The manufacture of this commodity began in Michigan in 1860. In 1869 the present law requiring all salt to be inspected went into effect. The following table shows the salt produced each year:

Years.	Barrels.	Fine, Barrels.	Packers, Barrels.	Solar, Barrels.	Second Quality.	Total, Barrels.	Average Price.
1860	4,000						
1861	125,000						
1862	243,000						
1863	466,356						
1864	529,073						
1865	477,200						
1866	407,077						
1867	474,721						
1868	555,690						
1869		513,989	12,918	15,264	19,117	561,288	$1 58
1870		568,326	17,869	15,507	19,650	621,352	1 32
1871		655,923	14,677	37,645	19,930	728,175	1 46
1872		672,034	11,110	21,461	19,876	724,481	1 46
1873		746,702	23,671	32,267	20,706	823,346	1 37
1874		960,757	20,090	29,391	16,741	1,028,979	1 19
1875		1,027,886	10,233	24,336	19,410	1,081,865	1 10
1876		1,402,410	14,233	24,418	21,668	1,462,729	1 05
1877		1,590,841	20,389	22,949	26,818	1,660,997	85
1878		1,770,361	19,367	33,541	32,615	1,855,884	85
1879		1,997,350	15,641	18,020	27,029	2,058,040	1 02
1880		2,589,037	16,691	22,237	48,623	2,676,588	75
1881		2,673,910	13,885	9,683	52,821	2,750,244	85
1882		2,928,552	17,208	31,335	60,222	3,037,317	75
1883		2,828,987	15,424	16,735	33,526	2,894,672	81
1884		3,087,033	19,388	16,957	38,428	3,161,806	73
1885						3,300,000	90
Totals		26,014,098	262,794	371,746	477,180	30,425,818	

The average depth of the salt wells is about 880 feet and the average strength of the brine is 91¼ degrees, while the Onondaga brine is given as 69½ degrees.

COPPER MINES.

THE COPPER MINES.

ONTONAGON COUNTY MINES.

Public interest in the mineral deposits of this county is at present concentrated in watching the developments which are rapidly making in the newly opened iron district. The Agogebic range, where the fortunes, real and prospective, that the investors have made, or hope to make in the near future, is the theme of much comment. The mines of this iron range are elsewhere described in this volume and need not at this point be further alluded to. This iron range occurs in the south part of the county, where the iron bearing rocks and the copper series come in contact. The latter, starting from the extremity of Keweenaw point at the north, trend southerly along the western border of the peninsula to the southerly line of the State into Wisconsin, comprising in this State a total distance of about 160 miles. Throughout its entire length this range is the most interesting feature of the landscape; rising as it does so prominently above the adjoining country. Near the extreme northeastern limit Mt. Bohemian and Mt. Houghton tower to heights respectively of 864 and 884 feet, and their beautiful, symmetrical forms are plainly discernable at a great distance. Away to the south in Ontonagon county, the Porcupine mountains, in this range, looming far above the horizon, are the first objects to attract the attention of the beholder and the last which his lingering gaze relinquishes.

The general trend of the iron ranges is east and west, and here in Ontonagon county is the only locality where the juxtaposition of the copper and iron ranges is apparent.

There has not been much copper mining done in Ontonagon county for many years, nor in any portion of the range south from the vicinity of Portage Lake. There are many old mines, however, most of which were worked to a very limited extent in the earlier years of the mining industry in this region; but mining has greatly changed since that day, and the limited openings which were made at most of these locations would scarcely be deemed as sufficient explorations now. Many of these early companies expended considerable capital, but this was due more generally than otherwise, to the incompetence or ignorance of the management and to the comparative necessarily excessive cost of all work in a region so isolated at that early day.

The period of mining activity in Ontonagon county was prior to the extension of railroads to within hundreds of miles of the district, prior to and contemporary with the building of the Sault canal. It was during a time when all materials, supplies and laborers had to be transported by the long circuitous water route, in sailing vessels, in the brief months of summer. The primitive methods of mining which were then pursued would even now, with all our increased facilities for transportation and the consequent cheapening of the cost of materials and of labor, lead only to failure if adopted at the best of our mines.

The career of the Ontonagon county mines was begun and ended before the advent of the compressor and air drill, the improved Ball stamp, the Collum washers and the high explosives. No stamp mill was ever, until recently, operated in Ontonagon county that was capable of reducing as much rock in a year as some of the mills on Portage Lake will reduce in a single week. It cost them then $3.00 per ton to break their rock that is now manipulated for 50 cents and less. In all the early Ontonagon mines mass copper only was sought, and when these masses were not of sufficiently frequent occurrence to meet the cost of the operations, the stockholders were called upon to make up the deficit until the work would be finally abandoned.

No stamp rock was ever worked in this county except at the Nonesuch, and even here it is not apparent that a profit could not be made if the mine and operations were properly managed; in point of fact when worked on a lease a few years ago in a limited way it paid nicely.

There are good stamp lodes in the county which could be worked at a profit. Certainly if operated on an equivalent scale with those that are worked at Portage Lake there would seemingly be as reasonable an assurance of success.

Those belts which I have examined somewhat and of which I speak with the most confidence, are the amygdaloid deposit and conglomerate vein at the National and Minesota mines and the Knowlton vein at the Mass. These will be further described in connection with my remarks under those heads. At these mines paying stamp lodes exist and can be seen and examined. It is apparent that copper is held in paying quantity, and they also afford mass copper which has heretofore constituted the main product. Open these mines extensively and the combined mass copper and stamp work would make a showing of some magnitude.

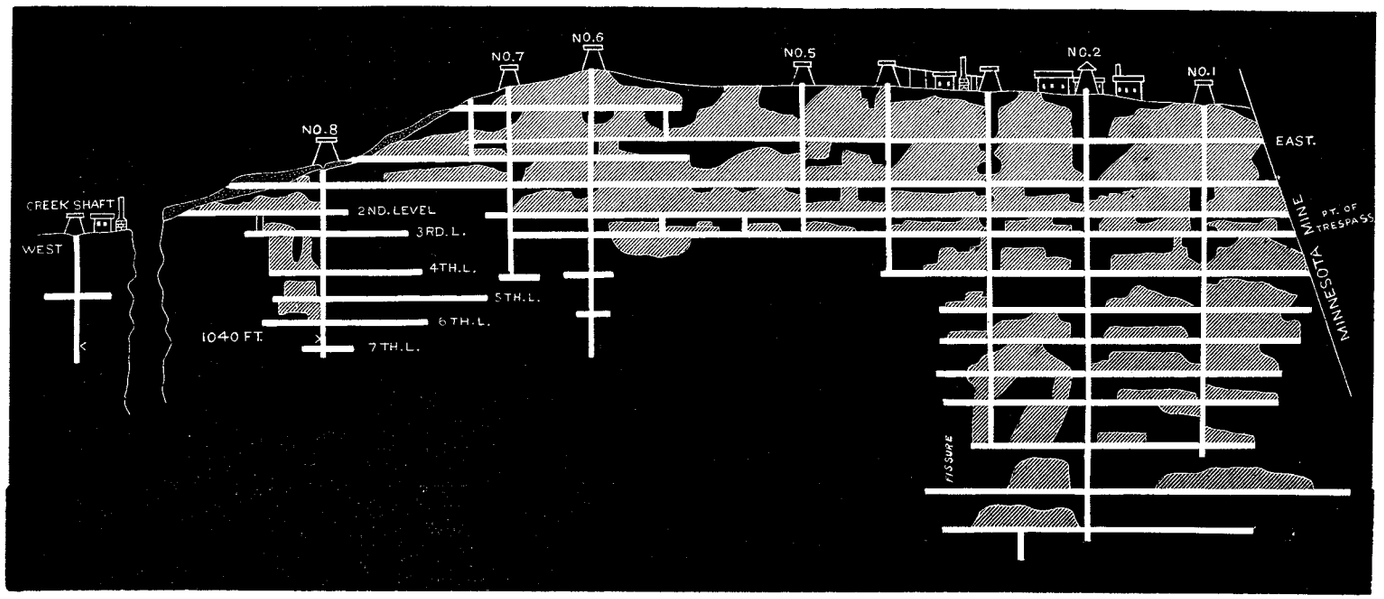
The Belt Co. has a stamp mill of the approved pattern, but it has done no work, only to test the rock, and there are no others in condition to be used except the small one at the Mass and the still less effective one at the Ridge mine.

The Ontonagon copper district also needs a railroad; it is inaccessible. To reach Rockland requires one to ride 36 or 40 miles over a rough road from any railroad. The Ontonagon & Brulé R. R. was built from Ontonagon village to Rockland and there it has stopped. If completed or if the M., H. & O. Co. extends its line to this point, the district will no doubt be greatly benefited. The country has an excellent soil for farming, and those who engage in this industry prosper as well as farmers do elsewhere.

There are many reported discoveries of rich silver lodes and also of heavily mineralized copper deposits made frequently by ignorant parties who bring in and exhibit the specimens, but fail to refind the localities from which they were obtained. It is a mineral region of great possibilities and it is altogether

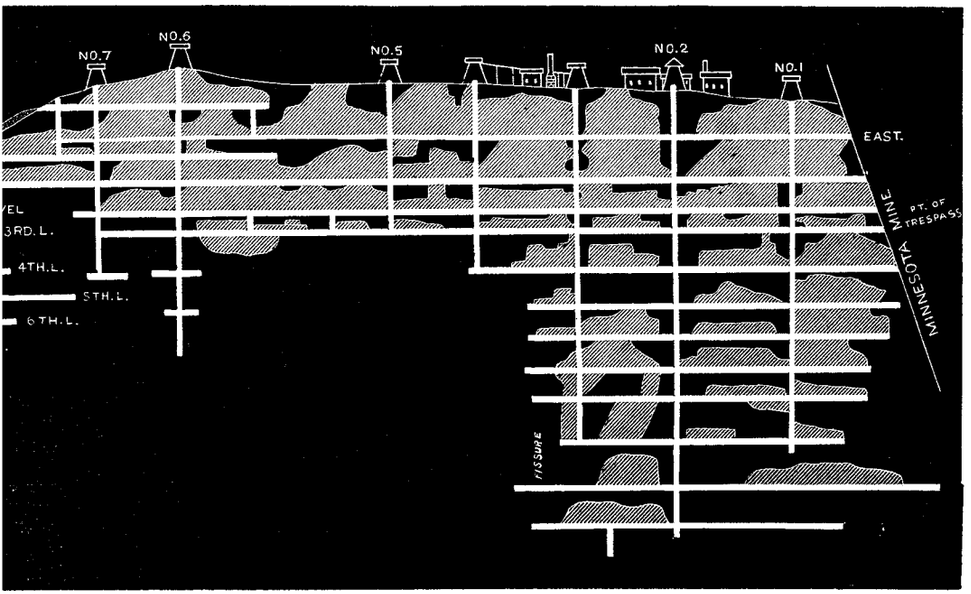
LONGITUDINAL SECTION OF THE NATIONAL MINE. JAN., 1886.

Scale, 300 ft. to one inch.



TUDINAL SECTION OF THE NATIONAL MINE, JAN., 1886.

Scale, 300 ft. to one inch.



probable that in the future, discoveries of mineral deposits may be made that will prove of much value. The old mines are usually in irregular, undefined belts of amygdaloidal trap or belts of trap in which there are seams and crevices filled with amygdaloid and vein matter, calcite and epidote being the predominating minerals. The miners in their work have sought to follow this vein matter, and with greater or less frequency masses of copper would be found. Sometimes the vein matter leads into large "pockets," when a good deal of copper would be extracted. These veins also contain more or less stamp rock, that is rock which holds native copper so fine that the rock must be crushed into sand and the copper saved by a system of washing, which carries away the valueless matter and retains the copper by reason of its greater specific gravity. At the present time the stamp mills have reached a high degree of perfection both as to their capacity and economy of working, but in the days when active mining was in progress in the Ontonagon district, the methods of stamping and working were comparatively crude. The old Minesota stamps were of wood, shod with iron, and others were little better. They were without exception placed by little rivulets that afforded but a meagre supply of water. Of course the stamp copper was of small account, the mining was almost exclusively for mass copper on barrel work, the latter being the small bits or pieces of copper obtained and which were put into barrels and so shipped to the smelting works. The mines that gave to the Ontonagon district its celebrity are the Minesota and

THE NATIONAL.

These mines are contiguous, the former upon the east and the latter on the west, and the property extends upwards of a mile in the line of the mine to the Ontonagon River. The river cuts through the Mineral range and from the mine the land descends rapidly to it. The collar of No. 2 shaft is 570 feet above the river.

Creek shaft is 253 feet above the river or 317 feet below the collar of No. 2 and is 1,040 feet west of No. 8 shaft, which latter is 2,230 feet west of No. 2, and 124 feet below it; reference to the accompanying map will show the relative positions of these shafts, etc.

The formation is very straight and regular and the copper-bearing lodes are continuous and can be traced to the foot of the bluff to the west. The formation here is spoken of as being east and west; the dip is northerly 54° with the horizon.

The National was opened at first west of No. 3 shaft; all the territory to the east of it was claimed by both the Minesota and National companies, but was finally secured by the latter, and immediately thereafter the mining force was all transferred to the new ground adjoining the Minesota line.

It will be seen from the map that west of No. 3 shaft no stoping has been done below the third level, although the ground above was fairly rich in copper. The belts embraced within the limits of the workings of these mines are first, sandstone 40 feet wide; overlying this is a bed of conglomerate 30 or 40 feet wide, and upon this is a belt of trap 140 feet in width; but below the conglomerate land this trap is a belt of vein matter—generally assumed to be a contact vein—having a variable width of from, perhaps, 6′ to 15′ wide. Overlying the trap is a belt of amygdaloid varying also from 6′ to upwards in width, sometimes also making out into large pockets; this was called the

north vein and was never much worked, as it is a stamp lode, though affording some mass copper and barrel work. So far as opened by the old company in former years it afforded some rich ground, about 3 feet wide along the foot wall, and thence to the hanging it was lean. Some of this foot wall part of the lode was very rich; 300 tons of it were stamped which yielded 3% of copper; a larger portion, which included the body of the lode, yielded a little under 2%; these facts I got from Capt. Chynoweth, who was an officer of the National at the mine for 25 years.

Running through the trap from the conglomerate to the north vein are frequent fissures and in these and in their vicinity in the main vein the bulk of the copper was found. Especially was this true of a diagonal fissure that extends through the trap to the amygdaloid west of No. 2 shaft. This was found to be very rich in copper in all the levels; as it dips at a less angle than the formation it tends to intersect the conglomerate vein and in this line of intersection, it is probable, much copper may be found; the work now is towards reaching this result. This fissure was first found by a cross-cut, at right angles to the formation, and was thought to be an independent vein, but upon following it in both directions it intersected the main lodes; other fissures, of less importance, also yielded copper in considerable quantity. The conglomerate does not hold any copper; masses of copper were sometimes found in the conglomerate where an opening or fissure in the conglomerate had become filled with vein matter. One of these openings extended through the conglomerate to the sandstone and was very productive in copper, in fact was almost completely filled with pure metal. It was in a fissure in the conglomerate that a 500-ton mass of pure copper was found in 1857, probably the largest native mass of copper ever discovered. (The Phœnix mine produced a 600-ton mass a few years later but it wanted the completeness of the Minesota mass. The details of these discoveries I have heretofore given in the report for 1880.)

The great success of the National and Minesota mines was due to the constant occurrence of masses of copper and of barrel work; each of the companies had, finally, a small stamp mill erected on a rivulet that runs through the valley south of the mines, but this only afforded sufficient water for a portion of the year, and the copper thus obtained was but a small percentage of the aggregate products.

