drifting done to the hanging. The chief mineral associated with the copper is epidote, the lode somewhat resembling the Isle Royal and Huron, of which lode it may be found to be the northerly prolongation. The mine is a short distance east from the highway leading from the Allouez to the Centennial, and about midway between those mines. The company has been organized (February, 1882) with a capital stock of $1,000,000, divided into 40,000 shares, 5,000 of which shares were sold for $5 per share, to create a working capital.

The officers are: T. W. Edwards, President, Houghton, Mich.; Edward Penberthy, Secretary and Treasurer, Houghton, Mich.; Richard Uren, Agent, Houghton, Mich.

The discovery of the lode is due to Capt. Johnson Vivian, Agent of the Pewabic, Franklin, and Huron Mines, who some years ago when Agent of the Schoolcraft explored this tract, and himself, with Mr. S. L. Smith of Lansing, purchased it from the State. The title was subsequently contested by parties in Houghton, who claimed that it belonged to Houghton county. The State relinquished its claim, cancelling the purchase by Messrs. Smith and Vivian, and the county came into possession of the land, when it was sold to Messrs. T. W. Edwards and Richard Uren, by whom the work now in progress was begun, and who have organized the present company. Some dwellings are being built and preparations are making to build a stamp mill, the water to be supplied by a small stream that courses across the property. A small hoisting engine is at work to raise and lower the buckets, and a small Burleigh compressor is now on the ground ready to be put into operation.

THE ALLOUEZ MINE.

It will be remembered that the Allouez Mine had, for several years prior to September, 1880, been worked on a lease, and thus, naturally on the resumption of work on company account, very much had, necessarily, to be done in the way of repairs, and still more, the company has been hampered by being obliged to employ its underground mining force in making new openings. Previous to the expiration of the lease a contract was made with the lessees to open some new ground, and under this arrangement No. 2 shaft was sunk one lift, to the 12th level, and this level was also further connected with the 11th by two winzes. In the lower level 200 feet of drifting was done—100 feet each way—from the foot of the shaft.

The suspension of the company in 1877 was due to financial embarrassment. The indebtedness amounted to $160,710.38, 111,634.35 of which sum, besides interest to the amount of $16,390.98, was paid from the proceeds of the lease, the company receiving one-eighth of the copper obtained from the mine by the tributers, thus leaving a balance of $49,076.03 of the indebtedness still unpaid.

The capital stock was, in April, 1880, by action of the stockholders, increased to the sum of $2,000,000, divided into 80,000 shares, at which figures it still remains.

The company resumed possession of the property on November 10th, 1880, and immediately made an assessment upon the stock of $1 per share ($80,000) to provide funds for the resumption of work.

As previously remarked, it has been necessary to push the openings, and still they are far from being sufficient to meet the requirements of such a mine as the Allouez. No. 2 shaft, the only one which has lately been operated, is now down to the 13th level, having been sunk one lift within the past year, and No. 3 shaft is sinking to the 6th level, and will be continued to the 7th, when it will be connected with No. 2, and will also be used as a hoisting shaft.

No. 2, the deepest shaft, is down 1,150 feet, and the extreme distance from the north end to the south end of the mine is about 1,800 feet. Still further to the north the same lode has an extent on the company's property of 1,116 feet, and south of the mine, the unexplored portion of the lode, on the property, is 784 feet.

The center of the main "shoot" of copper crosses No. 2 shaft at about the 8th level, and makes with the vertical an angle of 30°, opening upward to the south. The ground actually worked out in the mine is represented by a block of ground 750 feet to 900 feet wide, and 1,100 feet deep, having the thickness of the lode. The mine is on the south fractional half of Sec. 31, T. 57, R. 32.

A remarkable "slide" extends down through the mine from the surface 200 feet south of No. 1 shaft, and pitching to the north at an angle of 60°, crossing No. 2 at the 13th level. This slide is soft clay loam, crossing the formation. The 10th level is extending south to intercept a good shoot of copper that has been found to follow the slide. During the past year the 8th, 9th, and 10th levels have been driven north to nearly No. 3 shaft, and the main copper shoot of the mine is found to continue in these levels. When No. 3 is fitted up into a working shaft, this new ground will be stoped away and hoisted from it. No. 1, the south shaft, is used for the pumping shaft.

The lode bears N. 39° E., and dips 38° northwesterly; it is a very wide, coarse, conglomerate belt, corresponding with that which further north immediately underlies the greenstone. It is the same belt which is now being opened at the Delaware—Conglomerate Mining Company—though, at the latter mine it is claimed that the belt is richer in copper than it is at the Allouez. They find richer specimens at the Conglomerate than are found to occur at the Allouez, and likewise limited portions of the lode that carry more copper, but to what extent this will affect the average yield to the advantage of the former company remains to be seen. Here, as at the Conglomerate, the belt is very wide—twenty to thirty feet in width—much too wide to work to advantage.

The drifts are carried along the foot wall, and 4 feet or 5 feet of the conglomerate are left next to the hanging to help support it. The hanging wall is exceedingly poor, and requires frequent pillars to be left, together with considerable thickness to the bottoms of the drifts and a portion of the lode in contact with the wall, to support it.

The lode is not uniform in richness. The copper appears to be in seams, where it occurs, alternating, in streaks. It is exceedingly lean in copper, but requires to be all taken down and subsequently sorted, and even then very much of it is stamped that is really worthless. Heretofore the sorting has been done on the floor of the shaft, but a change in the railroad track is being made so that hereafter the skips from up out of the shafts will dump into a shute that will discharge directly into the car standing on the track that

runs to the rock-house, and the sorting, etc., will be done on the rock-house floor. The run is about 300 feet. The rock-house has been enlarged during the year past, and a heavy hammer added to break up the larger pieces; heretofore this labor had to be done by hand. *i. e.* with sledges and drills. The hammer weighs about 3,600, and is like those at other mines, works in a frame like a pile driver, and is raised by machinery to any height necessary to give the requisite fall to break into pieces the rock that is placed under it. The rock-house is now well supplied with every necessary requirement, and is conveniently arranged for economical working.

The machinery has been otherwise improved by the addition of new hoisting gear made at the Portage Lake foundry. Two winding drums, each 12 feet diameter and 8 feet face, and engine 24-inch cylinder, 6 feet stroke, and a new boiler.

The stamp mill is on the west fractional half, S. W. ¼ of Secs. 30, T. 57, R. 32—two and a quarter miles from the mine, with which it is connected by a 3-feet gauge railroad, operated with a locomotive engine.

The improvements at the mill consist of the addition of two Ball stamps in place of those formerly used, and in replacing the boilers with new ones; also a new boiler house has been built.

They have stamped during the year 74,538 tons of rock, which yielded 969 tons 860 pounds of mineral, which, smelted, gave 710 tons 1,403 pounds ingot copper. No. of tons rejected was 12,837, 1-7 of whole number of tons hoisted.

No. of pounds of copper obtained per ton of rock, 19; the average number of miners employed was 94; the average total force employed was 299; the total construction cost was $63,366.71.

No. of feet of sinking of shafts, 100½; average cost per foot, $35.

No. of feet sinking winzes, 57; average cost per foot, $15.

No. of feet drifting, 1,337 5-12; average cost per foot, $13.20.

No. of cubic fathoms stoping, 5,943 3-10; average cost per fathom, $10.22.

Whole number of cubic fathoms broken, 6,592.

The sinking of shafts was all hand work, and the drifting was partly hand, and partly power drill.

The location is very favorable for procuring wood cheaply, as there is no competition for a considerable distance. The wood has cost, this winter, only 2.10 to $2.75 per cord, and one cord of wood suffices to stamp 13 tons of rock. The shoes on the Ball stamp have to be renewed every five days.

The wood is obtained so cheaply by reason of the fact that the company purchased standing timber of the Canal Company for $10 to $12 per acre, and then hired it cut and drawn. The company owns 500 acres of land, having made some recent purchases, including 80 acres of Mr. J. N. Edwards, near the stamp mill; land that was being flowed and covered by the waste sand from the mill, and regarding which overflow an unsuccessful application had been made to the Court for an injunction. The contest was terminated through the purchase of the property by the company.

The other lodes which cross the company's property, have never been explored. The Calumet and Hecla conglomerate should lie to the east of the mine about 2,000 feet, and the Kearsarge conglomerate 1,550 feet further to the east; the Kearsarge amygdaloid 1,150 feet still beyond that to the east. All these lodes are, however, deeply covered by the drift.

The total receipts for the year ending December 31st, 1881, were:

For sale of copper, 1,204,224 pounds, at an average price of 18 8-10 cents		$226,488 53
For interest		1,473 15
		$227,961 68
The working expenses were	$197,735 18	
Lands addition	34,945 97	
Total	$232,681 15	
Construction account—expenses	63,366 71	
Total expenditures	$296,047 86	
	227,961 68	
Expenses in excess of receipts	$68,086 18	
Receipts from assessments		$155,206 92
		68,086 18
Surplus on hand		$87,120 74
Inventory of buildings		102,600 00
Valuation of machinery		185,364 45
Valuations of dams		7,500 00
Total valuation of machinery and buildings		$295,464 45

The officers are: Wm. C. Stuart, President. Wm. C. Stuart, John Banta, Edmund Ketchum, E. K. Goodnow, John Stanton, E. Coleman, C. H. Coffin, J. M. Stuart, William Walls, Directors. John Stanton, Secretary and Treasurer, 76 Wall street, New York. Fred. Smith, Agent, Allouez, Mich. James W. Raymond, Clerk, Allouez, Mich.

Since writing the foregoing the following printed report of the company's affairs has been received, and is herewith included.

REPORT OF THE ALLOUEZ MINING COMPANY FOR 1881.

At the last annual meeting the company's accounts brought up to the end of February, 1881, were laid before the stockholders, and the directors now present a statement of the operations for the remainder of the year ending December 31, 1881.

The product of the mine during that period (10 months) was 1,645,175 pounds of mineral, yielding 73 2-10 per cent., or 1,204,224 pounds of ingot copper, which realized an average price of

About 18 8-10 cents per pound, or			$226,488 53
Add balance of interest account			1,473 15
			$227,961 68
The working expenses at mine as per detailed statement appended, were		$197,735 18	
ADD.			
Freight	$6,533 42		
Smelting	18,202 76		
Commission and brokerage	4,787 18		
Marine insurance	686 71		
Expenses	4,735 90		
		$34,945 97	
Making the total working expense			$232,681 15
And showing a net deficiency of			$4,719 47
There has also been expended in construction of machinery, buildings, etc., as per statement appended			63,366 71
Making the total expenditure in excess of production			$68,086 18

The surplus brought forward from last report was	$75,206 92	
Add assessment July 8, 1881	80,000 00	
		$155,206 92
Leaving a net surplus Dec. 31, 1881, as per detailed statement herewith, of		$87,120 74

The production was considerably diminished by interruptions of work at the stamp mill, caused by breakages of the machinery, and the time occupied in changing the old worn-out stamps, for new stamps of greater power, while the expenses were increased by the large amount of necessary repairs to machinery and fixtures that have been made, and the extra work that has been performed underground in preparing for an increased and regular out-put, the cost of which has been included in the current expenses, the construction account only covering the cost of new machinery, and additions to the equipment.

The mine had for a long time been worked by means of one shaft only, which had reached the twelfth level, and it had become necessary that another shaft should be brought into operation. This has been done as far the 5th level, and substantial hoisting gear placed in position to operate both shafts. A dam across Hill's Creek has also been constructed, and a large reserve of water thereby secured, which, it is believed will be of material assistance in keeping the stamp mill supplied with water in the dry season.

The mine and equipment are now in very much better condition for regular and permanent work than when received back from the lessees in November, 1880, and we anticipate a regular production henceforward, to the extent of the capacity of our stamp mill, now containing two heads of Ball's 15-inch cylinder stamps, and there is reason to believe that before the end of the year another head can be profitably employed.

The details of the expenditures, and of the improvements made will be found in our agent's report, and in the mine accounts herewith submitted.

By order of the directors.

WM. C. STUART, *President.*

NEW YORK, March 14, 1882.

ASSETS AND LIABILITIES, ALLOUEZ MINING COMPANY, DECEMBER 31, 1881.

ASSETS.

Cash			$4,157 37
Loans			45,000 00
Accounts receivable			2,304 42
Copper on hand, 211,595 pounds, sold for			42,209 58
			$93,671 37
At Mine:			
Cash	$64 52		
Supplies	41,561 97		
		$41,626 49	
Total assets			$135,297 86

LIABILITIES.

Agent's drafts	$21,417 07		
Indebtedness at mine	21,766 98		
Accounts payable	4,993 07		
		$48,177 12	
Balance of assets			87,120 74

STATEMENT OF WORKING EXPENSES AT THE ALLOUEZ MINE FOR TEN MONTHS ENDING DECEMBER 31, 1881.

UNDERGROUND EXPENSES.

Sinking shaft 42 6-10 feet, averaging $35	$1,491 00	
Sinking winzes 39 feet, averaging $15	585 00	
Drifting 1,041 8-10 feet, averaging $13.20	13,749 80	
Drifting for pillars 84 5-10 feet, averaging $13.80	1,166 15	
Stoping 5,029 2-10 fathoms, averaging $10.22	51,400 30	
Sundry contracts	284 00	
Mining captains, timbermen, trammers, and other labor supplies used on company account	11,139 45	
	$111,003 74	
Less profit on supplies sold contractors	5,844 50	
		$105,159 24

HOISTING EXPENSES.

Engineers, firemen, etc	$4,714 15	
Fuel	6,898 50	
Wire rope and other supplies	1,493 43	
Cost of hoisting 74,499 tons of rock	$13,106 08	

SELECTING AND BREAKING ROCK.

Mechanics and laborers	$13,118 64	
Fuel	3,213 70	
Castings and supplies	2,671 78	
Sundry teaming	53 50	
		$19,052 62

SURFACE EXPENSES.

Superintendence and wages of mechanics and laborers	$7 883 65	
Supplies used	1,273 97	
Telephone line cost	193 44	
Taxes	2,094 07	
Insurance on buildings and machinery	1,717 39	
Teaming	314 74	
Sundry expenses	252 63	
	$13,729 89	
Less commissions on collections, and other credit items	2,394 58	
		11,335 31

RAILROAD EXPENSES.

Engineers, mechanics, and laborers	$3,549 82	
Fuel	1,686 13	
Rails, ties, supplies, and repairs	2,209 84	
Cost of transporting 63,362 tons rock		7,442 79

STAMP MILL EXPENSES.

Labor and superintendence	$15,898 90	
Fuel (7,205 cords wood)	19,874 80	
Supplies	2,467 87	
Foundry bills	2,920 77	
		41,102 34

Rock stamped, 63,362 tons. Rock stamped, per cord of wood used, 8 79-100 tons. Cost of stamping and washing, 65 cents a ton. Yield of ingot per ton of rock, 19 pounds.

MINERAL EXPENSES.

Transportation to smelting works	$2,752 93	
Mineral barrels and cooperage	527 50	
Assay expenses	260 00	
		$3,540 43
		$200,738 81
Less rents received		3,003 03
Net working expenses, March 1 to December 31, 1881		$197,735 18

CONSTRUCTION ACCOUNT.

At No. 1 Engine House:		
Boiler bought of Tribute Company	$1,050 50	
Blake steam pump	375 00	
At No. 2 Engine House:		
Addition to building 26x12 feet, new stone cistern, and pulley stands to Nos. 2 and 3 shaft-houses	$2,568 14	
Double friction hoisting gear with foundation, new piston, steam chest and governor, and galvanized heating pipe, etc.	13,397 82	
At Rock House:		
Addition to building 39x17 feet with new rock chutes	$2,600 00	
Drop hammer with gearing and belting	2,596 05	
At Machine Shop:		
New lathe and gearing	$1,504 68	
Underground:		
Three No. 3 Rand drills	$1,817 00	
Seven hundred and sixty-six feet 6-inch air pipe	957 50	
One thousand and five feet 6-inch air pipe (lap welded)	1,175 00	
At Stamp Mill:		
New boiler house, 52x42	2,175 00	
Two rotary pumps	234 00	
Two new mortars, 8-inch shafts and girts, three 15-inch cylinders, two sills, eight braces, galvanized heating pipe, injector condenser, and three new boilers	25,327 84	
Hill's Creek dam	7,049 51	
Railroad Creek dam	539 17	
		$63,366 71
		$261,101 89

Total expenditure.
Estimated value of buildings, machinery, etc., $102,600.

MACHINERY.

Hoisting engine and two boilers at No. 1 shaft, with winding gear and feed pump.

Pumping engine and boiler.

Hoisting engine (24x72), and 3 boilers with double friction gear to hoist from Nos. 2 and 3 shafts, heater feed pumps, etc.

Two Burleigh air compressors, pump, 5 Burleigh drills, and 4 carriages, 4 Rand drills, 1,781 feet of 6-inch air pipe.

Upright engine, 6 rock breakers, drop hammer, pulleys, shafting and belting at rock house.

At Machine Shop—Two large lathes, 1 drill press, 1 planer, 1 bolt cutter, 1 small engine and driving fan.

One locomotive, 1 large rock car, 9 small rock cars, 2 flat cars, 1 Worthington pump, No. 2; pump in No. 1 shaft to 8th level, pump in No. 3 shaft to 5th level.

At Stamp Mill—Two heads Ball's stamps, 2 engines, 3 new boilers and smokestack, 4 old boilers, heater and feed pumps, washing machines, 1 lathe, 1 grate punch, 2 rotary pumps.

Saw mill engine, saws and fixtures.

Total valuation of machinery	$185,364 45
Hill's Creek dam	7,000 00
Railroad dam	500 00
Valuation of machinery, buildings, etc	$295,464 45

AGENT'S REPORT.

ALLOUEZ MINE, MICH., *February 12, 1882.*

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

DEAR SIR—I herewith submit my report of operations at this mine, for the period commencing November 10, 1880, and closing December 31, 1881.

On the expiration of the three years' lease of your mine to the "Allouez Tribute Company," the machinery and general mine plant needed considerable repairs. All the remainder of November and the larger portion of December was consumed in making the most necessary repairs; the stamp mill running only part of December, producing 33 765-2000 tons mineral. A force of miners was set to work at once to extend some of the drifts, and engage in other underground work necessary for an active campaign.

No. 2 shaft has been sunk 100 6-10 feet, from the 12th to the 13th level, and passed through a promising lode the entire distance. The drifts from the bottom of the shaft, north and south, advanced 73 and 78 feet respectively, have shown good copper ground. A stope just north of the shaft has furnished very nice stamp rock, and this block of ground promises well for future stoping.

Twelfth level north of No. 2 shaft has been advanced 269 1-10 feet, making the entire distance from the shaft of 325 1-10 feet. For the first 50 feet the stopes yielded very well, but from that point the rock contained a less per cent. of copper. From the present appearance of the ground I look for a change for the better. The 12th level south of No. 2 shaft has been advanced 102 5-100 feet. Total distance from shaft 458 5-10 feet. The drift has been carried 24 feet south of the crossing, and has shown very good copper ground as far as the crossing. The entire block of ground opened by the drift has been stoped down, with good results. This crossing, composed of a large clay seam, with several feet of soft broken rock on either side, is a characteristic feature of this part of the mine. Passing through No. 1 shaft (distant from No. 2 shaft 600 feet) between the 2d and 3d level it has, in its northerly dip reached to within 144 5-10 feet of No. 2 shaft at the 12th level, and heretofore uniformly constituted the southern terminus of the present worked chute of copper ground. On the other hand the productive ground has attained in length to the north of No. 2 shaft more than proportionate to the loss south of the shaft.

The 11th level north of No. 2 shaft has been advanced 226 9-10 feet. Total distance from shaft, 437 feet. The present head of the drift is in fair copper ground, and the stopes have yielded an average quality of rock. The distance to the level above (10th) being 75 feet, the extention of this drift has been discontinued, with the view of stoping the entire block of ground from the 12th to the sole of the 10th level, without any further intermediate drifting; 320 feet north from No. 2 shaft a winze has been sunk 39 feet, and holed to a rising stope from the level below. This winze was sunk for the purpose of avoiding a large block of unprofitable ground.

The 10th level north of No. 2 shaft has been advanced 180 6-10 feet. Total distance from shaft 596 9-10 feet, and nearly under the line of No. 3 shaft. The stopes worked in this back, although poor at times have on the average produced moderately in mineral. The 10th level south of No. 2 shaft has been advanced 182 2-10 feet south of the crossing. Total distance from shaft 442 2-10 feet. The object of extending this drift was to prove the value of the block of ground entering from the crossing to No. 1 shaft a distance of 340 feet. A trial stope carried up in the back about 20 feet, has produced some copper rock, not sufficient, however, as yet, to prove it to be workable ground.

The 9th level north of No. 2 shaft has been advanced 91 9-10 feet. Total distance from shaft, 525 feet. For the last 60 feet of driving the drift has shown very well. A stope carried up in the back has furnished nice stamp rock. This development is in entirely new ground, none of the upper levels having been opened as far north of the shaft as this point. At the 8th level, 120 feet south of No. 2 shaft, a winze, which had been sunk by the "Tribute Company," for some distance, has been sunk 18 feet further and holed to the stope below. The winze penetrated a block of unproductive ground. Indications, however, in the bottom of the 8th level, and a short distance south of the winze were of such a promising nature that it was considered best to make connection. Although a stope worked near the winze has so far not yielded an average mill rock, still I am confident that this block of ground up to the crossing will amply pay us to stope away.

The 7th level north of No. 2 shaft has been advanced 55 5-10 feet. Total distance from shaft, 250 5-10 feet. The further extension of this level has been resumed with the view of carrying it under the line of No. 3 shaft; it can be run through this level to No. 1 (pump) shaft, and the operating of a second pumping outfit at No. 3 shaft dispensed with. At the same time the drift towards No. 3 shaft will pass through a large extent of virtually unexplored ground, extending from the surface to this depth, and it is more than probable, judging from the appearance of lower levels advanced further north, that we may meet with some paying ground.

The 4th level north of No. 2 shaft has been advanced 35 feet. Total distance from shaft, 125 feet. At times it has carried some copper, not enough, however, as yet, to prove it to be paying ground. It is my intention to drive this level further north, in order to test this long run of new ground.

The 5th level north of No. 3 shaft has been advanced 22 8-10 feet, and has been poor so far, and further driving has been discontinued for the present. Some stoping has been done the past year above the 3d and 4th levels north and south of the shaft, in ground formerly opened. At times considerable copper was met with, but on the whole the rock obtained was below a fair average.

Total Underground Work:

Sinking shaft	100.6 feet.
Sinking winzes	57. "
Driving levels	1,337. "
Driving for pillars	104. "
Stoping	5,943.3 cubic fathoms.
Ground broken in openings	549. " "

The copper-bearing portion of our lode occurs mainly in several seams distributed through the lode, with seams or bars of poor ground intervening. The stopes are usually carried to a width of from 14 to 22 feet from the foot towards the hanging wall. Near the foot wall the lode is generally poor for a distance out of from 2 to 5 feet. Although the seams of copper ground contain a fair per cent of mineral, yet taking them in connection with the bars of poor ground, and making such selection of rock when broken and hoisted as is deemed prudent, the average mill rock is still of low percentage.

It will be our aim to sink No. 3 shaft below the 5th level (its present depth) as rapidly as circumstances will allow and connect it with lower levels going north from No. 2 shaft. Part of the shaft (from 9th to 10th level) can be made by stoping. Until we are enabled to draw more mill rock from No. 3 shaft, almost the entire supply has to be hoisted through No. 2 shaft, which, with all possible care and attention, is attended with some drawbacks and risks.

Our construction account for the past year has been of considerable magnitude, and as it entered into all our principal working departments, has, consequently, caused some shortage in production, and an increased cost of such production.

Construction consisted of:

At the Stamp Mill.—Two mortars and 8-inch shafts and girts; 3 15-inch cylinders, sills and braces; heating pipes, rotary pumps, and injecture condenser; 3 large flue boilers, and boiler house 52x42 feet; the boilers have ample capacity and furnish the required steam power with ease; the stamping machinery is doing good duty.

At the Rock House.—Addition to building 39x17 feet, and large drop hammer with gearing and belting, also new rock chutes. The drop-hammer constitutes a valuable addition to the outfit of this part of the plant.

At No. 2 Hoisting Works.—Stone foundation for gearing; friction hoisting gear for two shafts; cap stone for engine bed; piston steam chest and governor for hoisting engine; Worthington pump and galvanized heating pipe; large stone cistern; addition to building 26x12 feet, and pulley stands to No. 2 and 3 shafts. The hoisting gear is a substantial piece of work; it gives perfect satisfaction, and will be of sufficient power to hoist our rock for a considerable depth.

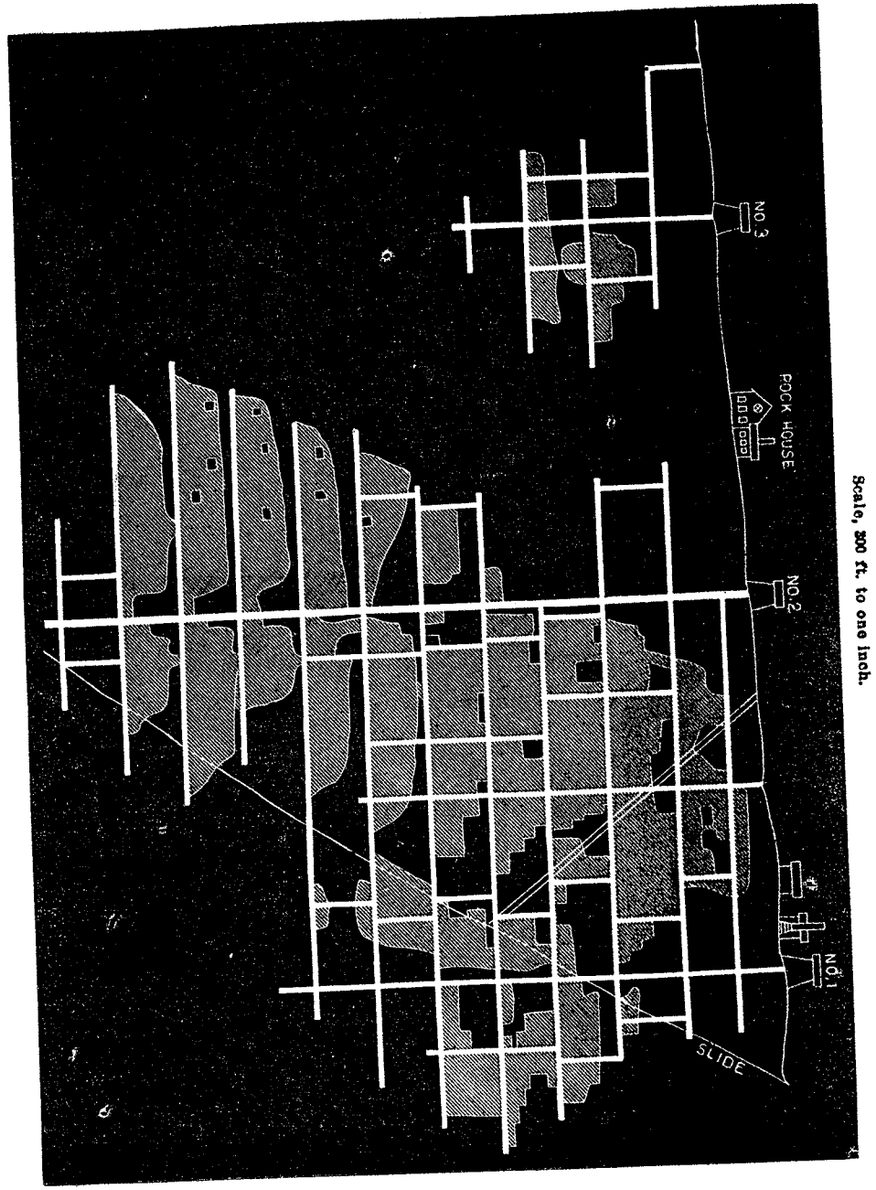
At No. 2 Hoisting Works and Compressor House.—A nearly new locomotive boiler put in by the "Tribute Company," and bought of them; one No. 6 Blake steam pump.