The mines yielded very richly in proportion to the openings made. This work of opening and stoping was excessively costly as compared to the same work now. It was all hand drill work and black powder for explosive. I was in a drift but a few days ago in the Osceola mine when four men were driving with an air drill—two men at each shaft—and they had advanced 98 feet the previous month, the drift 7½'x5½'. They had just blasted and the blast had opened ahead 5 feet, half the size of the drift. The next blast would take the remaining half. Such work was unheard of in the days when the National worked, and so it happened that when the masses of copper failed to occur in sufficient quantity to pay the usual profit the officers of the company, who were cautious, conservative men, shut down and allowed the mine to fill with water. But as will be noticed from the section the drifts afforded drainage to a considerable depth and this portion they allowed to be worked on tribute. From the company's share of the copper thus obtained from the old workings in the upper levels and the gleanings of the burros, the sum of $40,000 in dividends was afterwards paid to the stockholders.

The old company stopped work in 1871 and the mine was sold to Boston parties some years afterward and was not again worked, on company account, until in May, 1880, when the new company began the work of preparation to pump out the water. This proved a much more serious task than was anticipated. A 12" plunger pump was used and No. 2 shaft selected as the scene of operations. The shaft was found to be filled with timbers and rock, the debris of the tributers, who for ten years had been using this receptacle as a dumping ground for their refuse.

After nearly two years the work was completed and the mine was freed of water; the shaft was lined up in excellent shape and the skip road reached the bottom, a depth of 950 feet.

In the meantime a shaft was sunk in the amygdaloid vein to a depth of 340 feet, drifting was done to the east 100 feet, and to the west 250 feet. In all 14 tons of mass and barrel were obtained from this vein; of the stamp rock taken out no use could be made. Two cross-cuts connect the workings in the two veins, one from the second and the other from the fourth level. A shaft-house was also built over this new shaft, but all work has been discontinued in this vein, as it is mainly stamp lode.

Since the completion of No. 2 shaft two additional levels have been sunk 100 feet apart, making the total depth about 1,150 feet on the plane of the vein.

These levels constitute the 11th and 12th; the first has been drifted about 600 feet and the latter about 400 feet. In the stopes shown in the section in these levels considerable copper is to be seen and the winze west of the shaft is in very rich ground. Several large masses of copper were already broken down into the bottom of the level and an apparently still greater one was discovered in the foot wall, in the 12th level, west of the shaft. I should say that I saw in the mine at least 50 tons of mass copper ready or nearly ready to be cut up and hoisted. Capt. Parnell estimates the winter's product at from 100 to 150 tons, and he expects to have that amount at Ontonagon in the spring ready for shipment, and I am certain that he is safe in his estimate, as 30 tons are already there, and, with what I saw in the copper house and in the mine, the lower estimate is at least sure. He has a force of 14 men at work.

The most annoying trouble experienced now arises from the periodic flooding of the mine by the water which pours in from the Minesota. This occurs each spring when the snow melts away. All the ground along the vein in the Minesota and Rockland mines for a distance of three-fourths of a mile, has been dug out by the tributers until it has left a wide depression into which the water from the melting snow is conducted, filling the mine to the top and pouring through an opening between the mines into the National, floods it also beyond the capacity of the pump to control.

The point where this aperture is found is indicated in the map, just above the third level, and is claimed to have been made by the Minesota Co. many years ago, through the men inadvertantly encroaching upon the National ground.

The distress arising through this difficulty has led to a suit in trespass instituted against the Minesota Co. by its neighbor, that has been recently decided in the supreme court of this State in favor of the defendant, on the ground, as I understand, that upwards or 20 years having elapsed since the alleged trespass was committed, no action could be maintained.

Capt. Parnell is anxious to get the copper out of the mine before the annual flood arrives, which must, as heretofore, cause the suspension of work for a month or two, until the snow is all gone and the mine is again pumped out. It is a pretty large reservoir to empty—a mile in length. After the water in the Minesota is lowered below the point of connection there is, of course, no more trouble from it. Ordinarily the National, like most of the copper mines, "makes" very little water. The 12″ plunger will remove all the water that naturally collects in the mine, by running six hours a week. In former times a 6″ plunger sufficed to keep out all the water, and that by only running a portion of the time.

It seems very probable that the National mine contains a good stamp lode in the amygdaloid belt and also a fair portion of stamp rock in the conglomerate vein, and both of these extend through the whole length of the company's property, which runs to the river. The river is 570 feet below the surface at the east part of the mine, and it would seem that the best method of operating the mine now is to open with an adit driven from the river east on the amygdaloid or in the old vein. The advantages of this work would be many; it would prove the lodes for the entire distance. It would furnish many years of stoping ground above the adit. It would afford drainage for the entire mine, for all the water it could gather; it would do away with the necessity of hoisting, as the rock could all be run out of the mine through the adit in cars drawn by a small locomotive, as is now done at the Copper Falls mine; and above all, it would furnish the company with all the requisites for a stamp mill, without which the mine cannot be successfully worked. The stamp mill must be at the river; there is no other place possible, that I can see, and if the rock is hoisted to the surface in shafts and then run down to the river over an incline gravity road, it would be far more difficult and expensive to operate than the adit, and would also be more expensive mining. Running the rock down to the adit would be easier than hoisting it to the surface, to say nothing of the saving of the expense of a hoisting plant and the building of a long gravity surface incline; and keeping it in repair and free of snow in the winter is a serious matter.

The adit would be about a mile in length, but it would be all the way in the vein and thus be easy driving, and would be opening and paving the mine and thus would not be "dead work." The adit would furnish an outlet for all the rock that the mine could produce; sufficient evidence of this fact is afforded at the Copper Falls mine.

Even the matter of pumping the water for the mill can be avoided, I think, by bringing it in a launder from the falls in the west branch of the river above, a less undertaking than is done at the Atlantic mill.

The driving of this adit would not be a serious matter to accomplish. The old vein is easy ground to work; it is moderately soft and breaks from the force of the blast admirably. If desired, the opening could be pushed at several points as well as from the west end, by sinking the creek shaft and No. 8 shaft, etc., to the adit level and advancing the drift from them. In the light of recent mining operations in this country, successfully accomplished, the driving of this adit can be undertaken with perfect assurance of the result. There is no question but what it can be done, and at a moderate cost.

Heretofore it has been assumed that stamp mills for these Ontonagon mines should be at the lake; but I do not see the necessity of this, in fact there occur many objections.

The cost of conveying the rock so great a distance—12 miles or more—cannot be lightly assumed; and the beach in the vicinity of Ontonagon is extremely shallow. The sand extends for a long way out from the shore and is covered, but at a slight depth, with water. In the winter the ice piles up along the shore for a great distance out, resting on the shallow bottom; so that to obtain the necessary water for a mill a lengthy launder would be required reaching out into the deep water, or the water must be taken from the river at its mouth.

It might be objected to placing a mill for the National too near the river at the mine, that the refuse sand would be run into the river and tend to fill up the harbor and thus interfere with navigation. But it is doubtful if the sand from a stamp mill, even if run into the river, would be found to make any appreciable difference. For miles along the river are high clay banks, the material of which is washed into the river in immense quantity at every freshet, and is carried down by the current and lost in the great lake. It is probable the same would be the result with the refuse of a stamp mill.

The National company owns also the Rockland mine, which adjoins the Minesota on the east.

At present the plans of the National company seem to be to continue mining with a small force in the vicinity of No. 2 shaft, thus incurring but a small expense and, possibly, obtaining a sufficient amount of copper to meet all expenditures and accumulate a surplus and establish a reputation for the mine before deciding to proceed to open it largely. The No. 2 shaft is sunk to the 12th level; this latter and the 11th are the ones added since the new company took hold of the work, five years ago.

The 10th level has been opened east and west about 600 feet in length and some stoping done on each side of the shaft. In the 12th level they are now working west of the shaft, stoping out some masses of copper and cutting them up and sinking a winze below the stope in ground which is rich in copper. West of this stope is the fissure in which they have also worked up to the 10th level. As before stated, the ground where the men are working has a very promising look. I went through the mine, so far as the openings will admit of passage, and saw fair indications of copper in the new drifts, much of it, apparently, good stamp rock, which is not disturbed. The sinking being only for mass copper and barrel work. There are no facilities for obtaining copper in other forms.

The National, although an old mine, is not a deep one. It is of small extent, underground, as compared to many others in the peninsula, and yet so far as worked, it was a very profitable one. The original owners, the company that opened it and worked it, only expended in the aggregate a total sum of $110,250. All subsequent expenditures were met by the product of the mine. They received in dividends the sum of $319,255,—$3 for one. The total sales of copper produced amounted to the sum of $2,295,231.50.

Work was begun in 1848 and continued until 1871, after which the mine remained idle, except for tribute work, until May, 1880. Since that time a small force has been constantly employed, as previously explained, in opening and completing No. 2 shaft, getting the mine freed from water, doing the mining work before described, and repairing some of the houses, etc. In this work the sum of $150,000 has been expended. The work has been done under the superintendency of Wm. E. Parnell, a man of much intelligence and energy, and of life-long experience as a miner.

The location of the mine is in the village of Rockland, on Sec. 16, T. 50 N., R. 39 W.

Aggregate product down to 1883, 5,448 tons, 1,876 lbs.

Since the foregoing was written it transpires that the owners of the National have purchased the controlling interest of the Minesota, so that all controversy between the companies is thus permanently settled.

THE MINESOTA

mine lies next to the National, joining it on the east, and much of what has been said in connection with the latter is also applicable to the Minesota. It is a much larger mine than the National and was also a richer and more productive one and was worked during the same period. Notwithstanding the long period that has elapsed during which the mine has lain idle it is still fourth in the list of the dividend-paying copper mines of the State, that is the amount of dividends returned to the stockholders is only exceeded by those of the Calumet and Hecla, Quincy and the Cliff. The estate is a large one, consisting of 4,653 acres of land. The depth of the mine is 1,200 feet and its length 2,820 feet, lying between the Rockland mine on the east and the National on the west. Its elevation above the river is somewhat greater than that of its neighbor and does not possess the advantage which the National has of being opened by an adit, since the National lies between it and the river. The property is crossed by the same belts heretofore described and the formation is the same as in the National. Seventy per cent. of the product of the Minesota mine was mass copper, the remainder, small pieces —"barrel work," with a very few per cent. of stamp copper.

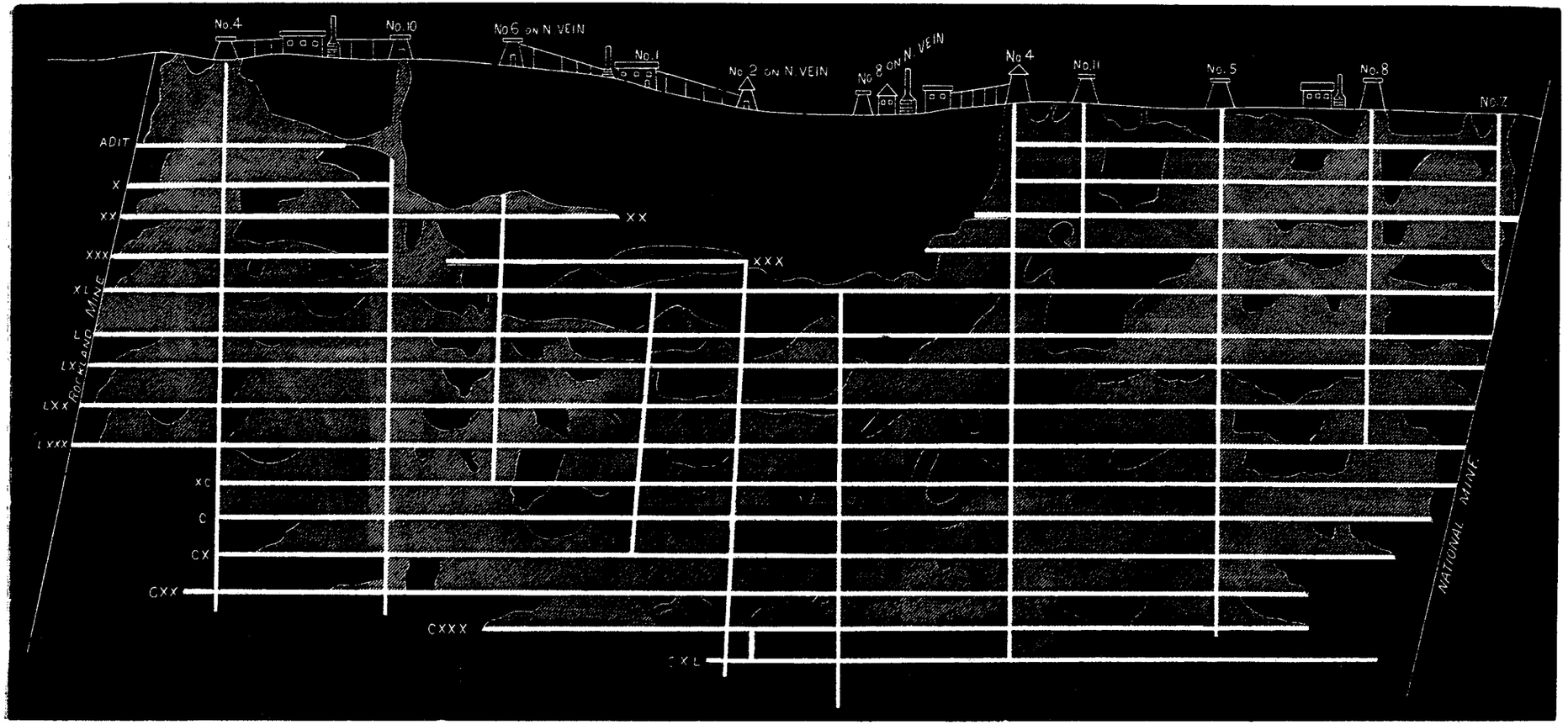
It was a wonderful deposit. Sometimes the only work was to cut up the masses of pure metal and hoist them to the surface. In places the stopes were nearly all copper.

The map of the mine, herein contained, shows only the workings on the south vein—the conglomerate vein—as in the National; but lying north of this, between it and the Amygdaloid, was a fissure vein running also east and west, but finally terminating in a cross-fissure to the west and intersecting the conglomerate vein to the east. In this longitudinal fissure the mine was first opened and worked before the fact of the existence of the other lodes had been ascertained. The National Company began on the conglomerate vein, and when they found that they were not working in the same vein as the Minesota people, they cross-cutted to find it, and came into a diagonal vein, as previously described. This middle vein in the Minesota mine lies north of the blank space shown on the section of the mine between No. 4 and No. 10 shafts. It dipped at a less angle than the conglomerate vein, and finally intersected it in the line indicated as the margin of the blank space on the map. Along this line of intersection of the conglomerate and the middle vein was the most productive ground found in the mine.

As has been previously stated, there is a controversy pending between the Minesota and National Companies regarding the water that flows from the former mine into the latter. The upper levels in the Minesota have been all dug out by tributers, making a depression all along the surface over the mine, which gathers a good deal of water in the spring, that fills the mine and runs through the opening into the National, flooding it for a time. But I should judge that the tendency of the water in the two mines would be to

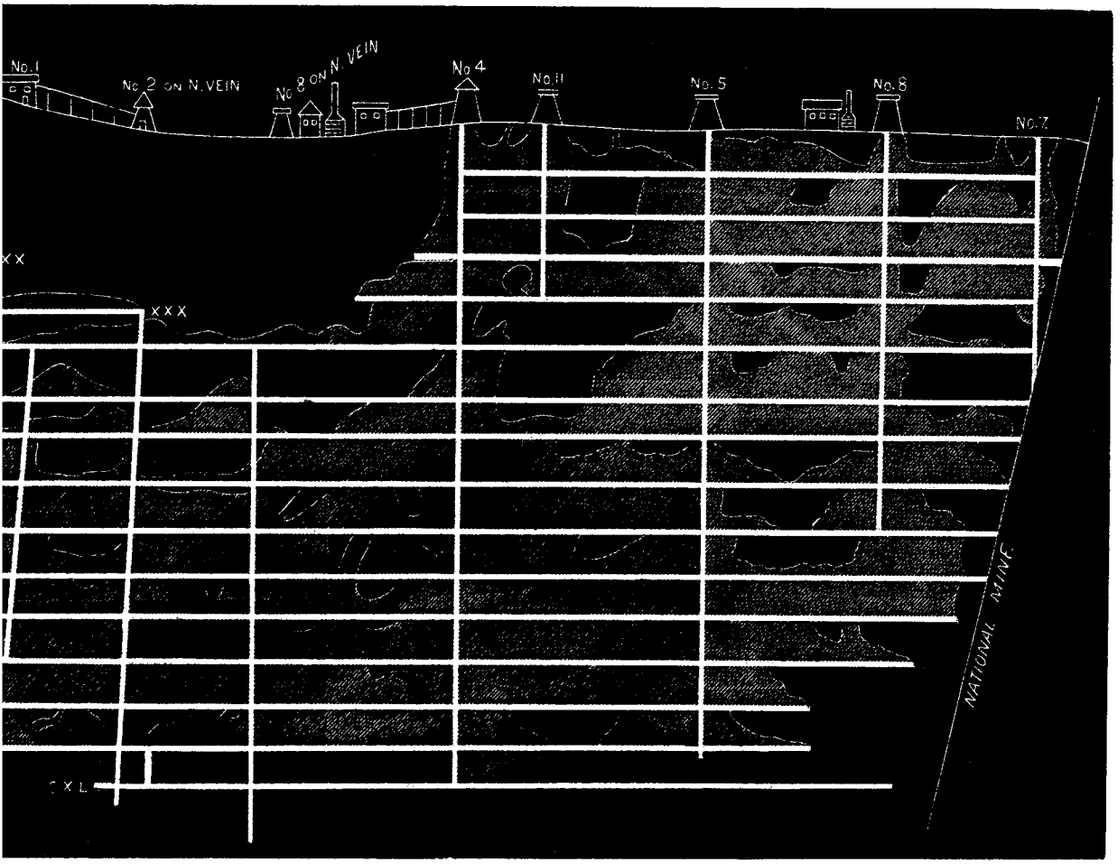
LONGITUDINAL SECTION OF THE MINESOTA MINE.

Scale, 300 ft. to one inch.



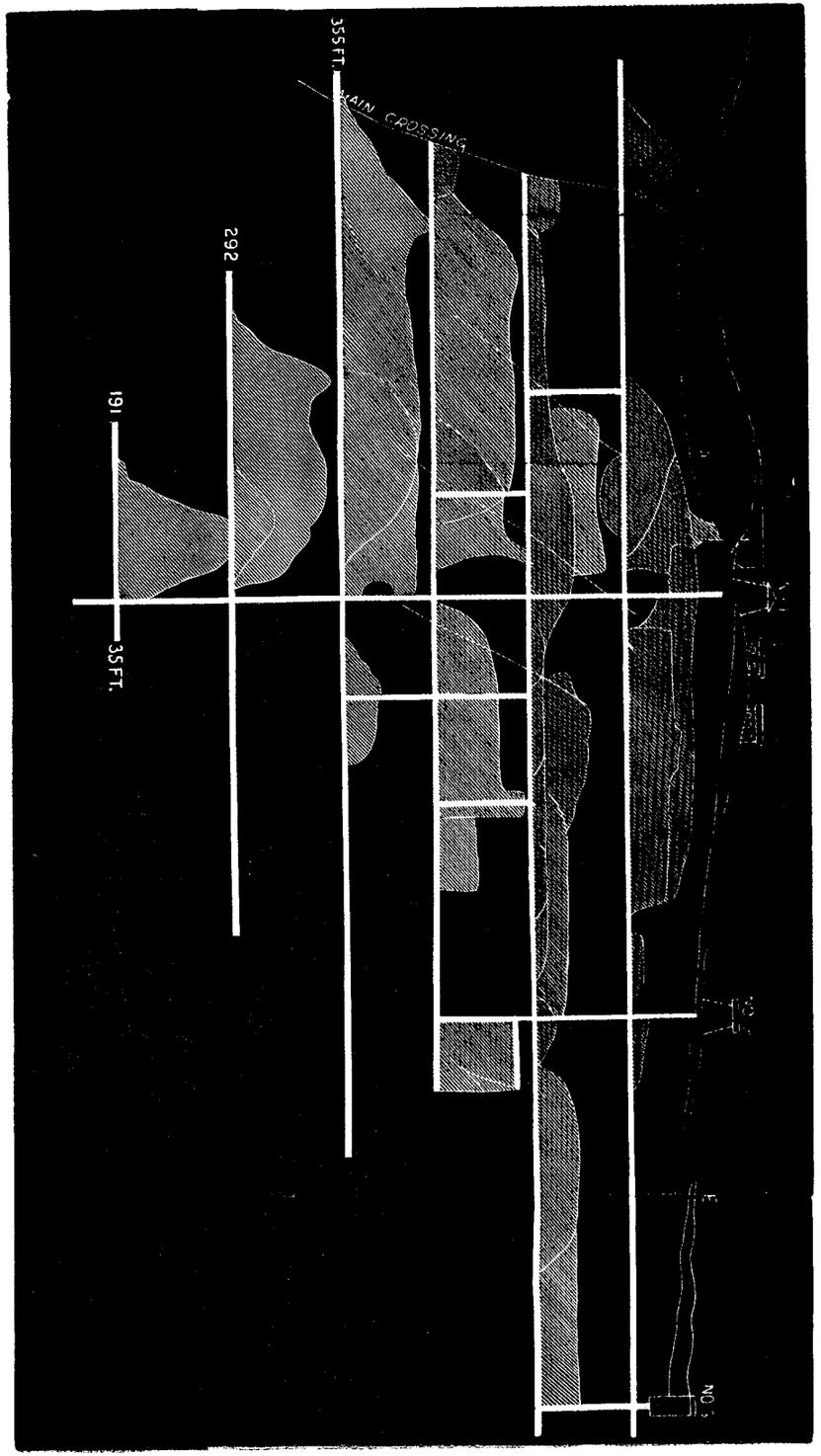
...DINAL SECTION OF THE MINESOTA MINE.

Scale, 300 ft. to one inch.



LONGITUDINAL SECTION OF THE MASS MINE, JAN., 1886

Scale, 120 ft. to one inch.



find its level anyway. The rock is so porous and the workings are so near together that the water must seep through. Of course, in time of a flood, it will rush through an aperture in far greater volume and in less time. There has been no change at the mine for years, and there are no changes contemplated, so far as I could learn.

The mine has produced in the aggregate 17,353 tons, 668 pounds of copper. The dividend paying point was reached in 1852, five years after mining was begun. The stockholders had advanced $60,000, and the balance of the expenditures ($320,000) was furnished by sales of copper produced, besides $30,000 for a dividend and a sufficient surplus.

The total of dividends paid to stockholders of the Minesota Company is $1,920,000.

A few tons of copper are annually produced in the mine by tributers. The amount obtained in this way in 1885 was 6 tons 608 pounds.

Office, New York. Geo. D. Pond, President; T. D. James, Superintendent, Rockland, Mich.

Since the foregoing was written, it transpires that the ownership of the Minesota mine has passed to the National Company. D. L. Demmon, Secretary and Treasurer, and Capt. Parnell, Local Agent. The two mines can be worked together to advantage by opening through both with a deep adit from the west end of the bluff. The National Company now holds the three contiguous mines—National, Minesota and Rockland.

THE MASS MINE.

I regard the work done at this mine as a valuable experience. When Capt. Chynoweth began in 1874 it was merely a wild location. The little work that had been previously done was of small account in the subsequent operations. The company raised by assessment the total sum of $26,000; all the rest of the money that has been expended in opening and working the mine and supplying all the machinery and other necessary equipments has been derived from the sales of the copper, which the mine has produced; each year the expenditures have held within the income thus obtained. The mine has produced fully 450 lbs. of copper to the fathom of ground.

The mine is a small one, opened in the Knowlton vein which passes through the northwest corner of the property. The vein being where it cuts the north line only 17½ chains east of the northwest corner, and from the same point south to the intersection of the vein with the west line is 25 chains, and the average dip is exactly 45° towards the northwest corner. It will thus be seen that the company owns a triangle shaped portion of the vein in this corner that is easily estimated. South and west of the Mass property lines, the vein passes to the Knowlton. There are six contiguous quarter sections belonging to the Knowlton Co., which if owned by the Mass and the vein properly opened and worked, there is every reasonable prospect would afford a profitable mine. There would be upwards of a mile of surface length of the Knowlton vein and an indefinite extent of it in the direction of the dip.

The Flint Steel River runs through the Knowlton property, curving northwesterly, and at a mile or two below the mine a stamp mill could be advantageously located. The Mass stamp mill is below the bluff, west of

the mine, on a small tributary of the Flint Steel. The main water course would gather the drainage of the entire valley and the hillsides which border it, and would furnish a sufficient amount of water to work up 300 tons of rock per day.

The mine could be opened by an adit from the south end of the bluff on the line of the vein, giving 500 feet of stoping ground above this adit level. A railroad track and a small locomotive would afford the facilities for running the rock to the stamp mill.

The mine could be worked very cheaply in this way. The productiveness of the vein in copper has been sufficiently shown in the Mass, in the Knowlton and in the Ogima mines, to establish confidence in that regard. There is a reasonable assurance that a mine thus largely opened and operated would be a paying one. Along the foot wall of the lode there is a frequent occurrence of small masses of copper that afford a cheap product which, when combined with enough stamp work, will furnish a profitable aggregate. I have so fully described all the characteristics of the lode in the previous reports that it would be mere repetition to dwell upon them here. The mass and barrel work amount to about one-half of the annual product, and the work of the mine has been confined to the capacity of the stamps. The mine is small, with a very limited supply of water, but the percentage of refined copper obtained from the rock treated is about $1\frac{1}{4}\%$. In looking over the record of the mine for the past ten years, I observe a remarkable uniformity in the monthly production; when any great discrepancy is found it is accounted for by the fact that the stamps were idle or through some equivalent fact. It is shown to be a fact in this mine that the same amount of openings of stoping each year affords about the same amount of copper.

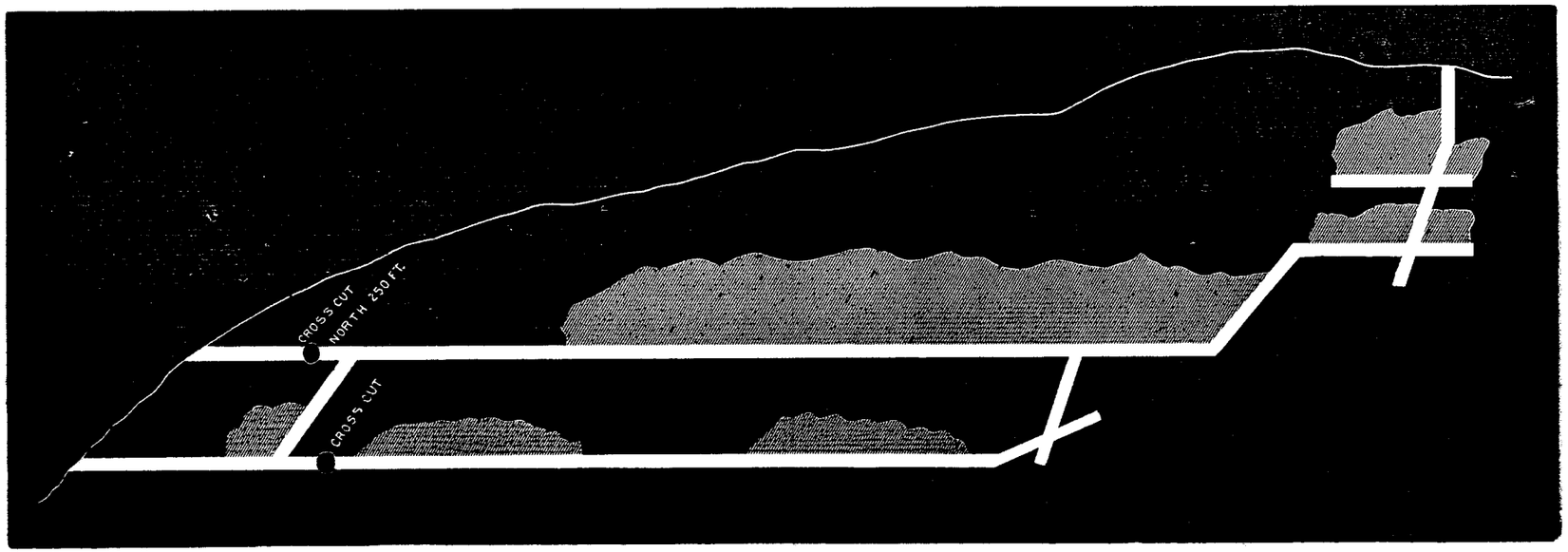
The mine is a small one and could soon be exhausted within the limits of the Mass property lines, and the chief officers and owners are too old or too indifferent to undertake the purchase of adjacent property. The owners of the Mass are the once famous Pittsburgh Company that were the first to begin copper mining on Lake Superior, at the old Cliff mine and later at the National. The company was distinguished for its good fortune and its conservatism, its good fortune in owning two of the most profitable mines, and its great caution manifested in shutting down as soon as the mines ceased to pay dividends.

Most of the prominent men in this company have passed away—Messrs. Avery, Howe & Cooper. The only one of the original officers equally prominent with those mentioned is Dr. C. G. Hussey, president of the company, but past 80 years of age. I am told the company would like to sell the Mass and that it can be purchased at a very moderate price; if the Knowlton can be had on equally favorable terms, the two would form the basis of a good mining enterprise for any parties who wish to undertake it.

The mine is as productive now as it has been at any time in its history, but the great fall in the price of copper rendered it doubtful if the mine could be worked without loss, so that the company, with its usual caution as ever shown in such matters, decided to shut down. It was worked on company account until September, 1884, when it was taken on lease by Messrs. Benj. Chynoweth, L. Collins, and L. Stannard. The company receives one-tenth of the product. The leasors have a store and furnish the men with all their supplies, and the profit on the goods sold helps them out on the mine. Though they estimate the cost of the copper at nine cents per pound, Mr. Chynoweth thinks he can produce it at that price.

LONGITUDINAL SECTION OF THE CALEDONIA MINE, JAN., 1886.

Scale, 90 ft. to one inch.



The mine has produced as follows—refined copper:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1857	8	228	1874	5	1,925
1858	6	.....	1875	1	1,014
1859	26	682	1876	40	1,952
1864	4	1,452	1877	54	238
1865	6	936	1878	206	339
1866	5	112	1879	228	294
1867	5	40	1880	258	1,159
1868	9	939	1881	233	1,684
1869	1	1,213	1882	368	1,446
1870	1	1,408	1883	329	1,474
1871	9	692	1884	281	718
1872	.....	1,403	1885	181	1,500
1873	4	265			
Total				2,279	1,607

The mine is down to the sixth level; they are sinking to the seventh. The work is mainly south of the shaft and they work up to near the west line of the property. The length of the shaft is 580 feet; depth, vertically, is 390 feet. The dip is 45° northwest. No pumps are used. What little water gathers in the mine is conducted into a "fork" near the shaft, and two or three times a week it is dipped into the skip and thus taken to the surface.

B. F. Chynoweth, Agent, Greenland, Mich.

THE OGIMA MINE

joins the Mass on the north. The company owns a fractional ¼ section that is crossed by the Knowlton vein, which was opened to a limited extent on this property many years ago. It never could be profitably worked by itself, but should be joined with the Mass and Knowlton.