At Machine Shop.—We added to the former outfit a large new lathe with gearing, which will enable us to do a line of work that formerly we had to have done by outside parties.

Underground.—We added 4 No. 3 Rand power drills, together with 1,005 feet 6-inch air pipe.

On Hill's Creek, the stream furnishing the main supply of water for our mill, we have built a large and substantial dam, which, when filled, will hold a body of water, that with the inflowing stream and a portion drawn from the well outside the mill, will furnish enough to run two heads of stamps throughout the year. We have not drawn any water from the Gratiot River since the setting in of winter, and do not now anticipate any shortage during the winter, from our present source of supply.

The tables of cost prepared by Mr. Raymond, our clerk, show in detail



LONGITUDINAL SECTION OF THE ALLOUEZ MINE.

Scale, 200 ft. to one inch.

brity of its climate, from the extraordinary richness, extent, and variety of its mineral deposits, stands pre-eminent among the mining regions of the earth. Its deposits of copper and iron are nowhere surpassed,—nowhere equaled, and from no other region can those minerals with less difficulty or greater economy be mined and transported to the markets of the world.

THE ATLANTIC.

In the copper region the richest deposits, so far as now known, are found in Houghton county, and of the mines which are worked in this district, the most southerly is the Atlantic; noted, not for the richness of the lode which is mined, but for the excessive leanness of the deposit, and the remarkable fact that from this comparatively barren belt—yielding only fourteen and a third pounds of copper to the ton of rock—a profit can be secured; that all the expenses pertaining to the equipping and operating of a first-class copper mine can be fully met, and annually —year after year—a dividend be paid to the stockholders! That such a result can be achieved illustrates the great advancement of mining work on Lake Superior. The problem has been thoroughly worked out, the cost in every department of the mining work carefully itemized, and the whole so conditioned, that the entire expenditure is brought within the conditions that secures a surplus. A few years ago it would not have been possible to accomplish the results now achieved at the Atlantic. Air compressors, power drills, high explosives, a more thorough knowledge of mining work,—the conditions to be met and difficulties to be overcome—a more careful attention to details have led to this remarkable success.

It will be remembered that the predecessor of the Atlantic, the South Pewabic, operating the same mine, was entirely ruined in the enterprise. After exhausting its capital stock and expending upwards of half a million of dollars besides, and, in addition, having an unpaid indebtedness, the company went into bankruptcy, and a new organization—the Atlantic—operating the same property, began its existence in 1872. But the old company, while shipwrecked itself, accomplished very much that made possible the success of the new. It had opened the mine and demonstrated the uniformity and yield of the lode; it had built the great stamp mill at the lake, and substituted for the costly pumps originally used the more simple and effective launder that supplies it with water. It had located and constructed the railroad to the lake. It had introduced the elevated automatic railway, now an indispensable adjunct at all the important mines. Thus the old company had paved the way—with gold it may be—had done a great proportion of the essential, preliminary work for the new. And the new company with a clean sheet, a tolerably well-equipped mine, a pretty thorough knowledge of the situation, derived from the experience of its predecessor, began a career which under the excellent management that has characterized the history of its affairs, has been, when we remember the poverty of the lode, in a remarkable degree successful.

The Atlantic lode is a very wide amygdaloid belt, running and dipping with much regularity. It is said to be uniform; by which it is meant that it is everywhere equally productive, and this is measurably true. When compared to many other amygdaloid deposits, it is certainly uniform; but in reality a great deal of the vein is practically barren, the copper occurs in small bunches —pockets—particles of copper occurring here and there, so that it is not easy to tell where it is and where it is not. Careful searching may fail to disclose

any copper in the surface of a rock, yet in the interior it may be found. Some portions of the lode are richer than others, yet in nearly all of it a little copper may be found; but everywhere the percentage is so small that it don't pay to select it, to attempt to sort out the worthless rock; the only way is to mill it all, the comparatively good and the poor, and get the average result. So that with the exception of the pillars that are left to support the hanging wall, the lode is all taken down; the mine is like an underground quarry; the problem is how the most economically and safely to remove the deposit and to support the insecure hanging wall. There is no dead work in sinking and drifting in search of ground that will pay to stope; they push right along and it all goes to the stamps.

The inclination of the lode is 45°, northwesterly, so that the lode, in dip, in width, and in uniformity of composition, is favorable for economical working. The only serious drawback is the unstable character of much of the hanging wall. A great deal of timbering is required to sustain it, and even then very much of it falls, sometimes in great bodies, crushing the timbers and all beneath it. One wonders that the workmen do not get killed working beneath these ponderous rocks that seem liable to fall at any moment, but they do not. Capt. Tonkin states that no person has ever been killed, in this manner, in the mine. When working beneath a roof that gives indications of falling it is carefully watched. The men insert wedges in the seams or cracks, and observe the progress of loosening which takes place. Besides, when about to fall there is generally a preliminary movement and slight noise, which men working in danger are quick to observe and thus to make their escape. The most lamentable instance of a fall of this kind in any of our copper mines, occurred at the Copper Falls, in 1874, when seven men were crushed beneath an extensive fall of the roof, and before their bodies could be recovered from the ruins they were so badly eaten by the rats as to be almost unrecognizable. Rats infest the copper mines, and they are of great value, acting as scavengers,—removing all the refuse and filth which, otherwise accumulating, would be unendurable.

But to return from this digression. The uniformity of the Atlantic lode, its width and steepness of pitch, as previously stated, favor a modification of mining it, greatly to the company's advantage. No sinking or drifting is done in the sense that is practiced in most other mines. The vein is one great stope, and it is cheaper to pay $13 to $14 per fathom for stoping than to pay $30 or $35 per foot for sinking. If the vein were less uniform, having stretches of barren ground, etc., it would be necessary to open ahead to extend long exploring drifts, in order to find the good ground and escape the poor.

The mining work is let to parties at different prices. The advancing party takes out the whole width of the vein from foot to hanging, and a track is laid along the hanging, and stulls and lagging are placed in along on the opposite side, far enough removed to give space for a platform between the line of stulls and the track for a platform sufficiently elevated to bring it at the same height of the top of the cars. A second party, working one or two drills, follows, taking out as before the entire width to a height of twenty feet, then a third, and so on, the "dirt" or loose rock being allowed to roll down against the lagging, whence it is drawn out on to the platform and shoveled into the cars, and trammed to the shafts. About eight feet of ground is left in the bottom of the drifts, and pillars are left upon either side of the shafts and elsewhere, also, as deemed necessary. To secure the ventilation, etc., instead of lowering a winze, it is simply necessary to break a hole through the bottom

of the drift. The shafts in the same manner are stoped out from below, carried up instead of being sunk, as it is cheaper to allow the rock to roll down to the track in the bottom of the drift than to hoist it, as is constantly necessary in sinking. The tracks follow the hanging and have some curvatures, due mainly to the widening and narrowing of the vein.

The men advancing the lower drift, while carrying the whole width of the vein are paid as if it were a drift, i. e., they receive $10 per foot for drift, 5 ft.x6 ft., and $12 per fathom for the remainder of the vein, embraced in their contract but carrying both along together. The second party receives $9 per foot and $10 per fathom, or the price paid may be $7 per foot and $9 per fathom. The price varies somewhat, depending on the width of the lode, character of the roof, etc.,—the wider the vein the cheaper it is stoped.

The contracts are made for three months, and may prove favorable or otherwise to the miners; they take their chances and must abide by the result. But they make wages anyhow, and usually realize about the same result, financially. If their contract proves an easy one they work shorter shifts—eight or nine hours. If it is a hard one they work harder, ten or twelve hour shifts—that is all. Dikes of trap occasionally occur rising up from the foot wall, but they never extend to the hanging,—across the vein.

No. 3 shaft is down to the 12th level, the deepest point in the mine. Here a pocket of unusually rich ground was intercepted, yielding largely in barrel work. Great hopes were entertained that a new era had dawned in the experience of the Atlantic. Greater depth having been reached an increased richness in the lode was found to occur; but these pleasant anticipations were doomed to disappointment, and the necessity still exists of exercising on the part of the company its accustomed economy. As the opening enlarged the vein assumed its normal condition of richness, or rather, leanness. This rich pocket extended about 15 feet to the north of the shaft, and about the same distance to the south.

No. 11 drift is extended south towards No. 4 shaft, or beneath and beyond it, as No. 4 is only to the 9th level, but they will rise up in the shaft. In this drift there are now 5,000 or 6,000 tons of rock lying against the lagging ready to remove. The stulls, lagged up, answer as bins to hold the rock. Holes are cut through the lagging to let it out upon the platform; it is thus very readily and cheaply handled. This drift (No. 11) extends north from No. 3 shaft 400 feet, but is not yet connected with No. 2 shaft.

In the 10th level, north from No. 3, it is opened 700 feet; 100 feet more will connect it with No. 2. The end of this drift is looking extremely well, and yields considerable barrel work in addition to an increased percentage in the yield of the stamp rock. In this drift a large amount of the roof has fallen.

The 4 shafts are connected in the 1st level, and Nos. 4 and 3 shafts are connected in all the levels down to the 10th, and Nos. 2 and 3 in all levels down to the 9th. The 4th, 5th, and 6th levels are extended from No. 4 1,200 feet, and 5th and 6th about 900 feet.

The work in the mine is admirably distributed, avoiding all interference and securing the greatest possible accomplishment. No more than two drills —seldom more than one—are used in a drift, and they are not allowed to be idle; at noontime part of the men, operating the drill, eat at a time; the others keep it at work.

The underground filling and tramming at the Atlantic is done at a lower cost than at any other mine—the average cost per ton being only 17½ cents. The

trammers get $1.50 per day, and a set works in each drift. Tally is kept in the engine house of the number of skips hoisted for each party, and it is thus known every night how much each has sent up, and so a check is kept on their work; that is, it is known how much the party should do, and if the work does not equal the requirement the men may be called to an account. There are just enough men kept in a place to work to advantage. One car works in a place, that is to tram in the same level in the same direction, to the same shaft. The amount sent up by a party varies with the distance they have to tram. In the 10th level tramming 700 feet from the south end of the drift, a party will send up 18 to 21 skip loads in 10 hours if they take from the drift. If they load from the platform they will send up 21 to 22 skip-loads in 10 hours.

In the 11th level, where the runs are short, they will send up 25 skip-loads in the same time. Two men work each car.

The following results are obtained from tabulating all items of cost and and securing the average; treating the rock at the rock house, including expenses of engine and all other expenses:

Cost per ton of rock	$0 11
" " " " " for tramming and filling in the mine	17½
" " " " " for railroad transportation	5½
" " " " " for stamping, washing, including repairs and new machinery at stamp mill	42½
Entire cost per ton of rock, including all expenses of the mine	1 75

When we consider that this rock is mined 500 feet to 1,000 feet under ground, is trammed to the shafts and hoisted to the surface, taken to the rock house and passed through the breakers, transported by railroad four miles to the mill, and there stamped and washed, and the whole done at a cost of $1.75 per ton of rock, that yields only 14½ pounds of copper, it is unnecessary to comment upon the skill and economy of the management. With the copper selling at an average price of but little above 17 cents per pound, and making a net profit for the year of upwards of $82,000, is a record of which any company might well be proud.

The Atlantic always comes up to its promises; whatever is predicted for the ensuing year is certain to be realized—in striking contrast to the history of some old companies in the earlier days, which in each prospectus promised great things and realized the reverse.

The length of the mine is 3,230 feet. No. 1 shaft is 250 feet down; No. 2, 800 feet; No. 3, 1,100 feet; No. 4, 900 feet.

They are connected on the surface by a straight, elevated, automatic railroad, which extends also to the rock-house, standing in line of the shafts. The car starts from No. 2 with a skip-load, 1½ tons of rock, and runs to No. 3, then stops and takes another skip-load, and runs on to the rock-house.

A new compressor building, pump-house, No. 3 shaft-house, have been constructed within the last year, the old having been destroyed by fire in June last. The new structures are of stone, with slate roofs and substantially built.

The engine and hoisting machinery for No. 3 and No. 4 shafts is placed between the compressor building and the rock-house. No. 2 hoisting machinery is in a separate building, standing north from the shaft. The machinery is first-class. The compressor, a new Rand duplex—is now operating 16 power drills.

The great pumping engine is a magnificent piece of workmanship, 22 feet cylinder, 8 feet stroke; wood is used under the boilers, the stock of which for the coming year is now being drawn and ranked, and costs $2.80 per cord, first-class hard wood. Capt. Tonkin bought the timber standing, and hires it cut and drawn. The dwellings and other buildings on the location are sufficiently commodious and substantial.