A small amount of copper has been taken from this mine annually for 30 years, aggregating 491 tons, 156 lbs.

The product for 1885 was 6 tons, 291 lbs., ingot copper.

L. Collins, Agt., Greenland, Mich.

THE KNOWLTON MINE

lies southwest of the Mass, in the same vein, and has not been worked on company account for many years. The mine is near the south end of the bluff, fronting the Flint Steel valley. A few tributers annually mine a few tons of copper, always made up of small masses. In this way were obtained

10 tons, 1,976 lbs. in 1885. The total product since 1862 is 285 tons, 317 lbs.

The estate consists of 550 acres in all.

F. W. Capin, Sec. and Treas., New York, N. Y.

There are on the property a number of comfortable miners' houses, and some idle machinery.

THE FLINT STEEL CO.

is an organization which owns the old Caladonia and Flint Steel mine properties, where some unavailing work was done in years gone by. All the facts that could be gathered that are of interest have been heretofore set forth, and I find nothing to add to my previous description.

Walter Furguson, Sec. and Treas., 35 Pine street, New York.

Altogether the mine has produced 604 tons of refined copper.

THE EVERGREEN BLUFF

reveals nothing new. The company was organized in 1853 and expended considerable money with poor results. The mine is in what is called the Evergreen lode, which shows much irregularity and very little copper. Altogether the mine has afforded 679 tons and 864 lbs. of refined copper.

F. W. Capin, Sec. and Treas., 44 Exchange Place, New York.

The estate comprises nearly 1,000 acres of land.

Adjacent to the Evergreen Bluff is the

RIDGE MINE,

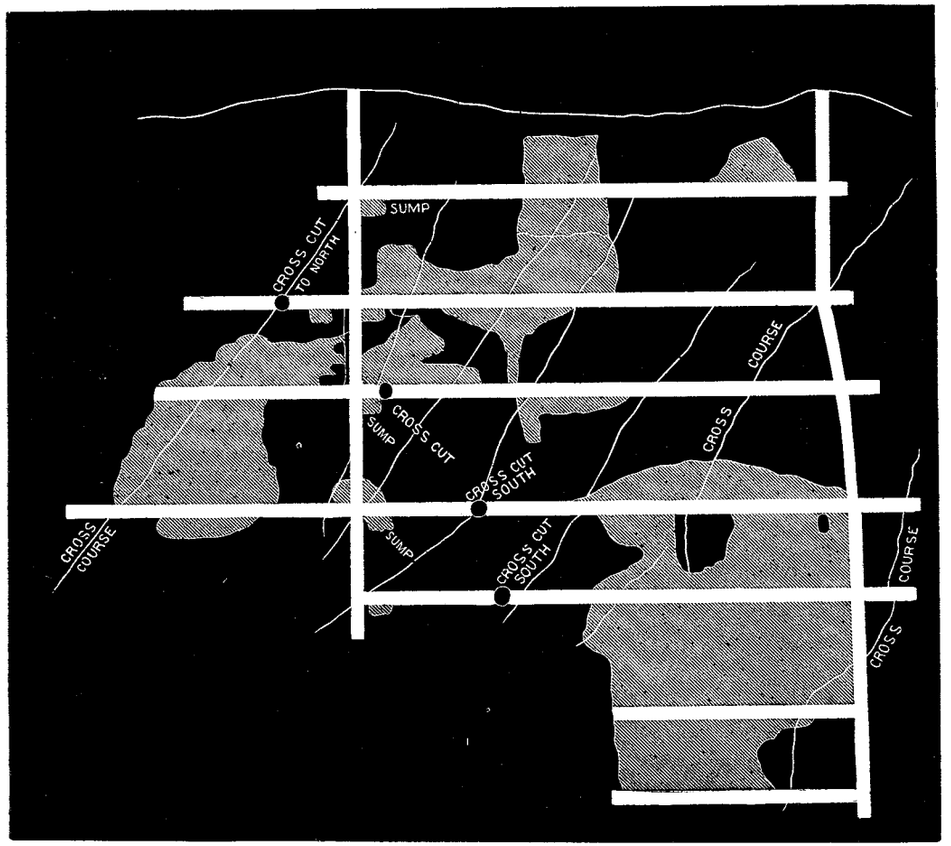
which is one of the oldest and most reputable mines in the Evergreen range, but which now is in the retired list. Two mines have been worked in this property, one in the Champion and the other in the Evergreen vein; both in the S. W. ¼ of Sec. 35, T. 51 N., R. 38 W., and 435 feet apart. The former was abandoned many years ago, and the latter has not been worked since 1883.

The Ridge has a good record. It bas produced pretty well, considering the primitive manner of working—all hand-drilling—and the little stamp mill has a very small capacity; but the Ridge has been somewhat of a favorite with the public, and very hopeful things have been expected of it in times past. The Company is not likely to start up working at the mine again until copper advances considerably beyond its present figures.

The following table shows the product for each year previous to 1885:

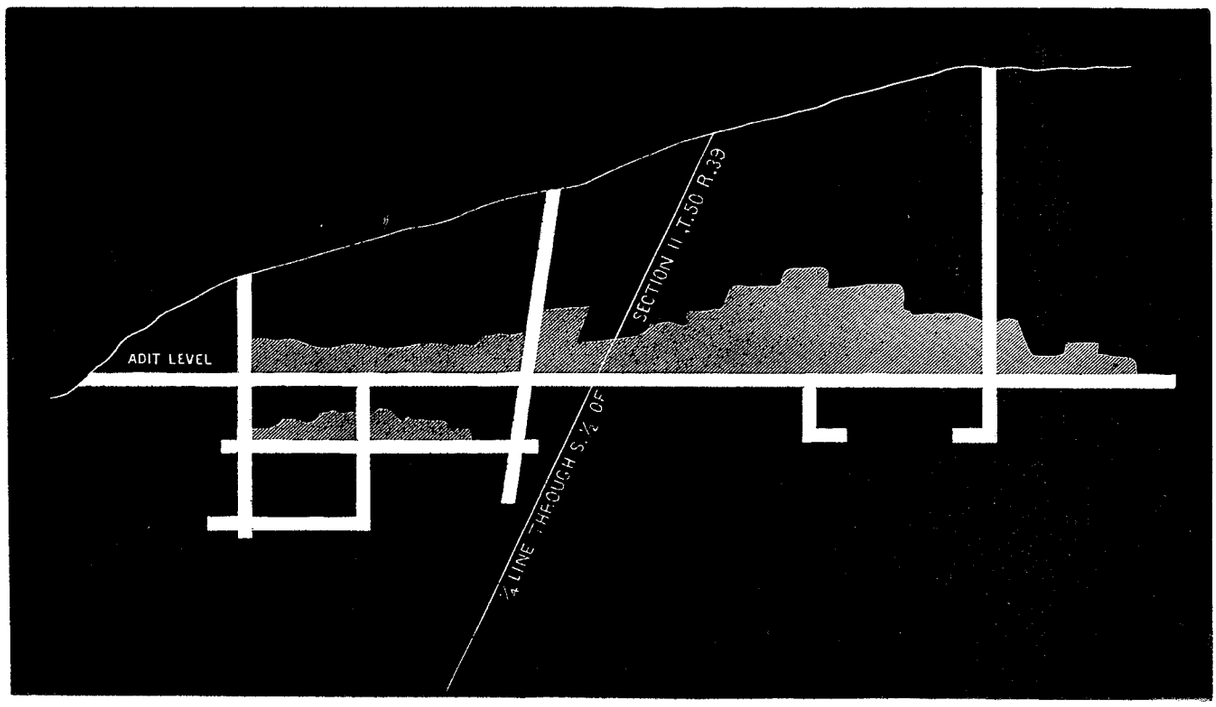
LONGITUDINAL SECTION OF THE RIDGE MINE, IN THE BUTLER LODE, 1886.

Scale, 120 ft. to one inch.



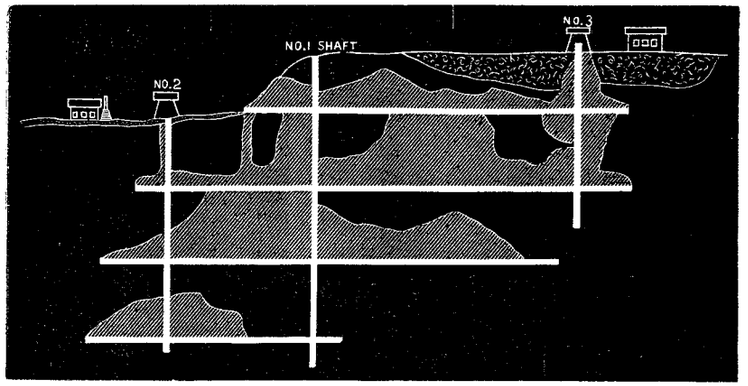
LONGITUDINAL SECTION OF THE FLINT STEEL MINE, JAN., 1886.

Scale, 216 ft. to one inch.



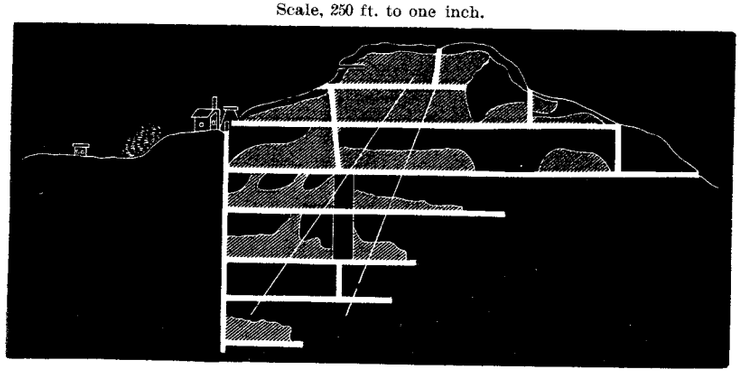
LONGITUDINAL SECTION OF THE KNOWLTON MINE. 1886.

Scale, 180 ft. to one inch.



LONGITUDINAL SECTION OF THE EVERGREEN BLUFF MINE, 1886.

Scale, 250 ft. to one inch.



Ridge Mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1855	30		1871	175	150
1856	35	631	1872	128	1,910
1857	36	1,874	1873	115	1,140
1858	29	790	1874	187	113
1859	39	690	1875	164	447
1860			1876	145	18
1861			1877	148	815
1862			1878	125	1,837
1863			1879	107	1,469
1864	8	917	1880	111	1,358
1865	85	433	1881	117	1,606
1866	71	411	1882	51	936
1867	94	1,537	1883	30	155
1868	86		1884	37	130
1869	126	1,840	1885	31	1,390
1870	122	1,700			
Total				448	1,892

The copper obtained for the past three years is the result of tribute work. W. Hart Smith, Sec. and Treas., 4 Exchange Place, N. Y.

The same gentleman is secretary and treasurer of several other mines in this vicinity—detailed descriptions of which have been heretofore given, and will be found in the Commissioner's Reports for the years 1880–81–82.

These are the ADVENTURE, HILTON, the LAKE SUPERIOR, none of which have been worked on company account for more than 20 years. Each affords annually a small amount of tribute copper.

The work that I described as doing at

THE AZTEC

three years ago, has been discontinued.

All told, the mine has afforded 353 tons, 863 pounds of refined copper. August Page, Sec. and Treas., Boston, Mass.

THE BELT COPPER MINES, LIMITED.

This company also has placed its mine on the retired list. The chapter recently added to the former history of this old mining location is one of misfortune and failure. It is proper to add that the result of this undertaking is in accordance with the expectations of nine out of every ten of the intelligent mining men in the copper districts.

The first company organized to mine in this property was as early as in 1848, and from that time on for many years, a good deal of work was done and very much money expended. The first organization was under a special charter from the Legislature. The company worked on assessments until its capital stock was exhausted, but only receiving from the sales of copper obtained down to 1862, all told, the sum of $13,320.17. In 1862 a reörganization was made, assessments called, and work resumed on a so-called large scale. This continued during four years, until 1866, when through the want of funds and their inability to find any copper or to squeeze the stockholders any further, they again shut down. Four years subsequently, in 1870, funds having been procured, under the stimulus of good times and high prices, work was again resumed and prosecuted, but with the same want of success.

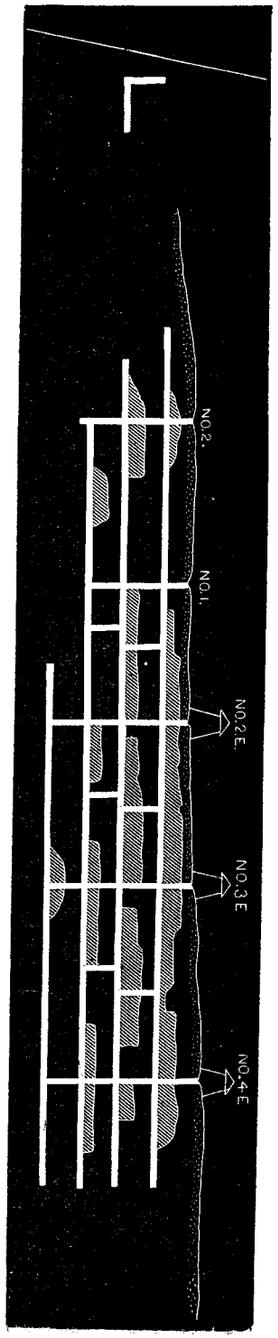
The name has been changed several times but never the fortune of the mine. That has never varied, it has been failure from the start.

Three years ago the property was purchased by its present owners and christened the Belt. The new company issued its prospectus from London, a document that created no little astonishment in the mining region here. The statements were so at variance with the well-known facts regarding this property that it could scarcely be credited that sane, intelligent men, acting in good faith, could make them.

Knowing that the mine had been operated for 20 years; that hundreds of thousands of dollars had been expended in the vain effort to secure a paying mine, and that the total product was but 216¼ tons of refined copper in all that time, how can men coolly state,—"The situation is the best on the mineral range; with proper machinery, etc., nothing can prevent making a larger output than the Calumet and Hecla, and receiving equal dividends!" It seemed then, as now, almost incredible that mining engineers, said to be competent men, recommended by the royal society of mining engineers, and in the employ of reputable companies, should state, as did Messrs. Rathbone & Coxan in a cablegram to England from Ontonagon, after having examined the property as they were sent here to do. "That the quantity of mineral in the rock is practically inexhaustible;" "that 2% of copper in the rock is a very low estimate;" "$200,000 will put the mine in shape to furnish an output of 200,000 tons of rock per annum, yielding 2% of copper."

In the same dispatch these gentlemen state "that having examined the leading mines in the district, they are convinced that the Belt is one of the most valuable properties on Lake Superior."

There was nothing in the history of the mine during its former years of working; there was nothing to be seen in the mine or on the property to justify these gentlemen in making any such report. The water had been pumped out of the mine so that they could examine it, and I went through it myself, afterwards, and without any exception I found it the most barren, unpromising mine I ever saw. No mine in the whole range could show so little copper; in fact there was not a particle to be found. It was barren trap with very little vein matter, calcite and epidote here and there sparsely disseminated; what the other veins might prove to be was unknown. They had not been tried, had not been discovered, and yet they state that, "after a careful examination of your ore, and comparing it with the produce of neighboring mines, I am of the opinion that 2% of copper is a very moderate estimate of its richness."



LONGITUDINAL SECTION OF THE TOLTEC MINE, 1886.

Scale, 300 ft. to one inch.