A foreign gentleman, interested in mining, lately visited the Atlantic, went through the mine, the stamp mill, over the railroad, observed the cars whirring along the high trestle to the great rock-house, the comfortable dwellings for the workmen, the costly machinery, etc., and realizing the magnitude of it all, exclaimed: "All this on three-fourths of one per cent?"

The details of the working of the mine and the financial statistics, etc., will be found in the following annual report of the company for the year 1881. I also include an interesting table of statistics of the Atlantic Mine, prepared by E. P. Kibbie, editor of the Northwestern Mining Journal.

REPORT OF THE ATLANTIC MINING COMPANY FOR THE YEAR 1881.

The directors present the following statement of operations during the year 1881:

The production of mineral was 3,632,841 lbs., which yielded 69 59-100 per cent., or 2,528,009 pounds of refined copper. The shipments to market during the year amounted to 2,546,344 pounds, which realized an average price of 17 12-100 cents per pound. The following is a summary of the year's business:

PRODUCTION.

Copper sold (2,546,344 lbs. at 17 12-100 cents)		$435,975 22
Copper at smelting works, Dec. 31, 1880	$53,608 00	
Copper at smelting works, Dec. 31, 1881, 291,346 lbs., valued at 16 cents net	46,615 36	
		6,992 54
Net value of product of 1881		$428,982 59

COSTS.

Working expenses at mine, as per clerk's tables	$290,448 82	
Smelting, freight, and all other expenses as per balance sheet	55,581 22	
Net operating expenses		346,030 04
Showing a net profit in 1881		$82,952 55
The amount expended in completing outfit of power drilling machinery, and charged to construction account was		7,372 13
Leaving as net gain in 1881		$75,580 42
The surplus, Dec. 31, 1880, estimated at	$263,320 02	
included 738,896 lbs. copper then unsold, valued at 8½c., but which only realized 16 3-100c., a reduction of	18,208 80	
The actual surplus Dec. 31, 1880, being		245,111 22
Making the net surplus, Dec. 31, 1881		$320,691 64

As shown in detail in the annexed statement of assets and liabilities, from which a dividend of $2 per share ($80,000) was paid February 1, 1882.

The tables of the amount of work performed in each department, and the cost thereof, together with the detailed description of the mine and of the operations during the year, contained in our agent's report, will, it is believed, furnish all the additional information desired by stockholders.

JOSEPH E. GAY,
GEO. A. HOYT,
JOHN R. SUYDAM,
JOHN J. CRANE,
JOHN STANTON,
Directors.

NEW YORK, March 14, 1882.

BALANCE SHEET, ATLANTIC MINING COMPANY, DECEMBER 31, 1881.

REAL ESTATE.

Mines, railroad, stamp mill, and machinery, as valued at consolidation	$659,642 11	
Woodlands purchased	16,664 41	
		$676,306 52
General expenditure previous to 1881		2,863,582 65

EXPENDITURES IN 1881.

Atlantic mine	$298,452 83	
Freight	13,021 02	
Smelting	32,210 39	
Insurance	1,820 56	
Brokerage	2,211 43	
Storage	298 30	
Expenses	5,641 21	
Interest	378 21	
		354,034 05
Dividends		60,000 00
Cash		74,233 42
Copper bills		21,468 61
Copper on hand, (sold, 637,974 lbs.)		122,412 14
		$4,172,087 89
Capital stock as consolidated, (40,000 shares of $17.50 paid in)		$700,000 00
Assessment on stock of Adams Mining Company		853 15
Assessments Nos. 1, 2, 3, 4, and 5		280,000 00

SALES OF COPPER.

Sales previous to 1881	$2,748,163 21	
Sales in 1881	435,975 23	
		$3,179,138 44
Accounts payable		12,095 80
		$4,172,087 39

ASSETS AND LIABILITIES, ATLANTIC MINING COMPANY, DECEMBER 31, 1881.

ASSETS.

Cash	$74,283 42
Copper bills	21,468 61
Copper on hand, 637,974 lbs., sold for	122,412 14
Copper at smelting works, 291,346 lbs., valued at 16 cents net	46,615 36
	$264,779 53

AT MINE.

Cash		$1,394 02
Coal		12,730 00
Wood		8,626 09
Supplies		26,304 48
Merchandise, provisions, etc.		50,825 84
		$99,880 34
Total assets		$364,659 87

LIABILITIES.

Agents' drafts outstanding	$13,160 25	
Indebtedness at mine	18,712 18	
Accounts payable	12,095 80	
		43,968 23
Balance of assets		$320,691 64
Mine plant, consisting of engines, stamp mill, implements, etc., as per inventory		379,637 08
Timber lands		16,674 41
		$396,311 49

STATEMENT OF WORKING EXPENSES AT THE ATLANTIC MINE FOR THE YEAR ENDING DECEMBER 31, 1881.

UNDERGROUND EXPENSES.

Sinking, 104 8-10, average $17.51		$1,835 35
Drifting 1,856 5-10 feet, average $10.08		18,708 30
Stoping 8,942 139-216 cubic fathoms, average $11.17		99,888 03
Timbering, tramming, and labor		40,440 84
Powder, candles, fuse, etc., used on company account		1,773 10
	$162,643 62	
Less profit on supplies	27,293 60	
		$135,350 02

SURFACE EXPENSES.

Labor, supplies, and materials used, after deducting credit items	$67,925 63	
Feed for teams, shoeing, etc.	2,154 68	
Fire insurance	316 56	
Taxes	3,531 51	
	$73,928 38	
Less amount received for rents	3,750 44	
		70,177 94

RAILROAD EXPENSES.

Labor	$6,526 03	
Fuel	3,190 00	
Supplies and materials	1,098 77	
	$10,814 80	
Less amount charged for hauling freight	783 55	
		10,031 35

STAMP MILL EXPENSES.

Labor	$25,461 35	
Fuel	35,116 75	
Supplies and materials	13,718 23	
Insurance	593 28	
Total cost of stamping and washing 176,055 tons of rock		74,889 61
Total running expenses in 1881		$290,448 82

CONSTRUCTION ACCOUNT.

Second half of Rand's Duplex Compressor	$3,400 00	
Eleven new power drills	3,720 00	
Materials, etc.	252 13	
		$7,372 13
Total expenditures at mine		$297,820 95

AGENT'S REPORT.

ATLANTIC MINE, L. S., MICH., *January 1, 1882.*

JOHN STANTON, ESQ., *Treasurer Atlantic Mining Company, New York:*

DEAR SIR—The following is a statement of work done, and the results of the same, for the year ending December 31, 1881.

No. 2 shaft has been extended within a few feet of the 9th level, and is in working order to the 7th level.

The 9th level has been driven 105 feet north to No. 2 shaft, and is close to the transverse vein. There is a quantity of ground to stope in the back between Nos. 2 and 3 shafts, which will be left until No. 2 shaft is in working order to this level.

The 8th level has been drifted 120 feet north of No. 2 shaft, but is still in the strip of barren ground which extends each side of the transverse vein.

The 7th level has been extended 195 feet north of No. 2 shaft, and the show is very good in the present end. Some very good rock has been broken from the back of this level.

The north end of the 5th level is now 420 feet north of No. 2 shaft, and 320 feet south of No. 1 shaft. A large quantity of rock has been taken from this back, but the yield has been hardly up to the average of that taken from the other parts of the mine.

The 3d level now extends 270 feet north of No. 2 shaft, the back producing about the same grade of rock as the 5th level.

No. 3 shaft has been sunk from the 11th to the 12th level, and the drifts at the 12th level have just been started. We have taken from this shaft splendid stamp rock, also a quantity of barrel copper. I think this lift has opened the most coppery ground I have ever seen in the mine.

The 11th level has been extended 300 feet north and 300 feet south of No. 3 shaft with good results. A large quantity of good rock has been taken from the back of this level.

The 10th level north of No. 3 shaft is 510 feet in length. The treacherous nature of the hanging wall necessitated the leaving of a large quantity of good rock standing in the back. I find, as we attain depth, that the hanging wall is getting weaker and requires more pillars, larger arches, and an increased quantity of timber to keep the mine in a safe condition.

No. 4 shaft has been connected with the 10th level. We are driving and stoping in the 10th, 9th, 8th, and 7th levels south of No. 4 shaft with about the same results as in the past.

Number of feet sunk	104 8-10
Number of feet drifted	1,856 5-10
Number of cubic fathoms stoped in rising stopes	1,110 179-216
Number of cubic fathoms stoped in ordinary stopes	7,831 176-216
Total amount of cubic fathoms broken in openings and stopes	9,240

There has been quite a reduction in the price of breaking ground compared with 1880, caused by working power drills. At the opening of the year we were working five drills, and have since increased the number to 16.

STAMP MILL.

The mill has stamped and treated 176,055 tons rock, at a cost of 42 54-100 cents per ton. The yield being 20 63-100 pounds of mineral, or 14 36-100 pounds refined copper for each ton of rock treated.

The machinery is in good condition, and has done the work very satisfactorily.

RAILROAD.

The railroad is in good condition. During the year we put in 666 new ties, and have taken a large quantity of dirt from the cuts, to finish filling in the ravine near the mill, which was spanned by a large bridge. The amount of rock transported over the road is 176,055 tons, at a cost of 5 7-10 cents per ton. The freight carried from the dock to the mine is 788 1987-2000 tons, the expense of which is charged to the different accounts. The locomotives and rolling stock are in good repair and running condition, and are able to do the required work of the road for years.

MACHINERY.

On the 29th day of June last we had a very severe accident. A fire broke out in the top of No. 3 shaft-house, and a strong wind carried the flames upon the pump, and compressor houses, destroying all the woodwork of the houses and machinery, The pump was started in 3 days, the compressor in 14 days, and hoisting from all the shafts by the 25th of July.

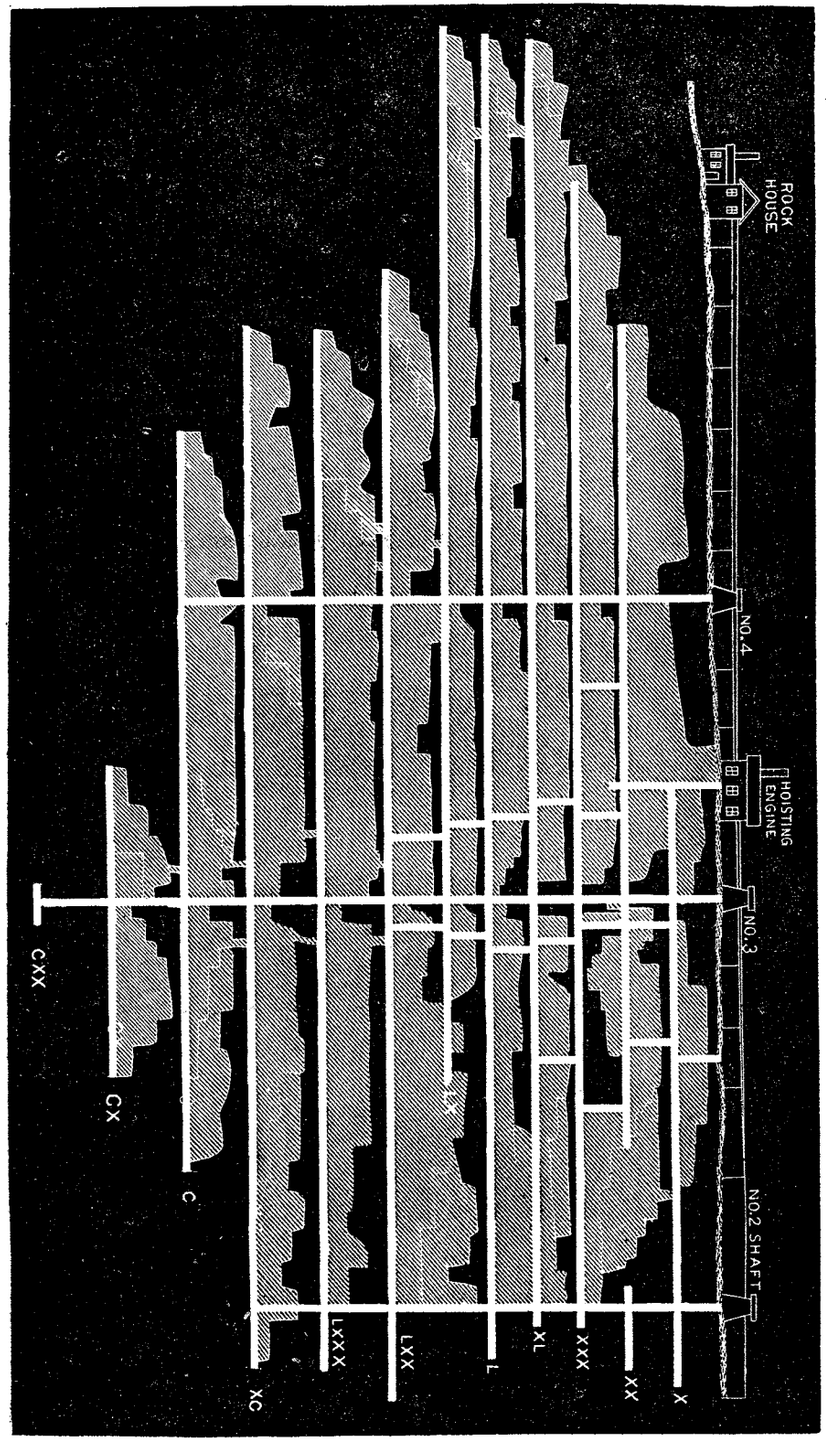
The compressor-house is built of stone, and covered with a slate roof, as also are the pump and boiler-houses. The cost of rebuilding the portions destroyed by the fire is about $3,500. The rock-breaker engine and machinery, the hoisting machinery, pumping engine and machinery, and compressor machinery are all in good working condition.

CONSTRUCTION.

The construction for the year consists of one-half of Rand's Duplex Compressor, 2 Rand drills, and a donkey engine for underground purposes.

In conclusion I would say that with the present appearance of everything connected with the mine, the prospect for 1882 is as good, if not better than that of 1881. Yours very respectfully,

WM. TONKIN, *Agent.*



LONGITUDINAL SECTION OF THE ATLANTIC MINE, JAN., 1882.

Scale, 300 ft. to one inch.

STATEMENT of Production, Cost, and Results from Atlantic Mine, 1875 to 1881 Inclusive.

ATLANTIC MINE.	1881.	1880.	1879.	1878.	1877.	1876.	1875.
Total product, mineral, pounds	3,632,841	3,353,190	3,257,085	2,847,899	2,880,378	2,665,216	2,178,897
Product of ingot copper	2,528,009	2,423,225	2,339,073	2,007,075	2,054,304	1,835,041	1,567,036
Percentage of mineral	69.59	72.28	71.81	70.44	71.32	68.85	71.92
Gross earnings	$428,982	$468,474	$392,592	$322,593	$378,141	$385,252	$354,759
Net operating expenses	346,030	384,083	285,765	311,268	323,572	342,371	312,170
Per cent of expenses to earnings	80.66	81.98	72.78	96.83	85.56	88.86	88
Construction expenses	$7,372 13	23,849 66	11,334 42	26,673 50	13,008 74	5,422 68	14,532 41
Profit, including construction account	82,952 55	84,391 01	106,827	11,325 06	54,569 86	42,880 55	42,579 67
Dividends paid	80,000 00	40,000 00		20,000 00			
Surplus undivided	320,691 64	263,320 00	242,778 00	147,286	182,634 00	137,043 00	99,585 00
Total mining cost of ingot copper per pound	11.48	13 54	10.18	14.41	13.83	15.99	19.26
Smelting, marketing, and other expenses per lb	2.20	2.30	2.02	2.42	2.54	2.96	2.86
Average cost per pound, marketed	13.68	15.84	12.20	16 83	16.37	18.95	22.12
Average sales of ingot copper per pound	17.12	19.97	16.30	16.15	18.54	21.35	22.47
Tons of rock stamped	*176,055	*169,825	122,668	111,709	105.780	96,696	80,000
Yield of mineral per ton of rock stamped	20.63 lbs.	19.74 lbs.	26.55 lbs.	26.25 lbs.	27.33 lbs.	27.56 lbs	27.23 lbs.
Yield of ingot per ton of rock stamped	14.36 "	14.27 "	19 "	18.50 "	19.42 "	18.99 "	19.58 "
Cost per ton, stamping and washing	42.54 cts.	38.13 cts.	42.44 cts.	48 85 cts.	57.79 cts.	67.09 cts.	87.96 cts.
No. fathoms broken in openings and stopes	9,240	9,929	8,665	8,299	7,091	6,550	5,628
Yield of mineral, per fathom	393 lbs.	337 lbs.	375 lbs.	343 lbs.	406 lbs.	406 lbs.	387 lbs.
Yield of ingot copper per fathom	273⅓	244 "	266 "	243 "	289¾ "	280¼ "	278½ "
Average force employed	322 men.	410 men.	370 men.	368 men.	352 men.	333 men.	316 men.
Fathoms of ground broken for each employe	27.83	24.21	23.41	22.55	20.14	19.67	17.80

*The cars formerly estimated to hold four tons each were found by weight to hold five tons, hence the apparently large increase in the number of tons stamped in 1880 and 1881, as compared with previous years, the decreased yield of mineral and ingot per ton, and the reduced cost of stamping and washing.

The following is a statement of totals and averages, of product, cost, etc., of the Atlantic mine, from 1875 to 1881, both years inclusive:—

Total product mineral, pounds	20,819,506
Average product (yearly) of mineral, lbs	2,974,215
Average percentage of mineral	70.88
Total product of ingot copper, lbs	14,752,753
Average product of ingot copper, lbs	2,107,536
Average mining cost of ingot copper, per pound	14.31 cts.
Average smelting, marketing, and other expense, per pound	2.47 cts.
Total cost of ingot per pound, marketed	16.78 cts.
Average sales of ingot copper, per pound	18.84 cts.
Average profit per pound on ingot, marketed	2.06 cts.
Total tons of rock stamped	*991,946
Average tons of rock stamped, per year	141,706
Average yield of mineral per ton of rock stamped, pounds	20.98
Average yield of ingot copper per ton of rock stamped, pounds	14.87
Average cost per ton, stamping and washing	44.62
Total number of fathoms of ground broken in openings and stopes	55,402
Average number of fathoms of ground broken in openings and stopes	7,914½
Average yield of mineral per fathom, pounds	375¾
Average yield of ingot copper, per fathom, pounds	266¼
Total construction account	$122,193.54
Average annual construction account	17,456.22
Average annual profit (including improvements charged to construction account)	60,789.38
Average annual profit, excluding items charged to construction account	45,525.80
Total dividends paid to date	140,000.00

The capital stock is $1,000,000, divided into 40,000 shares, $25.00 each, $17.50 of which has been paid in. Business office, 76 Wall street, New York. Jos. E. Grey, President; J. Stanton, Secretary; J. M. Mills, Treasurer; Wm. Tonkin, Agent; Capt. Peter Floyd, Mining Captain; B. C. McKeyes, Clerk.

THE HURON COPPER MINING COMPANY.

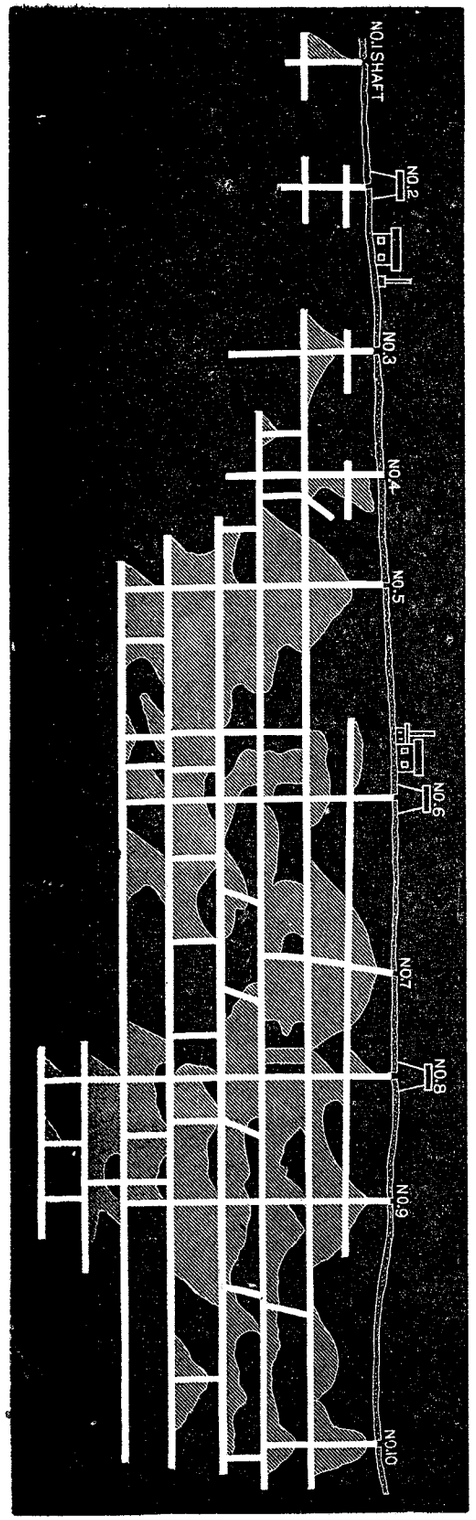
This company, it will be remembered, was organized in 1880 with a capital stock of $1,000,000, divided into 40,000 shares.

The Huron is an old mine, first opened in 1855, and represents one of those unfortunate locations with which the copper region is too familiar. In reopening the mine and resuming operations upon this abandoned property, the management has proceeded cautiously; evidently they want to ascertain the value of the mine first, and not to expend any more upon the surface than is unavoidably necessary to carry forward the underground work, the main purpose being to push the openings.

Two shafts are working, No. 6 and No. 8, and a portion of last summer, No. 10 shaft was working also. No. 6 shaft is to the 8th level and No. 8 to the 9th. All the shafts have been provided with new skip-roads. A new engine house has been built and furnished with new engine, 26 inch cylinder; also friction gear, hoisting machinery for No. 6 and No. 8 shafts have been provided. An engine, 10-inch cylinder, hoisting machinery—friction gear—have been erected to operate No. 10 shaft. This shaft is down to the 5th level. A new pumping engine—16 inch cylinder—has also been provided.

Five years ago, while the mine was run on tribute, a water wheel was built at the mill to run the stamp and other machinery. The wheel is 30 ft. diam-

*In computing this total and the three averages following it we have increased the tons of rock stamped in years previous to 1880 at the rate of one ton for each car sent to mill.



LONGITUDINAL SECTION OF THE HURON MINE.

Scale, 300 ft. to one inch.

eter and 3¼ ft. breast. The company repaired this mill and operated it during seven months of the past year, using the water wheel to furnish the requisite power. The mill shut down in November last, owing to some breakage in the driving gear, and repairs not having been made the mill has since been idle. They operated four batteries—sixteen stamps—Gates pattern. Since the mill stopped the rock has been transported to the Pewabic mill.

To increase the water, a ditch has been recently made one and a fourth miles long to a branch of the Pilgrim river. The water is drawn from the dam to the mill in a race 2,000 feet long. The mill will work up about 700 tons per month. As now selected the rock yields about 3.5%.

The company has employed on an average 111 men, and has obtained 298,153 lbs. of mineral.

The number of feet of shafting sunk is	369
The number of feet of winzes sunk is	383
The number of feet of drifting done is	1,052
The number of fathoms stoped is	532
All the ground broken in the mine, estimated in cubic fathoms, amounts to	862
The total amount expended during the year	$83,707.04

The general office is No. 4 Exchange street, Boston. D. L. Demmon, Secretary and Treasurer; Johnson Vivian, Agent, Houghton.

The description of the property is: S. ½ Secs. 1 and 2, T. 54, R. 34, lying south of the Isle Royal and north of the Atlantic.

The following report of Agent Vivian will give all the mining details.

I submit the following report of the operations at this mine for the year ending December 31, 1881:

SURFACE.

To protect the dam from injury during the spring freshets, it was necessary that considerable work should be done on it. Last spring the creek got so high that it threatened the destruction of a large portion of its bank. To prevent a recurrence of the like, we have taken out a large amount of timber that was used in its construction which was badly decayed, and substituted therefor clay and gravel. We have raised a portion of it. The water ditch from the dam has been extended a little over a mile, where it intersects another creek, which has greatly increased the amount of water that runs into the reservoir.

From April 15, last, to December 31, we ran from 10 to 12 heads of stamps with water power, which treated all the stamp rock taken from the openings and a few trial stopes.

We have commenced repairing a portion of the mill, and shall have 16 heads of stamps ready for use by the 1st of April; and, if we get the amount of water from the new ditch that we expect, we shall be able to treat about double the amount of rock that we did last summer, thus admitting a corresponding increase in the product. For about three months during the winter we shall stamp at the Pewabic mill.

Additions to Nos. 6, 8, and 10 shaft houses have been put on to facilitate the handling of timber that is sent into the mine, and assorting the rock that is taken out, etc.

MACHINERY.

All of our machinery, except the stamp mill, is in good running order. It may be necessary to put in a new foundation to the pumping engine next summer, which is only a short job.

We have purchased a diamond drill to explore some of the many lodes that run through this property. Two—the conglomorate and epidote—lodes were found between two and three hundred feet below the surface, in boring two holes about 600 feet apart. Both of these lodes contain copper, but not enough has been found to pay for working.

We have stopped operations with the drill for the winter, but as soon as the weather permits we shall start to bore again.

MINING WORK.

No. 8 shaft has been drained of water from the 5th to the 8th level, and sunk from the 8th to the 9th level. A winze, 60 feet south of the shaft, has been sunk to the 9th level. Both of these openings passed through a large lode, which contains a very fair amount of stamp and barrel copper; and some parts of the ground exposed are rich in stamp and barrel mineral. The old skip road, which was in very bad condition, has been taken out from the 3d to the 8th level and a new one put in; this was a very expensive piece of work.

The 9th level has been opened 50 feet; the lode at this point is showing some good stamp rock.

The 8th level has been extended north 100 feet; the lode in this opening is poor. The 7th level has been opened north 25 feet, and a winze sunk 25 feet to connect with a stope in the back of the level below, which has laid open a good little bunch of stamp copper. The 6th level has been opened north of this, No. 8 shaft, and connected with the drift from No. 6 shaft; in this back there is a rich piece of ground exposed for about 100 feet in length.

No. 10 shaft has been sunk from the 4th to the 6th level. The lode in this shaft from time to time showed some fair copper ground, but on the whole is rather lean.

The 6th level at this shaft has been opened south 10 feet and north 30 feet, all of which is very poor. The 5th level has been opened south 135 feet. The lode at this point is large enough, but too lean to pay for stoping. In a winze sunk from the 4th level, and connected with this drift, some good paying ground was found, which has been taken out. The 4th level has been extended south 165 feet, mostly through ground too poor to stope. The 2d level has also been extended south 87 feet, through very barren ground.