No one would question but what the Belt is a good property to explore, and all would concede the possibility of the discovery of rich bearing lodes, but we can only know of their existence when they are found. The probability of their existence is food for conjecture and a stimulus to discovery, and while the Belt property is undoubtedly crossed by all the mineral lodes of the Evergreen range, the discovery of these lodes had not been made on this property up to the time of its purchase by the present company; so that the surpassing richness so freely attested to by the various gentlemen whose evidence was taken regarding the value of the property, was wholly imaginary, based upon things unseen. The same could be said with equal truth of the whole mineral range. There is no part of it of the same extent where an equal amount of work has been done, where less success has been met with than here. All this by no means condemns the property, but it should make persons cautious not to risk extravagant statements for which there is only an imaginary basis.

At the time of my recent visit to the mine it was closed down and all work had ceased. Capt. John Trevarrow was resident at the mine and employed to look after the property. Hon. James Nercar of Ontonagon is the company's resident agent. I gathered from Mr. Brand, the former agent, many of the details of the work. The mine closed down in October, 1885; the new stamp mill was completed and started in February, 1884, and was run until the following August. They tried stamping the old burro rock but it produced no copper. The same proved to be practically true of the so-called stamp rock obtained from the old mine. Mr. Brand states that the last month he run through 700 tons of selected rock taken from the Knowlton vein which gave 1½% refined copper. Subsequently, under the superintendency of Mr. Rathbone, an English engineer sent over by the company to investigate matters, 1,500 tons of rock taken from the Knowlton vein, without any attempt at making any special selection, was tested, which gave about .9% of copper.

The accompanying sketch represents the old mine as it now is. They seem entirely satisfied that the old mine is valueless.

The work in the Knowlton vein is mainly opening. The southerly shaft —the Knowlton—is 300 feet down to the third level. Woolsely shaft is 720 feet north of this, and is down below the first level 160 feet deep. These shafts are connected in the first level, which reaches nearly 200 feet further north beyond Woolsely shaft. Great Western shaft is 540 feet north of Woolsely, and is down 120 feet deep, to a little below the first level, which latter has been driven south 80 feet from the shaft.

The second level extends 480 feet north of Knowlton shaft and 160 feet south of it. A winze north connects it with the first level. The third level was driven 100 feet north of Knowlton shaft. A few small blocks of ground have been stoped, the main shaft being a block north side of Knowlton shaft up from second level.

The Belt mine has produced in

Belt Mine.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1882	2	1,624	1884	89	351
1883	8	402	1885	13	1,433
Total				113	1,811
To which add the product of previous years				216	475
				330	286

The new stamp mill cost $100,000, has one Ball stamp in place and a second one ready to put up, 40 Collum washers, iron frames, three Evans Slime tables. The mill is on the Fire Steel River, 1¼ miles from the mine, with which it is connected by railroad. The company has a locomotive and rock cars for drawing the work.

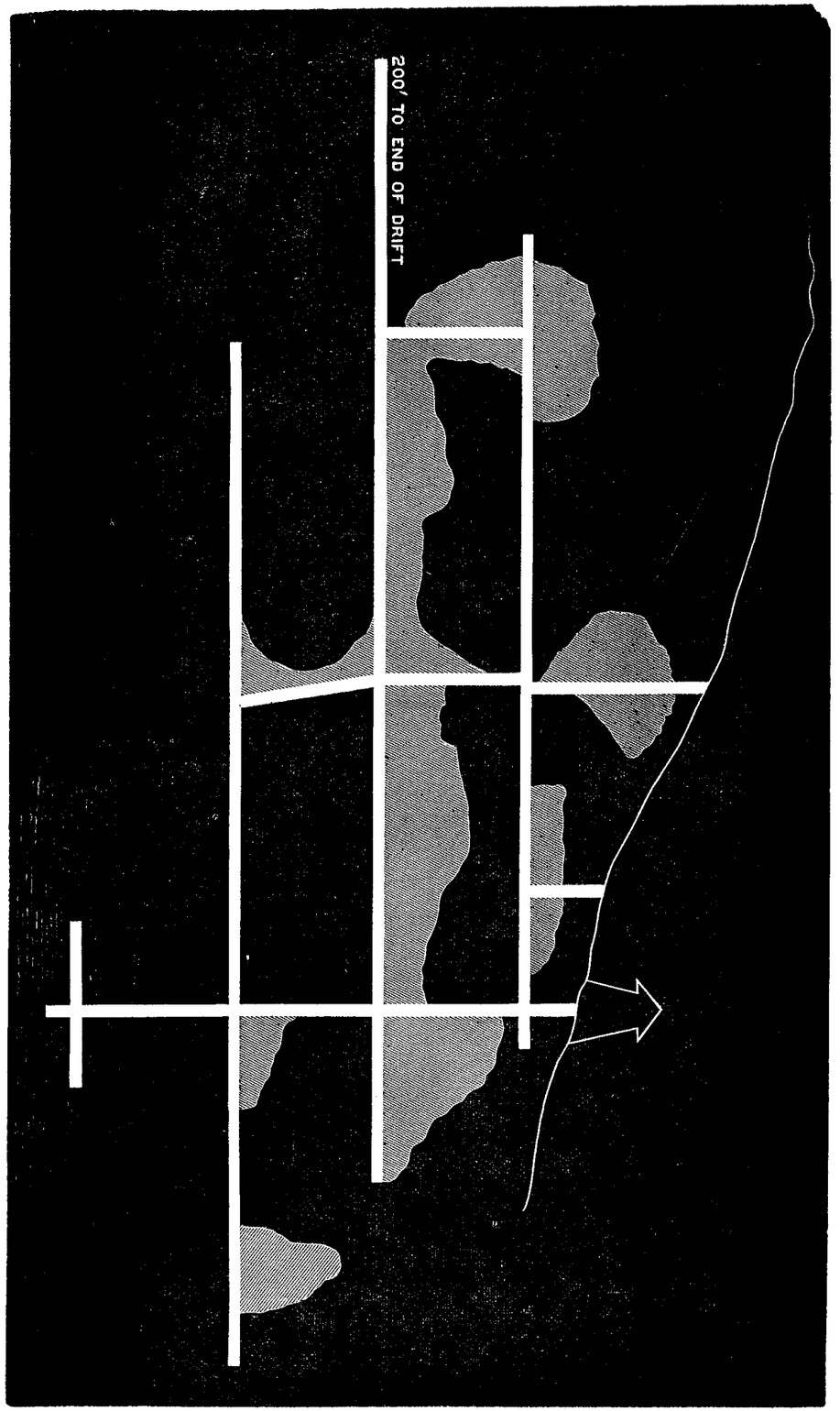
They have also built a rock house at the mine, furnished with two Blakes crushers 10″x15″; have also built an office, and an agent's house nearly complete; have procured a second-hand hoisting engine, also new Rand duplex compressor and 16 air drills. They have everything ready to work; seem only to lack copper, or at least lack it in quantity sufficient to pay to work the mine at present market price of that metal.

At the time of my visit, the company's books had been sent to England. The following was shown me, however, and given as embracing the essential facts, financially:

THE BELT COPPER MINES, LIMITED.

Balance Sheet, 30th Sept., 1885.

DR.		
TO CAPITAL:		
Nominal Capital—		
50,000 shares at £5 each	$1,215,000 00	
of which there have been issued—		
26,984 shares, fully paid, to the vendors	655,711 20	
17,820 ordinary shares, on which £5 per share has been called	433,026 00	
1,834 Preference Shares of £5 each (with preference rights of £10 per share in dividends per annum, cumulative), on which £5 per share has been credited as paid, issued on the surrender of the like number of ordinary shares to the allottees of 917 debentures, in terms of special resolutions passed 31st December, 1884	44,566 20	
	$1,133,303 40	
Less calls unpaid	4,671 22	
		$1,128,632 18
TO DEBENTURES:		
917 debentures of £25 each	$111,415 50	
Less instalments unpaid	23,262 39	
		88,153 11
TO VENDORS OF MINE:		
1,016 fully paid shares as yet unissued		24,688 80
Debenture interest accrued to date		3,132 99
Sundry creditors		5,906 00
Amount received on forfeited shares		607 50
		$1,251,043 78



LONGITUDINAL SECTION OF THE BELT MINE, IN THE BUTLER LODE, JAN., 1886.

Scale, 90 ft. to one inch.

CR.

By purchase of the "Penn," "Bohemian" and "Great Western" mines, with buildings, machinery, and plant, etc., under agreement of 14th July, 1882, viz.:—in cash		$121,500 00	
in fully paid shares		630,400 00	
			$801,000 00
BY EXPENDITURE, ETC., AT THE MINES:			
As per statement to 30th September, 1884		$327,031 12	
Expenditure since, viz.:			
Plant and machinery, including freight, etc.	$14,371 10		
Wages in erection of machinery and development of mines	33,870 50		
Stores	10,701 29		
Fuel	3,531 80		
Salaries, traveling and general expenses	6,331 97		
Insurance	1,764 78		
Stamp mill wages and smelting charges	4,671 36		
Local director's fees	121 50		
		75,364 34	
		$402,395 46	
Less, sales of copper, year to date	$22,737 67		
Stock of copper, 30th September, 1885	1,568 26		
	$24,305 85		
Deduct stock, 30th September, 1884	18,054 00		
		6,251 84	
			396,143 62
BY COST OF ADMINISTRATION IN ENGLAND, INCLUDING PRELIMINARY EXPENSES:			
Amount expended to 30th Sept., 1884, as per last statement		$30,211 80	
Expenditure since, viz.:			
Engineer's remuneration	$1,530 90		
Office salaries	1,592 74		
Directors' fees	2,065 50		
Trustees for debenture holders	1,822 50		
Traveling expenses	745 10		
Office rent, stationery and incidentals	1,119 98		
Law and accountant's charges	1,416 32		
Bankers' interest, balance of account	270 80		
	$10,565 86		
Less transfer fees	4 86		
		10,561 00	
			$40,772 80
By debenture interest			6,220 23
cost of remittances to the mines			1,304 97
office furniture at cost			949 40
sundry debtors			365 83
stock of copper			1,568 17
BY CASH			
At bankers		$1,180 12	
In hand		13 42	
At Houghton Bank		342 40	
At the mines		115 13	
			1,758 75
			$1,251,043 78

We have examined the above account, and find it to agree with the books and vouchers in London and with the accounts received from the mines.

London, December 1, 1885. PRICE, WATERHOUSE & CO.

The belt embraces what were formerly known as the Bohemian, Great Western and the Penn mines.

Bohemian, one of the early villages in Ontonagon county, which after so many years of abandonment was revived, is again deserted and the post-office discontinued. It is not known what action the company will take.

Joining the belt is the

TOLTEC,

one of the important mines of an early day. A half million dollars, it is claimed, were expended here, resulting in a total production of copper of 206 tons, 1,433 lbs.

Joseph Vila, Sec. and Treas., Boston, Mass.

THE VICTORIA MINE,

which I examined and wrote up very fully in 1882–3, because it seemed likely to possess importance from the fact that Capt. Thomas Hooper was at work pumping it out with the view to testing the value of the mine. After freeing the mine of water, Capt. Hooper did not find it to be as promising as he had been led to anticipate. This, with the depreciation in the price of copper, led to his abandoning the mine. The estate comprises 2,000 acres of land and is property worth exploring, since, if a productive lode were found, the location has important advantages for economical working, as was explained two years ago.

The aggregate product of the mine down to the present time is 186 tons, 1,279 lbs., refined copper.

A. W. Coffin, Sec., Boston, Mass.

THE NORWICH

was once an important mine and is still one of the best known locations in Ontonagon county, though no mining work has been done there since its abandonment, in about 1865. The mining at the Norwich was mostly done, however, prior to 1856.

The total of the products is 496 tons, 1,360 lbs.

Sec. 12, T. 49, R. 41; the mine being only a half mile from the Ontonagon River.

THE NONESUCH MINE

affords an example of great extravagance and folly. Four hundred thousand dollars, it is said, were expended by the new company in the construction of buildings, machinery, etc. All this was described in the report of 1882, since which time no work has been done, except a small amount of tributing. The aggregate product is 180 tons, 1,072 lbs.

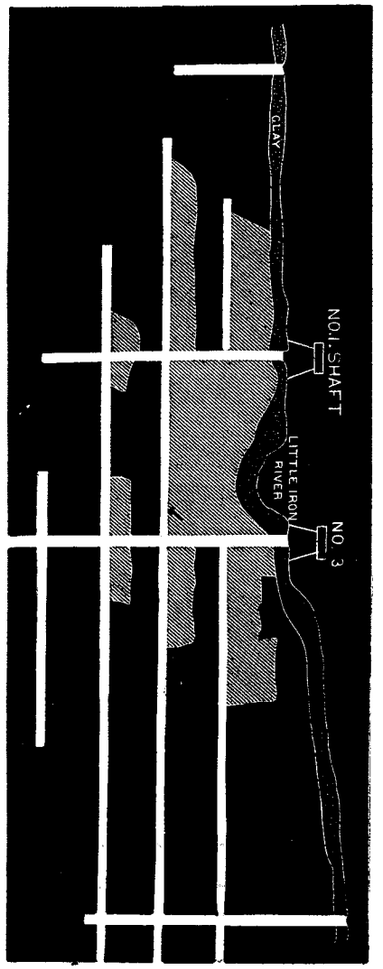
H. L. Horton, Sec. and Treas., Chicago, Ill.

"It takes a mine to make a mine" reads the Spanish proverb, and the history of Lake Superior copper mining proves the truth of it. But unfortunately, as in the case of the Nonesuch, the Belt and some others of a similar unfortunate recent history, the mine expended did not create its substitute.

The money has gone in, but there is none flowing out. Stamp mills and rock houses, etc., no matter how elaborate and expensive, are valuable only as adjuncts in creating wealth. If they are permanently idle they are practically of no more worth than the dead trees that cumber the ground.

The fine stamp mill at Lac La Belle, costing $184,000, and other surface expenditure aggregating $1,000,000, represent only so much absolute waste of capital, unless some mineral discovery shall be made that shall make all this preparation available.

One would think that experience should have taught men, by this time, that the proper thing to do is to develop the mine before making such extensive preparations to work it. The all important thing is to have a good mine, everything else is only accessory. All intelligent efforts in the way of exploration is justifiable, but until the essential facts regarding the mine are reasonably established, elaborate surface expenditure is folly.

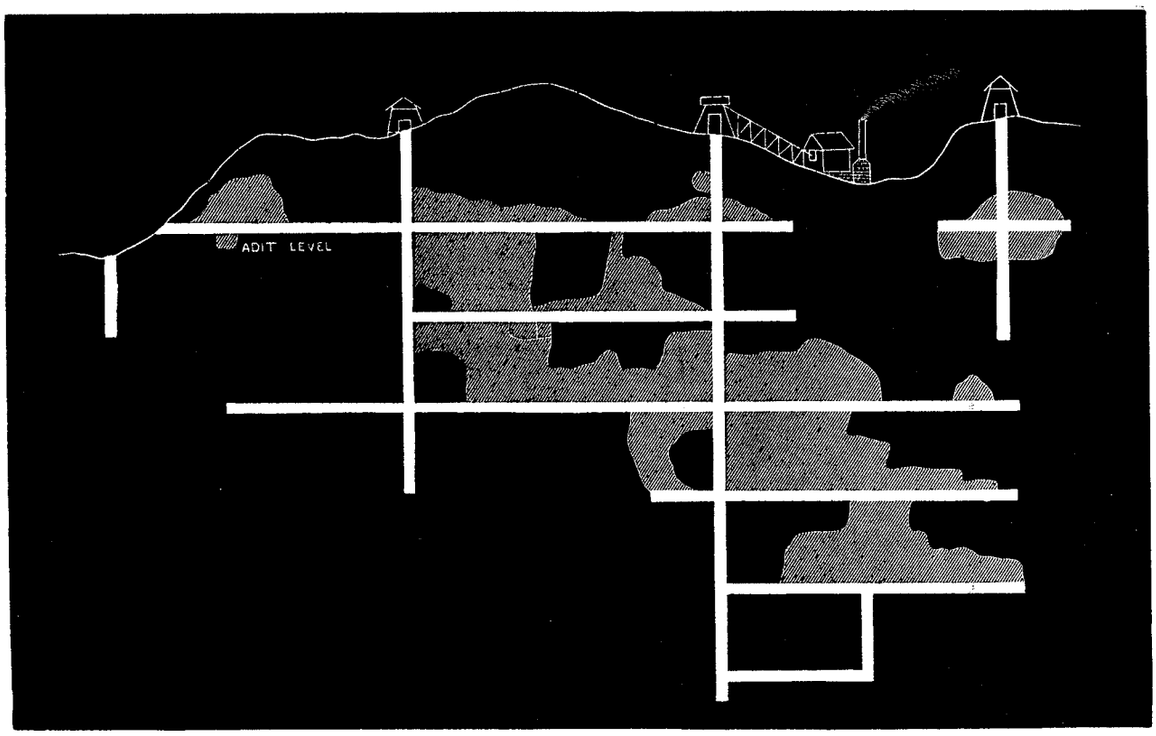


LONGITUDINAL SECTION OF THE NONESUCH MINE.