For the present we have discontinued all operations in this part of the mine, except opening the 6th level north, to connect with the old workings. When circumstances will permit, I would advise opening south of this shaft at a deeper level, where we should, I think, find some paying ground.

No. 1 shaft has been enlarged from the 6th to the 7th level, and sunk 35 feet below the latter. The lode, on the whole, in this opening is poor, but in the last few feet sunk there is some improvement, and it seems to be getting into a run of ground that will pay to stope.

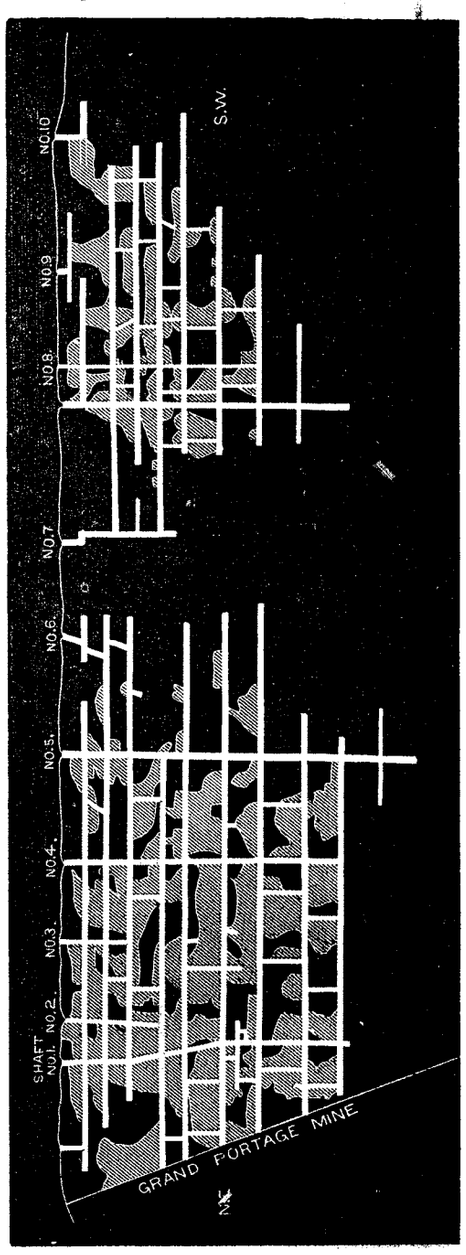
The 7th level has been opened north of this shaft 120 feet, and south 121 feet. The lode in these openings contains more or less copper the entire distance. In same places it is quite rich in stamp copper. A winze north 95 feet and one 100 feet south of this shaft has been sunk from the 6th level and connected with the level below. The ground exposed in both of these openings is showing considerable stamp mineral and will pay to stope.

FUTURE PROSPECTS.

I regard the prospects for the future as very encouraging indeed; for when we take into account the fact that the yield of mineral per fathom of ground

LONGITUDINAL SECTION OF THE ISLE ROYAL MINE.

Scale, 300 ft. to one Inch.



broken is 344 pounds (keeping in mind the bad and the good ground that was opened), the result will compare very favorably with other mines in this district that are now making fair profits. There is no doubt in my mind concerning the success of the Huron. With suitable machinery, such as the compressor, power drills and a good stamp mill, all of which will only cost a moderate sum, it would soon be numbered among the paying mines of this region.

For further information in relation to our business, I beg leave to refer you to the clerk's report, and the section of the mine, which is marked up to this date.

Capt. T. H. Odgers, who is in charge of the mining department, has taken pains to promote the best interests of the company.

I am, yours respectfully,

J. VIVIAN.

ISLE ROYAL.

Adjoining the Huron on the north is the Isle Royal mine, which is another old and heretofore unfortunate concern.

Since 1870 the mine has been worked only on tribute, and is now filled to the 2d level with water. It is the same lode that is worked at the Huron, the Grand Portage, and the Sheldon and Columbian. It bears northeast 62°, and dips to the northwest at an angle of about 45°; it has a width of 15 feet to 20 feet, and has rich pockets or bunches, but has a great deal of barren ground. The prevailing mineral is epidote. The belt is an amygdaloid.

Mr. Graham Pope, of Houghton, is agent for the property, and works a few miners in the two upper levels. Has had the past year 12 to 14 men. The rock is sorted very closely, so that it yields 8% to 9% copper. The product gotten out in 1881 is 38,380 pounds. Mr. Pope contemplates unwatering the north part of the mine so as to work it. He will do the pumping in company account, but mine, as now, on tribute. He thinks that the north part of the mine will afford some good ground. In the event of this plan being carried out, the machinery and the number of miners will be increased.

The property measures 1½ miles east and west and ½ mile north and south. The length of the lode on the property is about 3,000 feet. There are also several parallel lodes, one ¾ of a mile to the east, called the Mabb's vein. This has been explored with pits, and one shaft was sunk to the 3d level and some drifting done. The estate comprises 420 acres, to wit: the N. ½ Sec. 1, T. 54, R. 34, and the N. W. fractional ¼ Sec. 6, T. 54, R. 35.

Office in New York. Secretary and Treasurer, F. W. Chapin; Agent, Graham Pope, Houghton, Mich.

THE GRAND PORTAGE.

Lying next, to the north, is the Grand Portage, another of the south side mines, which has been the scene of repeated failure. The new company organized in 1880, with capital stock of $500,000, divided into 20,000 shares, has pushed forward its work with considerable vigor. The company is working the two lodes in which the old mines were opened. The Portage Mine lies 200 feet to the west of the Isle Royal vein, measured on the surface, but the former dips at an angle of about 45°, while the latter dips at about 35°, so that the two veins tend to come together. Probably the Portage is the "mother" lode and caps the other. The east vein terminates to the north

against a wall of trap, and in the same manner the west vein ends to the south.

If faulted the parts were also shoved past each other longitudinally. The company is working one shaft in each vein. The one on the east vein is down about 290 feet to the 5th level; this is called No. 2. They are driving, in the 5th level, which was opened the past year, and Capt. Tallon deems it to be the best level yet opened in the mine.

They are also drifting north in the 2d, 3d, and 4th levels. In the 5th the drift extends north of the shaft about 20 feet, and to the south about 100 feet. The lode has an extreme width of 30 feet and gives about one-third waste; the copper makes along the foot and hanging, and tends to leave a bar in the center. The extreme length of the opening in this branch is 450 feet; in the west vein the extreme length of opening is 700 feet.

There are three shafts in each vein; in the west vein they are working in the 4th, 5th, and 6th levels, the latter having been sunk the past year. The lode is more regular than the other, but the copper makes along the foot and hanging in the same way. About one-half of the ground is left, and they endeavor to leave it without breaking. In some measure the waste rock that is broken is left behind the stulls in the mine. The lode is a series of bunches, which are connected by strips of vein rock.

In the 6th level, south of No. 2, occurred a portion of lode which for a distance of 150 feet was 40 feet wide; its width was determined by cross-cutting, and no trap bar was found, but it was not equally rich. This ground still continues.

The rock is all sorted except the fine in the bottom, which of course must be shoveled up as it comes. The hanging is good, giving a soft roof, pillars are left sufficiently frequent, and some lode matter next to the hanging to help support it. When the lode makes out it is invariably in the foot, and it is along the foot that the most copper is found. In making the openings the foot wall is taken as the guide. The company employ a total force of 125 men, about 45 of whom are miners.

The stoping costs, underhand, $14 per fathom.

The stoping costs, breast, $16 per fathom.

Stoping costs, raised, $17 to $18 per fathom, the work being done on contract, the men furnishing themselves.

The rock is removed on day work, company account.

Trammers receive $35 per month.

Drifting, size of drifts, 5x6 feet, costs $10 per foot.

Sinking shafts, 9x12 feet, costs $25 per foot.

Sinking winzes, $10 to $15 per foot.

They have not treated the rock for a sufficient length of time to ascertain the yield per fathom or per ton. So far as treated at the new stamp mill the rock has given about 4 % of copper, but it has been well picked.

The mill is on the lake, on Main street, in Houghton, and was started the 22d of December, 1881, six batteries, 24 heads, similar to those in the Quincy mill. The mill is about 100 rods from the mine, and the rock is hauled to it with teams. Two teams now suffice for this work; each hauls 10 loads per day; as it is down hill and on sleighs they take large loads. The mill has 12 Shiermann washers, 1 slime table, 20 feet diameter, and a second one is building. The pump is a 10-inch Hodge. The engine is 18x36 feet, and drives everything in the mill. They are stamping 60 tons per day. The stamp could do more if the rock were broken finer.

There was a good deal to do. The shafts had to be lined up, and there is still very much to be done. The mine is deficient in machinery. There are two small engines to do the hoisting, each able to raise one ton at a time. They should have the power to bring up 2½ tons to a skip-load.

A tram road, a gravity incline, is needed from the mine to the mill; also a rock-house is needed, with a rock hammer, Blake's crushers, etc. Now the breaking is all hand work, of course imperfect and expensive.

With the mine well opened and the necessary improvements in machinery, etc., made, it is probable that the mine could be made a paying concern.

It certainly ought to include the Sheldon-Columbian Mine, lying between it and the lake; then the mine could be opened with an adit through which the water and product could be taken out, and the old Sheldon-Columbian stamp mill, still standing, is in a far better situation than the one the Portage Company have just built.

The officers of the company are not experienced in mining, but are business men in Hancock. They have in Capt. Tallon, however, a man who is familiar with the work, and who has many years ago worked in this mine, so that he knows from previous experience its peculiar features.

The officers are Joseph Worden, President; Peter Ruppe, Secretary and Treasurer; Michael Shubert, Superintendent stamp mill; M. L. Tallon, Mining Captain.

THE QUINCY.

Taken all in all the Quincy has, perhaps, the best record of any copper mine on Lake Superior. It would, no doubt, be easy to successfully criticise many of the details of the management; but it is an old company, started in 1848, and there are few others, if any, that can show, for so long a period, such a uniform and consistent record. It has a very valuable history; a suggestive one to other companies. If any one mine were to be selected as an example from which to derive important lessons, undoubtedly the Quincy deserves the preference. Its management may be characterized as, on the whole, a fortunate medium between the conservative and progressive; it has ever held to that which has stood the test of experience, and availed itself of whatever was new that was proved to be of value.

It has experienced all the difficulties that have been encountered by other companies, and has equally met with good fortune. Not unfrequently in this, as in other mines, the copper has, to all appearances, been approaching exhaustion, but the company has never hesitated in such emergencies, but has held to its faith in the ultimate result, and pushing forward with undiminished vigor, has ever been rewarded by opening again into productive ground. The confidence which the management has shown in the mine has long ago extended to the public, and everywhere the substantial character of the Quincy is regarded. No reported exhaustion or leanness of the lode would suffice to impair people's confidence in the mine. The company has experienced too many such periods of depression, and having always passed through them unscathed, it is no matter of surprise that the Quincy should enjoy a reputation for solidity and permanency.

The chief peculiarity of the Quincy Mine has been that however unfavorable it may have sometimes appeared, it has always been found to recover its productiveness as the work has been pushed, so that the confidence in the lode has become so well established that though there may be occasional cause for

anxiety, there is never discouragement. The narrower and leaner the lode has become the greater the energy and vigor displayed in opening into new ground.

A sufficiently full statistical history of this important mine for each year of its working up to 1881 was given in the last commissioner's report, and it is not necessary to repeat any of its details. The following table, which summarizes the more important of these results for a period of 12 years, is taken from the Northwestern Mining Journal:

QUINCY MINING COMPANY.	1870.	1871.	1872.	1873.	1874.	1875.
Product of stamp copper	1,437 tons.	1,370 tons.	1,302 tons.	1,644¼ tons.	1,752¾ tons.	1,717⅝ tons.
Product of mass copper	86 tons.	96 tons.	100 tons.	67½ tons.	58 tons.	46 tons.
Total product, mineral	1,523 tons.	1,466 tons.	1,402 tons.	1,712 tons.	1,810¾ tons.	1,763¾ tons.
Product of ingot copper	1,248¾ tons.	1,204¾ tons.	1,134⅜ tons.	1,400 tons.	1,525¾ tons.	1,399⅛ tons.
Percentage of mineral	84.48	79.76	81.12	81.90	84.12½	82
Gross earnings	$538,170 00	$549,730 00	$725,097 00	$722,409 00	$656,083 00	$653,168 08
Total expenses	382,710 00	355,513 00	522,107 00†	519,903 00†	461,089 00	456,816 66
Per cent of expenses to earnings	71.11	66.49	71.99†	71.97†	70.39	69.93
Net profit	$157,630 00*	193,377 00*	213,544 00*	208,469 00*	‡174,472 00*	a216,964 00
Dividends paid	80,000 00	260,000 90	250,060 00	160,000 00	160,000 00	160,000 00
Surplus undivided	263,533 00	297,742 00	265,103 00	313,572 00	328,044 00	385,009 00
Total mining cost of ingot copper per pound	12.43	13.22	20.26†	16.28†	12.84	13.37
Smelting, marketing, and other expenses per pound	2.47	2.38	2.67	2.29	2.29	2.42
Average cost per pound, marketed	14.90	16.60	22.93†	18.57†	15.13	15.79
Average sales of ingot copper per pound	21.00	23.50	32½	26.50	21.88	22.67
Tons of rock stamped	55,027	59,757	60,828	63,272 00	67,112	70,501
Average per cent of mineral in stamp rock	2.61	2.59	2.14	2.60	2 61	2.44
Stamp mill in operation	283 days.	292½ days.	283 days.	293 days.	292½ days.	278 days.
Cost per ton, stamping and washing	$2 15	$1 01	$1 06½	$1 21	$1 08½	96½
Number of fathoms stoped on contract	4,275	4,692	5,165	4,946	4,352	4,968
Yield of mineral, per fathom	624 lbs.	551 lbs.	482 lbs.	600 lbs.	685 lbs.	591 lbs.
Yield of ingot copper, per fathom	528 lbs.	441 lbs.	391 lbs.	491 lbs.	577 lbs.	485 lbs.
Average force employed	422 men.	410 men.	437 men.	489 men.	468 men.	504 men.
Average number of miners	181 men.	194 men.	233 men.	223 men.	234 men.	271 men.
Average wages of miners on contract, per month	$46 09	$47 08	$60 62	$62 92	$48 38	$46 74

* Including interest on loans, $2,169.26 in 1870; $10,160.56 in 1871; $10,422.67 in 1872; $2,725.32 in 1873; $4,432.20 in 1874.
† $67,227.65 "extraordinary expenses" in 1872, and $35,492.46 in 1873.
‡ The $28,820 "for copper delivered Holmes & Lissberger, bankrupts," is deducted.

a This includes $4,323, being 15 per cent, received in settlement with Holmes & Lissberger for $28,820 of copper sold them in 1874, and charged off in the accounts of that year.