Scale, 200 ft. to one inch.

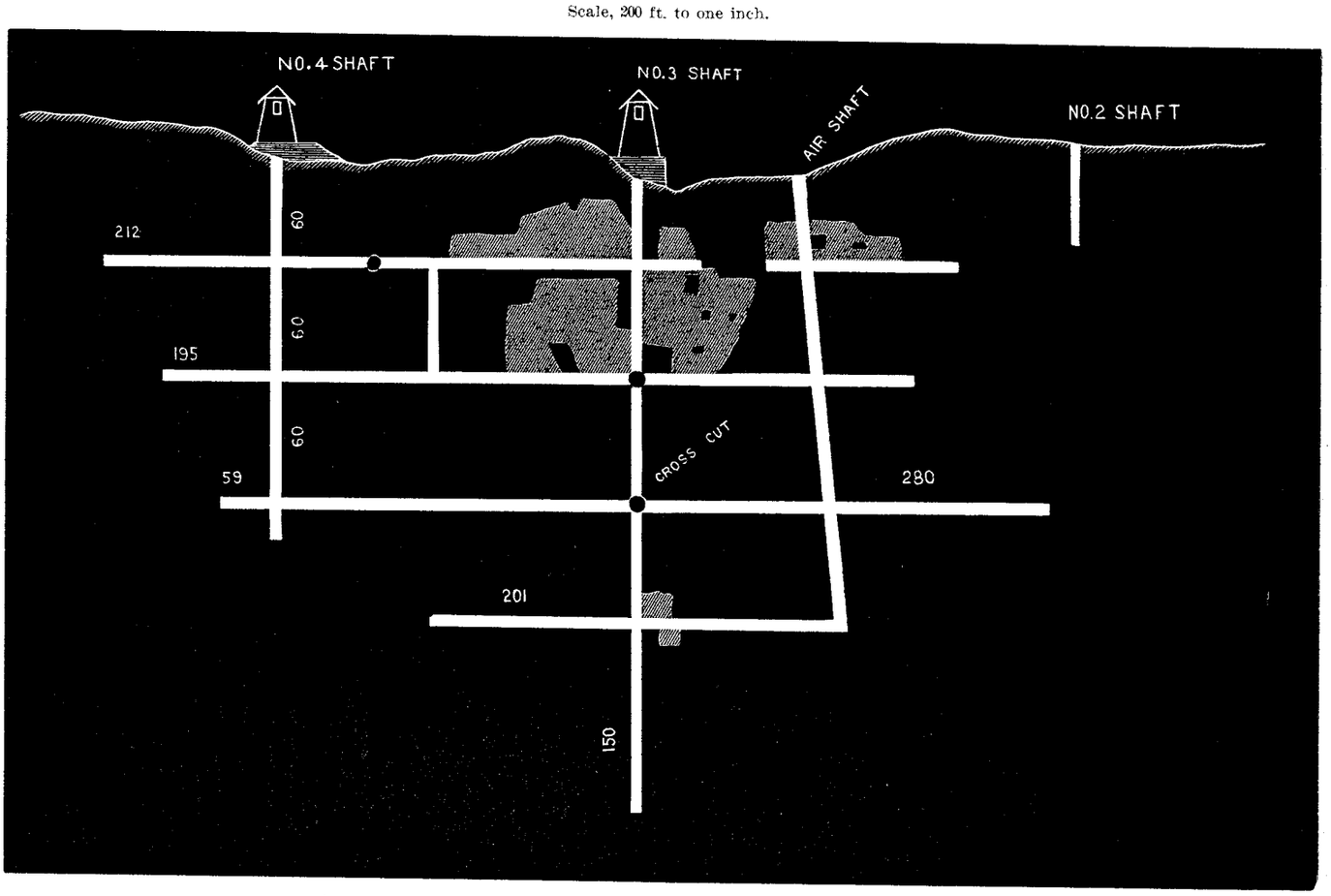
LONGITUDINAL SECTION OF THE HENWOOD MINE, JAN., 1886.

Scale, 120 ft. to one inch.



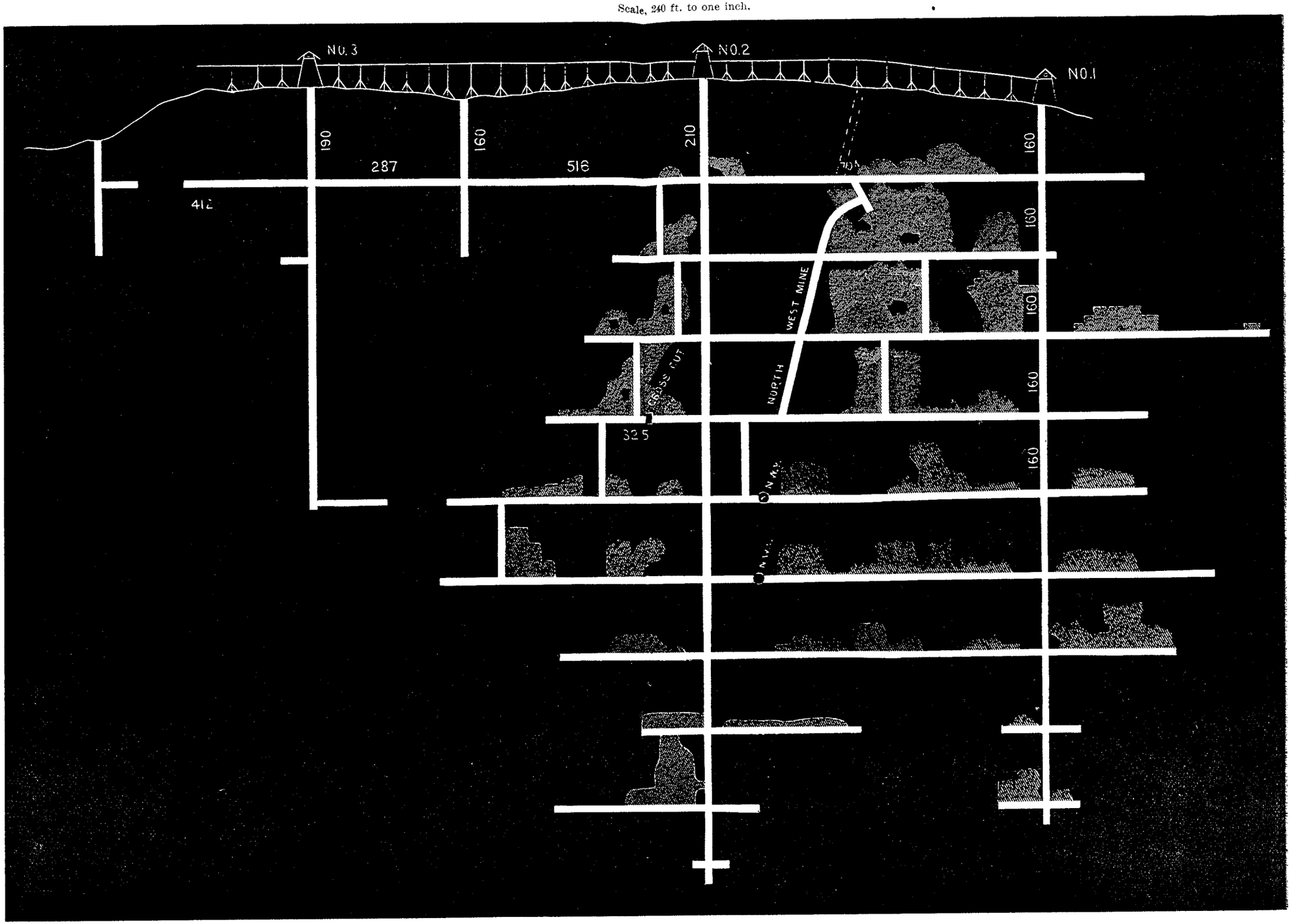
LONGITUDINAL SECTION OF THE VICTORIA MINE, 1886.

Scale, 200 ft. to one inch.



LONGITUDINAL SECTION OF THE CONGLOMERATE MINE, JAN., 1886.

Scale, 240 ft. to one inch.



History seems to repeat itself in mining as in everything else. People of this generation will recite the mistakes of their predecessors of a former time; will relate how stamp mills were built and great expenditure of money made at locations "down on the point," before actual mining was scarcely begun, and where, in instances, it was pursued to but a limited extent. But alas, for our consistency! we have but to look around us to behold that at these very places, which have so long stood as monuments of the folly and mismanagement of the past, the self-esteemed wise ones of the present generation have but just repeated the errors and inconsistent management which they have been so ready to condemn, have exemplified, in a greatly exaggerated and magnified form, the very follies which have constituted the darkest shadow in the history of mining.

But fortunately there is a new generation growing up who will be far wiser in such matters than those of the present or were those of the past. They will assume the burdens of our work ere long and, probably, in spite of the teachings of experience, while condemning the mining errors and follies of the past, will forthwith proceed to do likewise and repeat them on a still greater scale.

These reflections naturally suggest the Keweenaw peninsula and bring us to the consideration of the

CONGLOMERATE MINE,

which affords, perhaps, the most notable example of injudicious outlay that the region presents. It is a location where mining work has been prosecuted for 40 years, and the record of every successive attempt is the record of a failure. But the primitive operations of the predecessors of the present company are dwarfed into insignificance by the lavishness of their final successor. Horace Greeley, Oliver Johnson, and James G. Clark, among the original corporators and officers of the old Northwest, would rub their eyes in astonishment to behold the transformation that the scene has undergone.

The early companies,—the Northwest, Pennsylvania, and the Delaware,—worked fissure veins, of which a number were mined in and were known as the Stoughtenburg, Northwest, Clark, Hogan, Kelly, Delaware, etc., veins. The history of all these old companies was given in the Commissioner's report for the year 1880, at which time all the lands, property, etc., formerly held by these old concerns were merged into the new organization, the Conglomerate, which began operations Jan. 1, 1881, and worked continuously until 1884, when all operations ceased. In these three years the company opened a large mine, as will be seen by refering to the map of it contained in this report, built many new dwellings, store, office, stone-house for compressor, for boilers, for hoisting machinery, etc.; built seven miles of railroad to Lac LaBelle, where a new stamp mill was erected, etc. In all this work the new company raised and expended in the three years' time, the sum of $1,300,000. And now it is perfectly apparent that the mine will not pay to work. Unless some new mineral deposit can be found in which a profitable mine may be opened, something that has not yet been discovered, all this preparation, the result of so much labor and cost, will go for naught.

The mine, as will be remembered, is in the conglomerate belt which underlies the great greenstone formation that constitutes the most prominent feature of the northeastern part of the Mineral range.

At this mine the conglomerate belt is 25 feet in width. In the same belt are the Allouez and the Peninsula mines, many miles to the south of here; neither has ever proved profitable.

At the time of my visit to the Delaware, in Dec., 1880, when the whole plan of future operations was explained to me, it did not seem probable that the scheme would be carried out until the mine should be opened and the richness of the lode practically determined, as could be very easily done, since the company had a stamp mill and other machinery used in operating the old Northwest vein, the mine which they were at that time working. The whole plan, which has since been carried out fully, was all determined in advance, and heralded far and wide as one of the most magnificent mining schemes of the time. The mine was described as a veritable bonanza; and yet at that time the only tests that had been made in the lode were embraced in four shafts that had reached to a depth of 20 to 40 feet, and only one of them showed copper in paying quantity. And yet at that stage of development, with that meagre showing, I was confidently assured that this lode was to redeem all the disasters of the past! Rather it was to climax all the disasters of the past.

The company ascertained the fact that the lode was not a paying one long before the new stamp mill and the railroad, etc., were built. In 1882 56% of the rock actually broken in the lode was ground and treated in the old mill, 41,104 tons, which yielded 671,681 pounds of copper, $\frac{81}{100}$%. Yet no halt was called, however inevitable failure must have appeared. The channel connecting Lac La Belle with Lake Superior was dredged out so that vessels could enter and load, etc., at the company's dock.

In the spring of 1883, Mr. Chas. H. Palmer, C. E., was appointed agent of the company, which position he still holds. Mr. Palmer has kindly furnished me with the following interesting statistics of the last year of work, when every effort was made to give the business a fair test.

Details of the mining costs at Conglomerate mine during the year 1884. The total credit account is proportionately deducted from the department costs in making these details:

Total No. of tons of rock stamped in 1884	120,868 tons.
Yield of mineral copper	1,682,100 lbs.
Per cent of mineral copper in rock treated	.695 per cent.
Yield of ingot copper	1,140,173 lbs.
Yield of ingot copper	570 tons 1,731 lbs.
Per cent. of ingot copper in rock treated	.47 per cent.
Pounds of ingot copper in tons of rock treated	9.43 " "

ITEMIZED MINING COST PER TON OF ROCK.

	Cents.
Mining cost (underground)	.7374
Compressor cost	.0192
Pumping	.0101
Hoisting	.0179
Handling in shaft-house	.0282
Transportation to rock-house	.0216
Breaking in rock-house	.1080
Transportation to stamp mill and maintenance of 7 miles of railroad, etc.	.0625
Stamping, working and drilling the rock—the copper	.4119
General surface expense	.0385
Office, etc., expense	.0556
Total cost	1.5789

RECAPITULATION.

	Cents.
Total cost of rock delivered on the surface	.8808
Handling of rock between mine and stamp mill	.1921
Stamping, dressing and delivery to dock	.4119
Superintendent and general expense	.0941
Total cost per ton of rock treated	1.5789

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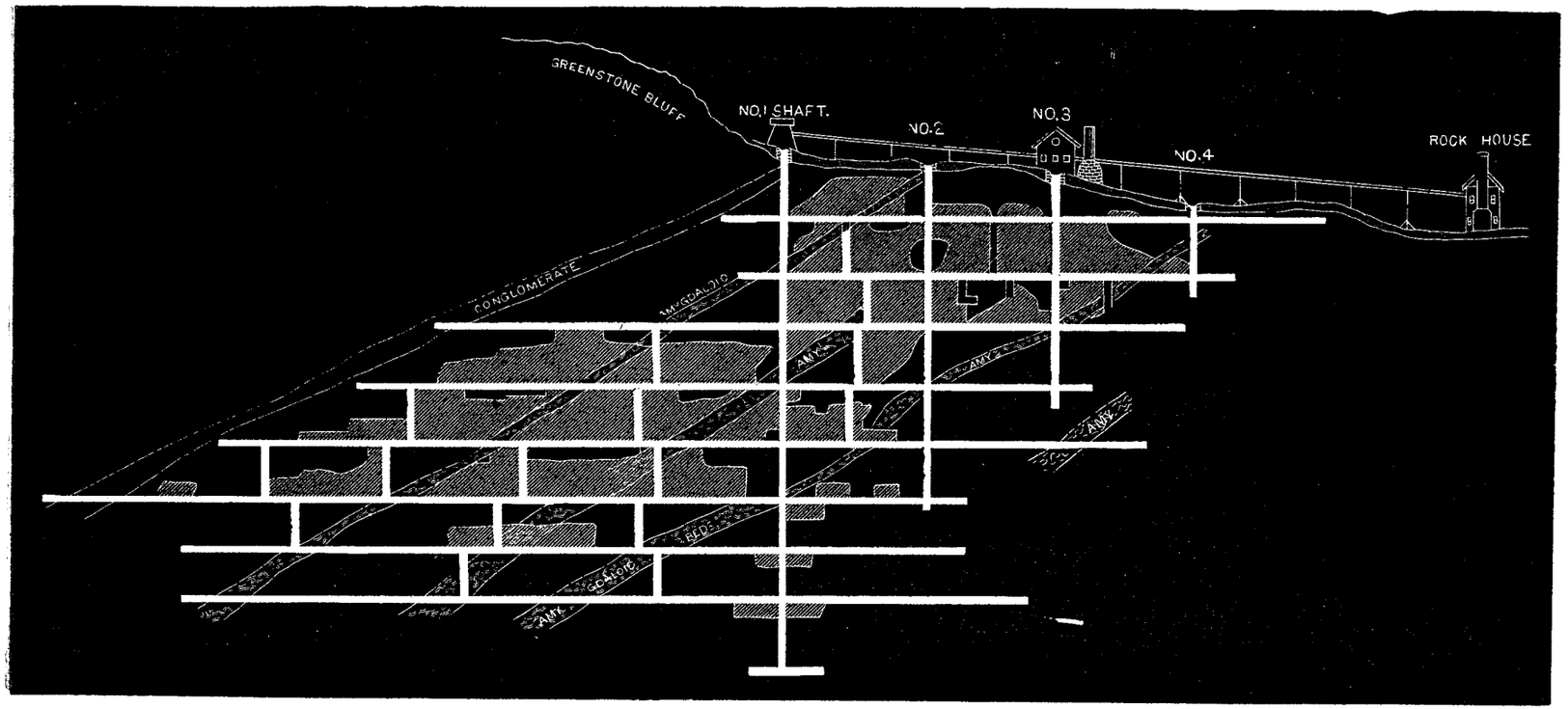
.....	1.5789

VERTICAL SECTION OF THE DELAWARE MINE (CONGLOMERATE MINING CO.), 1886.

Scale, 240 ft. to one inch.



COMPARATIVE COST PER TON OF ROCK IN DIFFERENT MONTHS.

	Cents.
Cost per ton in January was	2.149
Cost per ton in March was	1.913
Cost per ton in June was	1.471
Cost per ton in September was	1.319
Cost per ton in October was	1.271

DETAILS OF MINING COST BASED ON THE ROCK STAMPED.

	Cents per ton.
Contract cost of breaking rock	.4621
Mine captains and foremen	.0383
Timbering, including labor and materials	.0083
Carpenter, blacksmith, machinist work and surface labor connected with mine	.0201
Laborers in stopes	.0790
Trammers	.1019
Drill repairers	.0177
Total cost per ton of rock	.7274

DETAILS OF COMPRESSOR COST IN CENTS PER TON OF ROCK, 1884.

	Cents.
Labor and supplies	.6104
Fuel	.0301
Repairs	.0017
Total compressor cost per ton	.0422
Cords of wood consumed for drill per day	.640

DETAILS OF STAMP MILL COST PER TON OF ROCK, 1884.

	Cents.
Labor and supplies	.1329
Fuel	.1899
Repairs	.0891
Total cost per ton stamped	.4119
Tons of rock stamped per cord of wood consumed	10.79

The total expenditures amount to	$1,300,000
Stamp mill cost—construction	184,000
Hoisting plant, 3 14′ Love drums, etc., engine, building, all complete, cost	70,000
Compressor, plant and building	62,000
Railroad—7 miles—and rolling stock	146,000

Electric light plant for stamp mill is very complete; it cost for the year to light the building, $412.

The stamp mill is a very complete one,—4 Leavitt heads, 84 iron washes. If it should run again, a launder to bring the water to the mill will probably be used instead of pumps. Mr. Palmer states that the cost of running the pumps to supply the stamp mill was 5 cents per ton of rock. All the water necessary to supply the mill could be easily brought from Lake Gratiot.

There are some other changes that, if the mine were working, could be made to advantage. But then it is not much matter; as shown above, it costs $1.58 per ton to mine and treat the rock, while the rock yields but 943 lbs. of copper to the ton, which at 11 cents per lb. gives 103 cents, leaving a loss of 55 cents on every ton of rock treated; mining is not likely to go on much under such circumstances.

The misfortune of it is that this could just as well have been known without spending but a small portion of the million and a quarter of dollars that seem to be as good as wasted.

The only thing to do would seem to be to explore the property. The company has a diamond drill, and by test pits and boring the whole formation can be proved south of the bluff (at this portion the range runs east and west), and possibly a paying lode could be found.

A young man residing in the location, came in last summer, bringing with him a piece of copper in a matrix of epidote, which he claimed to have broken from a ledge of the same,—12 or 14 feet wide. He states that he peeled the bark from a small birch tree near where the outcrop was found; but neither he, nor the others who have since accompanied him, have been able to find the spot.

The estate is a large one, and now that the company has expended so much money, they had better put forth every endeavor to find a mine.

In contrast with the Conglomerate is its neighbor,

THE CENTRAL MINING CO.,

which is an economical, conservative corporation. The Central mine has been a valuable one and is well managed.

The product of the mine for each year, in refined copper, has been as follows:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1856	32	403	1872	623	56
1858	71	1,011	1873	751	1,117
1859	84	312	1874	870	900
1860	125	1,370	1875	733	952
1861	70	139	1876	1,080	1,400
1862	133	1,972	1877	997	1,640
1863	278	1,548	1878	945	1,013
1864	381	1,855	1879	899	1,495
1865	346	1,200	1880	1,013	78
1866	574	1,842	1881	709	465
1867	687	745	1882	676	1,595
1868	1,353	1,827	1883	634	556
1869	903	1,801	1884	723	747
1870	663	1,156	1885	1,078	1,408
1871	716	662			
Total tons				18,241	287

which has been sold for the aggregate sum of $7,872,230.44. All the stockholders ever advanced was the sum of $100,000, and real estate was subsequently sold considerably in excess of the sum paid in. The mine itself has furnished all the funds, and has for years given a surplus to the stockholders in the form of dividends, which amount to the total sum of $1,740,000, and to all appearance the dividends will continue in the future,—a safe conjecture, since the product of the mine in 1885 was one of the largest in its history. The facts about the Central possess a good deal of interest; it

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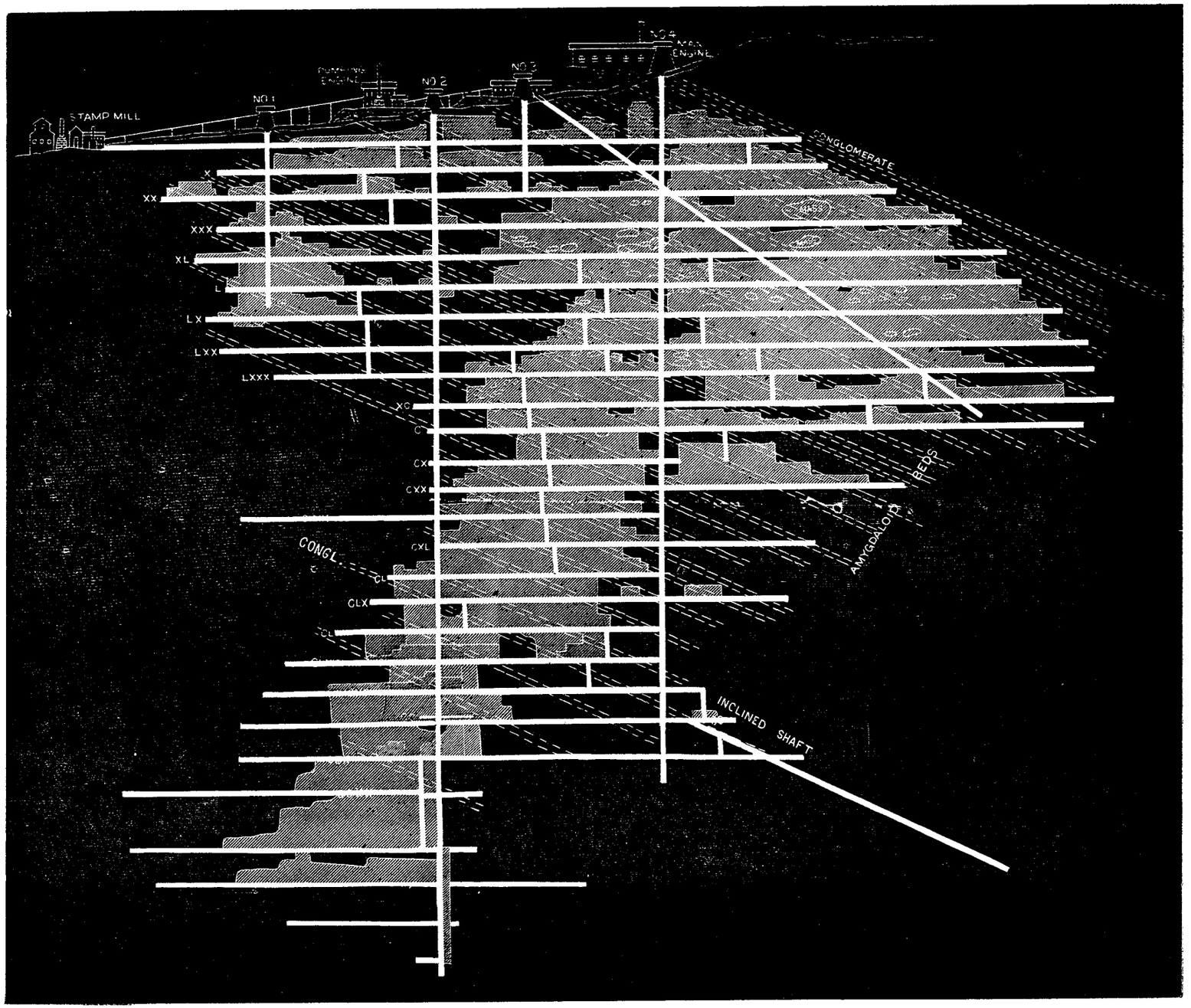
LONGITUDINAL SECTION OF THE CENTRAL MINE, JAN., 1886.

Scale, 360 ft. to one inch



is in a fissure vein, crossing the formation south of the greenstone and extends vertically down, the bottom being 2,160 feet below the surface. It is a small mine; there is only one hoisting shaft—No. 2, and the copper bearing ground, which has a gradual pitch to the south, is now all south of the shaft—No. 2. The mine looks about the same as it has heretofore; there is no change whatever. The small Conglomerate belt, which has been worked downward north of No. 4, has been abandoned, the belt no longer proving productive. The mining work is all confined to the copper shoot, which has, practically, afforded all the mineral that the mine has produced. The vein is continuous, sometimes only a ribbon of vein matter, which widens to 8′ to 10′ in width and contains the masses of copper; the most copper is found in the widest portions of the vein. When the vein matter is soft and spongy it is found to lack productiveness; a firm, hard vein yields the most copper.

The man engine is down to the 22d level. They open very little in advance of the stoping. In 1885 the total cubic fathoms of ground broken in the mine was 2,800, yielding 770 lbs. of refined copper to the cubic fathom. Pretty rich ground, certainly.

In 1884 the yield was 589 lbs. of refined copper to the fathom.	
The copper sold in 1884 at 11.79 cents per lb	$170,692 56
The silver amounted to	485 25
Total	$171,177 81
The total amount broken in the mine in 1884 was	2,454 cubic feet.
The cost of stamping and working per ton, 1884, was	85.03 cents.

The following is a summary of the statistics at the mine for 1885:

GROUND BROKEN.

Sinking in shafts and winzes 206 8-12 feet, average cost	$19 88
Drifting on vein, 859 5-12 feet, average cost	9 00
Stoping on vein, 1,849 15-36 sup. fathoms, cost	12 07
Stoping on vein, 24 192-216 cubic fathoms, cost	32 82

The total amount of ground broken in openings and stopes is 2,800 cubic fathoms.

PRODUCTION.

979 bbls. stamp copper, weighing	1,482,535 lbs.
471 hhds. barrel copper, weighing	522,395 lbs.
325 masses copper, weighing	709,910 lbs.
Total	2,714,840 lbs.
Or 1,357 840-2000 tons.	
Average yield of mineral per fathom of ground broken	969 lbs.
Average yield of ingot per fathom of ground broken	785 lbs.

STAMP MILL.

The expenses at the mill were as follows:	
Labor	$5,985 49
2,000 cords wood consumed	6,500 00
Lights, oils, shovels, etc	410 04
Repairs, materials, fixtures, etc	305 52
Lumber, freighting and teaming	36 23
	$13,237 28
Tons of rock stamped	17,812
Yield of rock in mineral	4 16-100 per cent.
Yield of rock in ingot	3 37-100 per cent.
Cost of stamping and washing per ton	74 31-100 cents.
Running time of 24 heads	140 3-4 days.
Rock stamped per head, 24 hours running time	5 27-100 tons.
Rock stamped and washed per cord of wood consumed	8 91-100 tons.
Cost per ton of breaking and selecting rock and tramming to mill	9 80-100 cents.

PRODUCTION.

Copper and silver delivered	1,600,899 lbs.	$177,418 69
Copper on hand, sold	556,509 lbs.	63,151 54
	2,157,408 lbs.	$240,570 23
(Averaging about 11 15-100 cents per pound.)		
Silver		390 90
		$240,961 13
Mineral at mine Dec. 31st, '84, 139 90-2000 tons, at $145 per ton	$20,155 00	
Mineral at mine Dec. 31st, '85, 164 1925-2000 tons, at $145 per ton	23,919 56	
		3,764 56
Net value of product of 1885		$244.725 69
Add interest received		2,333 06
		$247,058 75

COSTS.

Central Mine, payments for labor, supplies, etc	$130,151 27	
Add decrease in available assets at mine	24,079 56	
Working expenses at mine	$154,230 83	
Smelting, freight, and all other expenses, as per balance sheet	36,185 42	
Net operating expenses		190,416 25
Showing a profit of		$ 56,642 50
The surplus from 1884, after disposal of copper on hand and payment of dividend, was		211,639 48
Making the net surplus, Dec. 31st, 1885, as shown in detail in the annexed statement of assets and liabilities, and out of which a dividend of two dollars per share ($40,000) was paid February 1st, 1886.		$268,281 98

The foregoing figures show a gratifying improvement on the business of the previous year, which was due to the large increase in product. Some of the ground stoped during the year proved to be much more productive than could have been anticipated from the appearance of the levels, and gave an increased quantity of copper without increased cost; the running expenses at the mine being about the same as in 1884. It is too early in the year to estimate the amount that will be produced in 1886, but the product for the first two months is about equal to the average of 1885.

The mine having reached a depth of more than 2,000 feet vertically, the capacity of the hoisting arrangements is now strained to the utmost, and will not be adequate to hoist from a greater depth. It has, therefore, become imperative that more powerful hoisting machinery should be erected during the coming summer, and preparations are making for a plant that will meet all probable wants for a long time to come. In view of this large expenditure the directors have not considered it prudent to divide the entire earnings of the year among stockholders, but have reserved a portion of same to be applied towards payment for the new machinery.

ASSETS AND LIABILITIES, CENTRAL MINING COMPANY, DECEMBER 31, 1885, EXCLUSIVE OF REAL ESTATE AND MINE PLANT.