QUINCY MINING COMPANY.	1876.	1877.	1878.	1879.	1880.	1881.
Product of stamp copper	1,765⅛ tons.	1,586⅛ tons.	1,634¼ tons.	1,608 tons.	2,355¾ tons.	3,096⅛ tons.
Product of mass copper	65¾ tons.	65¾ tons.	70¼ tons.	59⅛ tons.	83½ tons.	314¼ tons.
Total product, mineral	1,830¾ tons.	1,652¼ tons.	1,704⅛ tons.	1,667⅜ tons.	2,439¼ tons.	3,407¾ tons.
Product of ingot copper	1,536¾ tons.	1,427⅛ tons.	1,434¼ tons.	1,392 tons.	1,848¾ tons.	2,851⅛ tons.
Percentage of mineral	80.53	82.23	84.18	83½	83½	83.73
Gross earnings	$581,226 66	$515,584 00	$447,510 00	$457,606 00	$755,694 00	$1,044,610 00
Total expenses	461,032 48	421,874 00	401,849 00	382,064 00	481,652 00	572,008 00
Per cent of expenses to earnings	79.32	81.05	87.88	83.49	63.73	54.75
Net profit	120,194 18	93,710 01	55,340 38	75,541 00	347,154 00	472,591 00
Dividends paid	140,000 00	80,000 00	40,000 00	40,000 00	*d*220,000 00	320,000 00
Surplus undivided	381,299 11	364,685 85	380,026 00	455,567 70	*e*582,722 00	*i*735,313 00
Total mining cost of ingot copper per pound	13.33	12.31	11.88	11.62	10.01	7.83
Smelting, marketing, and other expenses per pound	2.39	2.80	2.13	2.09	1.80	2.20
Average cost per pound, marketed	15.72	15.11	14.01	13.71	11.81	10.03
Average sales of ingot copper, per pound	20	18.56		16.32	18.51	18.17
Tons of rock stamped	74,717	75,307	92,860	89,817	84,426	98,869
Average per cent of mineral in stamp rock	2.38	2.11	1.76	1.85½	2.79	3.13
Stamp mill in operation	280 days.	266 days.	281 days.	284½ days.	255 days.	
Cost per ton, stamping and washing	91	*b*94.90	*f*66.53	*g*65	*h*78.83	
Number of fathoms stoped on contract	4,796	4,729	7,220⅜	6,919	7,243½	7,424½
Yield of mineral per fathom	629 lbs.	568 lbs.	472 lbs.	482 lbs.	673 lbs.	918 lbs.
Yield of ingot copper per fathom	507 lbs.	467 lbs.	397 lbs.	403 lbs.	563 lbs.	767 lbs.
Average force employed	510 men.	474 men.	490 men.	481 men.	492 men.	486 men.
Average number of miners	271 men.	249 men.	234 men.	212 men.	192 men.	212 men.
Average wages of miners on contract, per month	$47 13	$43 79	$41 50	$38 76	$49 10	$48 54

b 29.50 cents of this was for repairs on mill.
d Includes stock dividend, Sept. 1. 1880; $100,000.
e From which deduct dividend of $200,000 paid Aug. 1, 1881; and dividend of $120,000, Aug. 22, 1881.
f 17.83 cents per ton for repairs.
g 17.74 cents per ton for repairs.
h 22.36 cents per ton for repairs.
i From which deduct dividend of Feb. 20, 1882; $320,000.

The Pewabic lode, as developed in the Quincy, is a broad belt, 200 or more feet in width, through which runs a bunchy deposit, or a series of connected deposits of amygdaloid; laterally, in the foot, and hanging, are also pockets of amygdaloid, which, when worked, are reached by cross-cuts from the main drifts. Altogether these make up the belt. The main lode is tolerably well defined and is followed, and the diamond drill, which for years has been employed in the mine, discovers the lateral pockets, many of which prove greatly productive in copper. They are sometimes in the foot, and as frequently in the hanging side. Nearly 300 borings have been made in the mine with the diamond drill, having an average length of 120 feet. These explorations have been made chiefly in the 60th, 70th, 160th and 180th levels, and from the latter down to the bottom of the mine, more or less in every level, but a greater number in the 230th, 240th, 250th, and 260th levels. The mine has been explored in this way, from north to south, 1,700 feet, and to a width of from 200 feet to 400 feet.

These holes are all mapped and the character of the ground gone through in each is clearly indicated, so that the mining captain can thus be guided in laying out his cross-cuts.

The Quincy affords an excellent example of the value of the use of the diamond drill in the prosecution of mining work. Most of the copper is now coming from the 180th, south, and in the north end from the 180th down, and in the bottom, that is in the lowest two levels, 270th and 280th—though they are down to the 290th, and during the coming year, 1882, will sink to the 300th. The depth of the mine on the inclination of the lode, 56° with the horizon, is 2,200 feet. It is also expected that 6,000 feet of ground will be opened. The hoisting is done from No. 2 and No. 4 shafts, and the product is run by an automatic railway, wire rope transmission, to the rock house, which latter stands at the head of the incline, double track, gravity railroad that runs to the stamp mill.

The automatic railway is 1,465 feet in length, [illegible] the gravity incline is 2,200 feet long; two loaded cars go down at a time, each carrying 2 tons of rock, and two empty cars ascend, drawn up by the descending ones.

In February, 1881, Mr. A. J. Corey, who for the period of 10 years had been agent of the Quincy, and who, prior to that, had served as clerk, died very suddenly. Mr. Corey was esteemed as an unusually intelligent and energetic mining agent, and was highly regarded by the company and by the people, among whom he had for so long a time dwelt.

The company was very fortunate, however, in being able to repair the loss occasioned by the death of this very capable and faithful officer, in securing the services of Mr. Frank G. White to fill the place thus made vacant. Mr. White has heretofore been agent of several of the leading mines on the lake—the Ridge, Phœnix, Osceola, etc., and is known to be a thoroughly qualified agent, and withal a genial, popular gentleman. Under his management the Quincy is sure to continue to be intelligently looked after.

The company for the past two years has been unusually prosperous. The increase is shown in the following table. In 1879 the product was 1,322 2-3 tons; in 1880, 1,848 1-8 tons; in 1881, 2,753 1-2 tons.

The per cent of yield of copper from the rock stamped for each year is given in the Commissioner's Report, 1880, and the table is herewith copied with the year 1881 added:

Year.	Per cent.	Year.	Per cent.	Year.	Per cent.
1861	2.55	1868	2.25	1875	2.44
1862	2.03	1869	2.48	1876	2.38
1863	2.75	1870	2.61	1877	2.11
1864	2.96	1871	2.29	1878	1.76
1865	2.60	1872	2.17	1879	1.80
1866	2.63	1873	2.60	1880	2.50
1867	2.74	1874	2.61	1881	3.13

The yield of copper per fathom of ground broken in the mine, the past year, was nearly twice as great as it has been in many former years, 767 pounds. In 1877, for instance, it was 467 pounds.

In the mine are 20 batteries—80 stamps. This mill has heretofore had a high reputation, and was, until recently, considered to be the most economically worked mill on the lake; but whatever its merits, the figures of cost of working are against it, as shown by the following:

Quincy mill, cost for stamping per ton of rock stamped, 72 3-10 cents.

Osceola mill, cost for stamping per ton of rock, 44 cents.

Atlantic mill, cost for stamping, etc., per ton of rock, 42½ cents.

The Quincy rock should be treated as cheaply as the Osceola or the Atlantic. To all appearances there should be no difference in working it in the stamp mill. On such an assumption there should be a saving of 28 to 30 cents per ton, as shown in the foregoing comparison, on the present cost of treating the rock, which applied to 100,000 tons, the amount treated annually in the mill, would result in a yearly saving of $30,000 to the company.

On the other hand Mr. Corey and those who favored the use of the stamps now employed in the Quincy mill claimed that there is otherwise a saving that compensates for the increased cost of stamping. Average assays of the waste sands from the Quincy stamps show, it is said, a very small loss as compared to the tailings from the Ball stamps. For instance, in 1879, the loss was only 185-1000 of one per cent at the Quincy Mine.

Notwithstanding, the change to Ball stamps is seriously contemplated, and would no doubt be an important pecuniary advantage to the company.

About 80 % of the rock mined is stamped; the remaining 20 % is either left in the mine or rejected after hoisting. The following summary will be of value:

No. of tons of rock broken in the mine but not hoisted, 1,509.

Cost per ton for mining rock, including all rock broken	$3 53
Cost per ton, embracing only the rock which was hoisted, but compared to the same aggregate cost as the above	4 01
Cost per ton including only the rock stamped, but compared to total expenses, as the above	4 51
In the same manner the total construction expenses per ton of rock mined	53
Total construction expenses per ton of rock hoisted	60
Total construction expenses per ton of rock stamped	67½
Total cost per ton for stamping, etc., per ton of rock hoisted	56 7-10
Total cost per ton for stamping, etc., per ton of rock stamped	72 3-10
Mining expenses, including cost of mining, tramming, hoisting, etc., etc., apportioned, per ton of rock mined	2 14
Total mining expenses apportioned per ton of rock hoisted	2 43
Total mining expenses apportioned per ton of rock stamped	2 73

The average price paid per foot for driving drifts, 6 feet by 7 feet, has been	$10 25
Average per fathom for stoping	15 82

Further statistics will be found in the subjoined report of the company for 1881.

Since 1878, the date of the company's reorganization, the capital stock has been $1,000,000, divided into 40,000 shares.

The officers are Thomas F. Mason, President; Wm. R. Todd, Secretary and Treasurer, No. 4, Exchange street, New York. Frank G. White, Agent, Hancock, Mich.

The latest quotations of stock in the Boston market, $54 per share.

REPORT OF QUINCY MINING COMPANY FOR THE YEAR 1881.

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 shipment of the season was 6,576,755 pounds of mineral, which has been smelted and yielded about 83 73-100 per cent, or 5,506,848 pounds of refined copper.

The product of the mine for the year, as prepared for shipment, was 6,815,485 pounds, or 3,407 1485-2000 tons of mineral, of the following descriptions, namely:

	Pounds.
Stamp copper	6,193,190
Mass copper	622,295
	6,815,485

for which, estimating December product at 82 per cent yield, and 20 cents per pound, has been realized the

Gross sum of	$1,036,175 90
Realized from sale of silver	2,280 94
	$1,038,456 84

The expenses of the year are as follows:

Running expenses at mine	$379,326 17
Building and construction account	66,673 86
Smelting, transportation, and all other expenses	126,018 42
	$572,018 45
Which, deducted from gross earnings	1,038,456 84
leaves as mining profit	$466,438 39
There has also been realized during the year from interest	6,153 36
	$472,591 75

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

January 1, 1881		$582,722 04
Add earnings of 1881		472,591 75
		$1,055,313 79
Deduct dividend of February 15, 1881	$200,000	
Deduct dividend of August 22, 1881	120,000	
		320,000 00
Making balance of assets Jan. 1, 1882		$735,313 79

A dividend of $8 per share, or $320,000, payable February 20, has been declared, which, with dividend of $3 per share, paid August 22 last, makes total for the year $440,000.

During the past year it has been deemed advisable to introduce 12 additional power drills, and to construct water works to supply the mine engines with water, and for use in case of fire, and for other purposes. These expenditures, together with the purchase of one of Rand's duplex air compressors for driving the drills, the erection of a building for the compressor, new machine shop, shaft house, warehouse addition, sand wheel and building, with the completion of the dwelling for the mine agent's residence, have added largely to the construction expense; but the additions thus made to the mine plant will, we believe, furnish facilities for maintaining our increased production, with fewer miners than it would otherwise have been necessary to employ.

Below we present the Treasurer's statements, and the annual report of Mr. F. G. White, agent at the mine. All of which is respectfully submitted.

THOMAS F. MASON, *President.*

NEW YORK, February 20, 1882.

GENERAL SUMMARY OF RECEIPTS AND EXPENDITURES OF THE QUINCY MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1881.

EXPENDITURES.

For expenditure on location previous to 1856	$42,097 98
For expenditure on Quincy vein in 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, tram road, dock, warehouses, and other buildings and roads	788,116 20
For mining and surface labor, expense of smelting and marketing copper, and all incidental expenses	9,673,294 10
Balance carried down	3,545,313 79
	$14,115,322 07

RECEIPTS.

From capital stock paid in	$200,000 00
" proceeds copper and silver (59,560,041 pounds copper)	13,709,685 61
" interest	88,313 39
" profit on sale of P. L. & R. Improvement Company stock, and other investments	70,316 39
sales of real estate, Hancock	47,006 68
	$14,115,322 07
By balance brought down, being receipts over expenditures	$3,545,313 79
Deducting dividends declared, Nos. 1 to 26 inclusive	2,810,000 00
Leaving balance, as per statement in detail	$735,313 79

STATEMENT OF ASSETS AND LIABILITIES, EXCLUSIVE OF REAL ESTATE, MINE PLANT AND SUPPLIES IN USE, JANUARY 1, 1882.

ASSETS.

Loans on call	$241,500 00
Cash in bank	1,435 77
Cash on hand at mine	4,807 37
Copper on hand (unsold, estimated at 20c per pound)	449,578 40
Accounts receivable, (since paid)	24,064 44
Bond of Mineral Range R. R. Co., $13,000, at 50 per cent	6,500 00
Company's stock, costing	342 00
	$728,227 98

LIABILITIES.

Drafts unpaid	$394 22	
Dividends unpaid	3,190 00	
Accounts payable in N. Y	23,000 00	
Accounts payable at mine	52,557 82	79,142 04
Balance available assets		$649,085 94
Add at mine, supplies per inventory on file	$69,529 02	
Farm account (horses, wagons, etc.)	13,937 47	
Accounts receivable	2,761 36	86,227 85
Total balance assets		$735,313 79

Less dividend payable February 20, 1882, $8 per share, or $320,000.

SUMMARY FOR THE YEAR.

Average force employed	486 men.
" number of miners	212 "
" wages of miners on contract per month	$48 54
Yield of mineral per fathom of ground broken	918 lbs.
" " refined copper per fathom of ground broken	767 "
Total rock mined	126,140 tons.
" " hoisted	111,131 "
" stamp rock treated	98,869 "
Yield of stamp rock treated (3 13-100 per cent)	6,193,190 lbs.
Product mineral	6,815,485 "
" refined copper	5,702,606 "

AGENT'S REPORT.

QUINCY MINE, MICH.,
January 1, 1882.

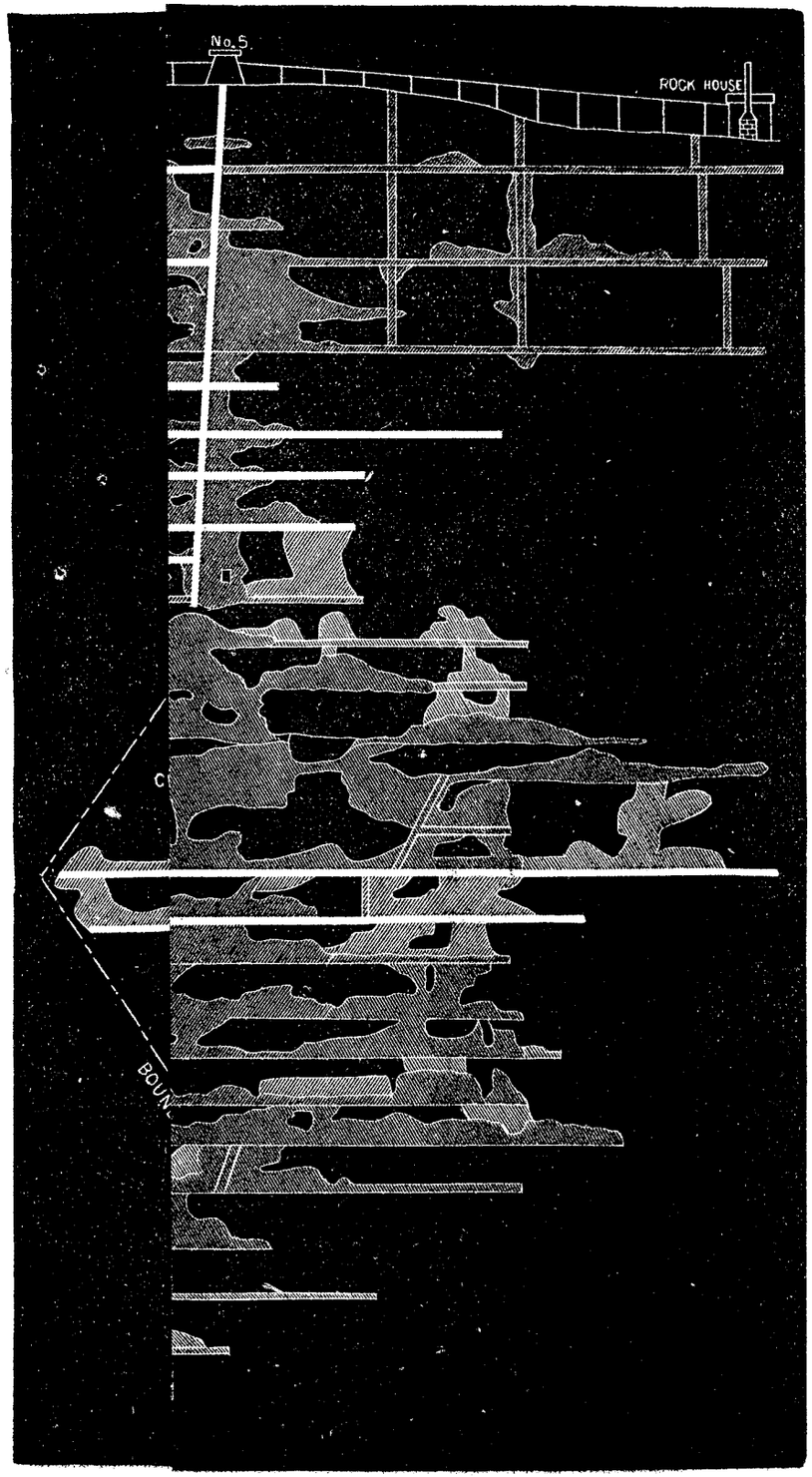
After the sudden death of Mr. Corey, your late superintendent, you placed the local management in my hands, and it now affords me great pleasure to testify to the general good condition in and about the mine, and to the fact that the results of the past year are largely due to his labor, and the good judgment exercised by him.

The underground work has progressed favorably during the year, while the product has been exceptionally large as compared with former years. The continuance of the rich stope which proved so productive in the twenty-fourth and twenty-fifth levels has more than equaled expectations and still promises well in the twenty-seventh level. This stope produced largely in the later months of the year. All the levels below the nineteenth and several above the thirteenth have contributed to make up the product, and from the eighteenth, nineteenth, twenty-first, twenty-second, twenty-fourth, twenty-fifth, twenty-sixth, twenty-seventh, and twenty-eighth, we expect continued good yield.

The eighteenth level has been extended to a point 1,120 feet from No. 4 shaft, the most southern point reached by any level in the mine openings, and is now in copper. As this is new ground, the back being intact to surface, developments here will be of great value should the copper continue.

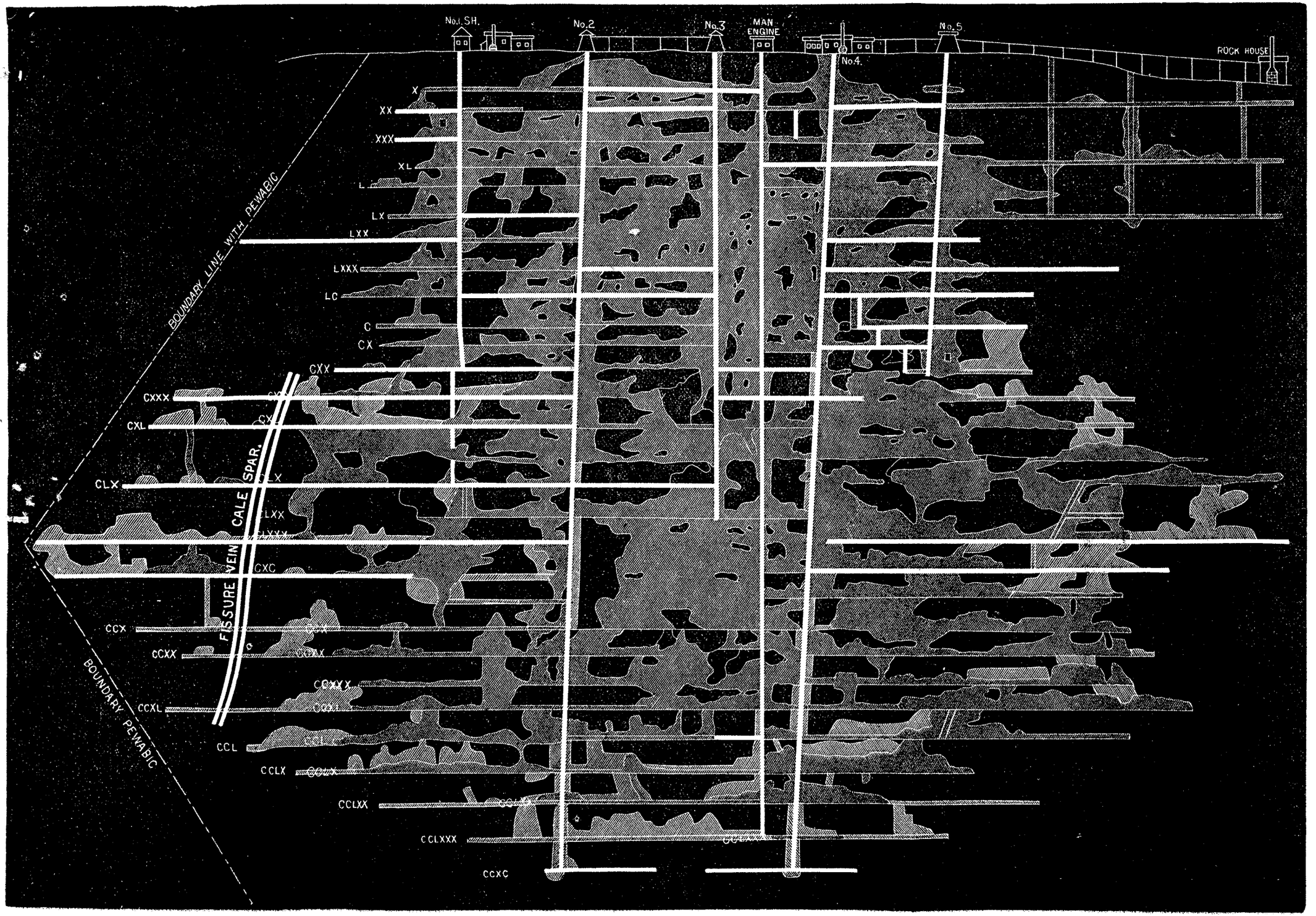
During the coming year we expect to sink both shafts to the thirtieth level, and extend, as rapidly as can be done by use of power drills, all the levels below the nineteenth, north of No. 2 shaft, and as many as developments warrant south of No. 4 shaft.

The use of the diamond drill was discontinued in March last, the old compressor being unable to furnish sufficient air to run that and other power drills. The result has justified this course, but we soon expect to again resume its use.



LONGITUDINAL SECTION OF THE QUINCY MINE, JAN., 1882.

Scale, 300 ft. to one inch.



In June last we decided to put in use additional Rand drills, also to procure a Rand compressor to supply the requisite power, the old compressor proving inadequate. A stone building was erected in which to place the compressor and the pumping engine, and to furnish room for a machine shop, for which we have procured the necessary tools for doing repair work.

During the past several winters it has been necessary to melt snow to provide water for steam purposes; and considering the expense and the uncertainty involved, and the damage which would result from total failure of a supply of water, a pump was purchased and placed at the mill, and a line of iron pipe laid, leading from the lake to a cistern at the mine, to supply the lack of water needed for steam and other purposes; and, after several months' use we find it to work satisfactorily in every way.

No changes have been made in hoisting and steam equipment, except the placing of a stone foundation under No. 2 engine, the material and plans having been procured by the late Mr. Corey. For economy, it will soon be necessary to consider the question of a new engine at No. 2 shaft, as the present engine will be inadequate to the demands. No time should be lost in giving our steam equipment full consideration. Quite a number of the boilers have been in use over twenty years, and all are old and require frequent repairs, involving us in great liability to accident, as well as, under present circumstances, being far from economical. I would strongly recommend an early attention to this question.

At the stamp mill we found it a necessity to build a new sand wheel with a building, also a new tailing house. The new wheel is of much larger diameter, to enable us to elevate the waste sand to a point which commands a much larger area for its deposit. We will be called upon to incur quite an expense during the next few years in improving the dock front around the accumulated waste sand, to enable us to continue to run it into the bay. Work should be commenced this season to provide, also, facilities for handling coal for steam and fuel purposes at the mine, which will be needed within three years, as no timber will then be near enough to the mine to allow of its use as fuel, as compared with the cost of coal.

The stamp mill has given good results for the year. It was under repairs during the latter part of last April and early in May, being idle fourteen days. The cost of stamping has been somewhat less than the year previous, and cost for repairs also less, but other expenses have been about the same. We have, however, been unable to obtain as low a rate of cost in stamping as have other mines in treating similar rock. The mine is equal to supplying a large quantity of low grade rock in addition to what is now treated, and which should be mined and milled with the higher grades which have been stamped during the past two years; but the mill having been worked to its full capacity, no increased duty was possible.

The usual statements and tables, giving the cost of all operations for the year, have been forwarded by Mr. Kloeckner; they will show the expense incurred in each department. I also send the underground plans, as prepared by Mr. L. G. Emerson, C. E., showing the openings and stopes for the year.

It gives me pleasure to commend the hearty co-operation which has been shown by my associates, and to note the harmony of action in all departments of work.

F. G. WHITE, *Agent.*