Assets.

Cash		$92,174 67
Loans		64,359 60
Silver on hand		390 90
Copper on hand, sold (556,509 lbs.)		63,151 54
		$220,076 71

At Mine.

164 tons 1,925 lbs. mineral, at $145		
Cash	$23,919 56	
Merchandise in store	2,579 82	
Supplies	19,684 27	
	29,900 08	
		76,083 73
		$296,160 44

Liabilities.

Agent's drafts	$ 3,698 06	
Indebtedness at mine	19,684 57	
Accounts payable	4,495 83	
		27,878 46
Balance of assets		$268,281 98
(Less dividend, February 1st, 1886, of $40,000.)		

BALANCE SHEET, CENTRAL MINING COMPANY, DECEMBER 31, 1885.

Capital advanced by stockholders		$100,000 00

Real Estate.

Sale of timber	$100,000 00	
Less cost of real estate	20,988 25	
		79,011 75

Sales of Copper.

Sales previous to 1885	$7,634,472 01	
Sales in 1885	240,570 23	
Silver in 1885	390 90	
		7,875,433 14
Interest received in 1885		2,333 06
Accounts payable		4,495 83
		$8,061,263 78
General expenditures to Dec. 31, 1884		$5,925,748 31

Expenditures in 1885.

Central Mine	$130,151 27	
Freight	8,293 11	
Smelting	19,941 37	
Insurance	715 29	
Brokerage	1,165 61	
Expenses	5,849 04	
Storage	46 06	
Taxes [N. Y.]	175 00	
		166,336 69
Dock and warehouse		9,112 07
Cash		92,174 67
Loans on call		64,359 60
Copper on hand		63,151 54
Silver on hand		390 90
Dividends		1,740,000 00
		$8,061,273 78

Average number of miners employed for the year	78
Average wages paid miners per month	$44 31
Average wages paid surface men per month	34 23
Average number of men (surface) employed	41
Average number of stamp mill men employed	14
Average wages paid stamp mill men per month	$34 63
Average number of underground laborers employed	21
Average wages paid underground laborers per month	$34 26
Number of square feet of copper cut	59 109-144
Dividends paid in 1885, $2.00 per share	$ 40,000 00
Dividends paid in 1884, $1.50 per share	30,000 00
Dividends paid in 1883, $3.00 per share	60,000 00
Total dividends paid to date	1,740,000 00
Total expenditures at the mine, 1885	150,548 87

AGENT'S REPORT.

No. 5 shaft has been sunk 97 feet, and is now 15 feet below the 26th level. A winze has been sunk from the 25th level to the 26th level. In sinking this winze, the vein has been very small for the greater part of the distance, but in the last 15 feet it has improved, showing a small but good vein in the north side of winze.

DRIFTING.

At the bottom of the winze at the 26th level we have drifted north about 25 feet, the vein is about two feet thick and well charged with copper; for the last ten feet of drifting we cannot take down the vein until some stoping is done, it being so strongly charged with copper. The 25th level south of No. 2 shaft has been extended 364 3-12 feet. The vein has been very variable, sometimes very small and poor, and again it opened out to 10 or 12 feet wide, and has exposed considerable good ground.

The 24th level has been driven 127 6-12 feet south of No. 2 shaft. The vein here also has been variable, but during the year it has shown some very good copper ground.

The 23d level, south of No. 2 shaft, has been extended 189 4-12 feet. The vein has been small, but has yielded some good stamp rock. At present it is so poor that we have discontinued this drift, as it will not pay to work at the present low price of copper.

STOPING.

Most of the stoping for the past year has been done in the backs of the 24th and 25th levels, which have produced much better than anyone would have expected from their appearance at the beginning of the year. We have not had any very large masses, but have had very rich stamp rock, with small masses and barrel copper. In the back of the 25th level, south of No. 2 shaft, we have twelve men now cutting a mass estimated to be about 40 tons. Most of the other stopes are looking very well.

CONSTRUCTION.

In the way of construction, we have built a new boiler house at the stamp mill, and placed therein two new fire-box boilers, and a smoke-stack 4 feet diameter and 70 feet high, and also one new boiler and smoke stack at No. 3 boiler house, which puts us in excellent position, as far as boilers are concerned. We have taken out two of the old boilers at No. 3, and have had them repaired and re-set again, and we will have to do the same with the others.

Our steam hammer still continues to work well and effectively in cleaning our barrel copper and small masses to a very high percentage, which you can readily see by comparison of percentage of 1883, which was cleaned by hand labor, and that for last year, which we cleaned with the steam hammer, with much less expense.

In conclusion, I am pleased to say that the mine looks much better than it did at the beginning of 1885. The low price of copper seems to be the only thing that is against us.

Yours respectfully,

JAMES DUNSTAN,
Agent.

The Central requires a new hoisting plant; 2,200 feet vertically down is reaching a great depth for a single skip shaft. The matter of a new plant is under consideration, but it is not yet decided what it shall be.

The company has a large number of good houses for the men, has an excellent school building, church buildings, etc., so that the men mostly have families and there are very few changes. It is a common remark that a man at the Central stays for life, but the reason is that the company can provide them with good places to live and the educational and social advantages are also good. There are no more changes among the officers than in the mine; everything remains the same. The map has been marked up to the close of the year.

John Stanton, Sec. and Treas., 76 Wall street, N. Y.; John Dunstan, Agt.; J. F. Robert, Clerk; Samuel Bennett, Mining Captain.

THE COPPER FALLS MINE.

The Copper Falls mine is coming to the front as a large producer. If any company deserves a good mine as a reward for faithful efforts, courage and persistence, the Copper Falls company is certainly one of them. The stockholders seem always ready to respond to any demand that is made upon them, and when the mine fails to meet all the requirements, they make up the deficiency and create a fund for the future. Thus it has been for nearly 40 years. And now, when added to all the discouragements which the company has borne, is the great depreciation in the price of copper, below a point to which it would seem possible for the work to pay, the company so far from giving up, is putting forth greatly increased effort. If the rock were a little richer, if the lode stood up at a steeper angle and were double its present width, the company would be assured of success. But these drawbacks are serious,—the rock yields but .70 per cent. of copper; the lode is but seven feet in width and lays at an angle to the north of about 27°; the rock is so soft that it will not run down on the foot wall, but has to be shoveled from the stopes down to the level, requiring as many extra men for this work as it takes to mine; and yet, with all this, the work is cheaply done. The arrangements are most admirable, considering the circumstances, for economical work. The most telling innovation that the company has

recently made is the substitution of a locomotive for the mules to haul out the cars from the mine. It is a diminutive affair, but it does its work all right and could haul 1,000 tons of rock a day if the mill could work it up. I came out of the mine on the locomotive at noon, and it had hauled out that forenoon 105 cars of rock, 2½ tons each. It weighs, when loaded, 9,000 lbs.; has 22-inch drive-wheels; cylinders, 5x10 inches.

The work in the mine is all in the ash-bed west of the Owl Creek vein. They are at an extreme distance in this direction of 1,415 feet. The adit level is the ninth, and the workings reach to the 14th below and to the fifth above, making a maximum length up and down on the plane of the vein, of about 1,150 feet. Altogether the company has worked out on the ash-bed about 50 acres, east and west of Owl Creek vein. They reckon 20 tons to the superficial fathom of the bed. The 8th, 9th and 10th levels are in west to about the same distance.

These levels are to within 250 feet of the west line of the property. The cars are drawn into the mine and are taken up or down the inclines to the level desired, thence run out to the stope and filled and run back to the incline and taken up or down, as the case may be, to the adit level. All cars come into the mine and go out in the adit level. The locomotive goes on this level to the west end of the mine, making a nearly right angle in leaving the Owl Creek vein to go into the ash-bed west. There are two shafts or inclines up and down, in the mine. No. 1 is 160 feet west of Owl Creek vein, and goes down to the 14th and up to the 5th. These inclines are a short distance apart, east and west, to give room for a turn-table at each to change and move the cars. A small engine that operates a drum is placed at this level to assist in working the inclines. From the drum a rope runs up to the head of the incline and over a pulley, and thence down the track to be attached to the car. A second rope is provided for the track that descends from the 9th. If two empty cars are to be sent away to be loaded, they are run, one upon each turn-table, and quickly put into position, the ropes attached, the signal given, the one descends to the required level, the other goes up to the corresponding one above. The friction of the ascent, not overcome by the descending car, is the work of the small hoister to take care of. In the same manner the descending loaded car from above brings up one also loaded from the corresponding level below. It all works very completely and expeditiously. No. 2 shaft, or incline, has been made up to the 7th and down to the 11th; its location is about 850 feet west of the vein.

The ash-bed is faulted at three different points in this mine, west of the main adit. The main faults are 65 feet, and cause a good deal of dead work in the drifts in each level. The ash-bed mines very cheaply, the main drawback is in the matter of getting the rock down from the stopes. They want to save the cost of shoveling it. Mr. Emerson has a scheme to accomplish this work that I think will succeed all right. The device consists of two wire ropes suspended up the bed, attached at the extremities and made taut, a space being left between the ropes and the hanging wall, sufficient for a narrow sheave-block to run in. A car is suspended from the sheave-block on one of these ropes—capacity 1,000 pounds—and a suitable counter-weight from the other. A rope passes from the car or sheave up over a pulley, controlled by a brake and situated between the two ropes, and is attached to the counter-weight. The car being filled at any point in the stope desired, descends the rope, dumps automatically into the main car and is carried

back to position for refilling by the counter-weight. Of course the wire rope track can be run up the bed at any angle to suit the circumstances.

The company has greatly increased its stamping and washing facilities, having added two improved stamp heads, one of which is already at work and the other soon will be. These stamp heads are a modification of the Ball stamp. The steam cylinder is set closer to the stamp. The iron cross-head dividing the frame is dispensed with, and thus the whole is more compact—weight is 50 tons; 18 inch cylinder, 8 inch shaft; rolling valves made by E. P. Allis & Co., Milwaukee; the three heads were working up 470 tons per day, February, 1886. The mill has been greatly enlarged, naturally, for the increased work. The mill building is now 110x142 feet, all under one roof; then there are attached two slime-table rooms, 60x78 feet, under one roof.

The whole mill has 15 hydraulic separators, 60 "rough machines," and 44 finishers—104 washers, or 119 washing machines in all, and 15 Evans' slime tables. They are striving to save the fine copper and are making every provision to do so.

In the stamp mill boiler-house are eight steel boilers, five of which are now in use. The coal costs $4.00 per ton at the mine.

To secure the water for four heads, a new pump has been added for raising the water from below the mill back again to be used over in the mill. The pump is made by Gordon, Maxwell & Co., Hamilton, O.; size 12x22x17½—24-inch stroke. It is called Compound High Pressure Duplex pumping engine, outside packed.

Have added to the mill a new engine 14x20 inches, also one of same size for the rock house. Have added three Blake's crushers, 9x15 inches, and one 13x15 inches.

The cars of rock for the old stamps are drawn up the incline as heretofore which is now covered; but for the new stamp the cars are elevated by direct hoist. From the mouth of the adit to the rock house they have laid several tracks, so as to make as much of a yard as admissible. The hoist consists of two platforms, one runs up as the other descends, each carrying a car The hoist is 48 feet. Ropes—one from each end of the platform, passing over a large wooden drum—wind up or unwind as the platforms either pass up or down.

Each platform holds a low skeleton iron car with the wheels set on a track to run east and west with the line of the rock bins. The top of the skeleton carries two short rails bent up in a curve at the far ends to receive the car to be hoisted or let down. The loaded car is run onto the platform on the skeleton, and when it reaches the level above, the skeleton carrying the loaded car is pushed along on the track to the point to be dumped, where it discharges over a screen composed of T rails set with lower face up, 2½ inches apart; the fine dirt runs through, the larger pieces run down on the irons and are thrown into the breakers, six men sufficing to handle all the rock.

There are four dogs—chairs—one at each corner, to catch the platform when it gets to the right place, and it sets on these, thus taking the strain off the ropes. The "chairs" work by springs automatically, and when ready to descend are thrown back with a lever. Only one of the platforms is now used to hoist; the other carries an empty car up and down. When the No. 4 stamp is ready to operate, loaded cars will be hoisted up on both platforms.

It is a simple and effective hoisting arrangement, and works nicely. Railroad tracks run to all the shops—machine shop, blacksmith, carpenter, etc., so that anything to be repaired is run from the mine, or from one shop to another, directly on the car. Heavy shafting, etc., can be run on the car to the lathe before unloading, and the little locomotive rests at night in the machine shop. The company only works day shift. No mining work is done at night except a few drills used in driving through the faults, etc. There are 28 power drills in all, of which about 20 are run. A new Burleigh No. 10 compressor has lately been added—this, in addition to the No. 2 and No. 3 Burleigh, old style,—four steel boilers furnish the steam for the compressors and for the little hoisting machines in the mine.

No. 3 stamp head was started 22d of December last, and they are greatly pleased with it. Certainly the quietness and effectiveness with which it does its work is greatly in contrast with the work of the two old Ball heads working near it.

They are doing no work east of Owl Creek vein, though the old workings on that side are quite extensive and are said to have been, in the upper levels, very rich, for the ash-bed, in copper, but of late years the ground has been poor and only exploring has been done.

It was mentioned that the 8th, 9th, and 10th levels had approached within a few hundred feet of the west boundry, but the 7th is 500 feet and the 6th 800 feet from it yet, and the 11th and those below are yet more than 1,000 feet away.

There is no change in the method of mining as I have heretofore described it in previous reports. The drifting and stoping are carried on together, the work being paid for by the fathom. The lowest stopes are reckoned at 35 feet high on the width of the vein. The remainder of the back is taken down in succeeding stopes, leaving only the pillars.

It is probable that the Copper Falls mine will be worked very cheaply another year. Were it not for the pump, for throwing back the water, the stamp mill cost would be very low. The ash-bed is one of the best known lodes in the copper country; it has long been a problem how to work it cheaply enough to make it pay. The Copper Falls company may possibly solve it.

The company has expended the total amount of $2,925,491.39.

Expenditures for year closing December 31, 1885, were as follows:

Total running expense		$127,778 99
Construction and openings		74,370 76
		$202,149 66
Total mining cost, including breaking the rock in the mine and putting it into the cars		80,619 52
Main adit cost		4,111 91
Rockhouse		5,352 30
Stamp mill		33,264 45
Other cost		4,430 72
Number tons of rock mined and treated	88,800	
Number tons of mineral produced	776 475-2000	
Number tons of refined copper	575 538-2000	
Per cent. of ingot to rock treated	65 per ct. min.	
Pounds of copper in a ton of rock	13 per ct. min.	

The following table shows the product of the Copper Falls mine for past years:

Years.	Tons.	Pounds.	Years.	Tons.	Pounds.
Previous to 1855	158		1870	386	990
1855	100		1871	239	883
1856	104	10	1872	260	862
1857	153	1,305	1873	643	540
1858	151	1,852	1874	535	359
1859	173	174	1875	203	1,587
1860	255	818	1876	8	1,488
1861	280	11	1877	5	1,950
1862	299	299	1878	5	1,790
1863	159	1,348	1879		
1864	179	808	1880	3	645
1865	235		1881	334	1,121
1866	568	1,169	1882	293	1,500
1867	1,128	1,485	1883	402	
1868	239	1,384	1884	445	1,168
1869	345	1,400	1885	575	538
Total product				8,805	1,454

The original company was organized in 1845, and the Copper Falls Mining Company began work at this mine in 1846. The stockholders have received dividends to the amount of $2.50 per share—$100,000—and have paid in in assessments probably $20 per share.

David Nevins, Jr., President, Boston, Mass.; B. F. Emerson, Agent, Copper Falls, Mich.

THE ASH BED MINING CO.

has done nothing for years, and there is no probability of work at this mine at present.

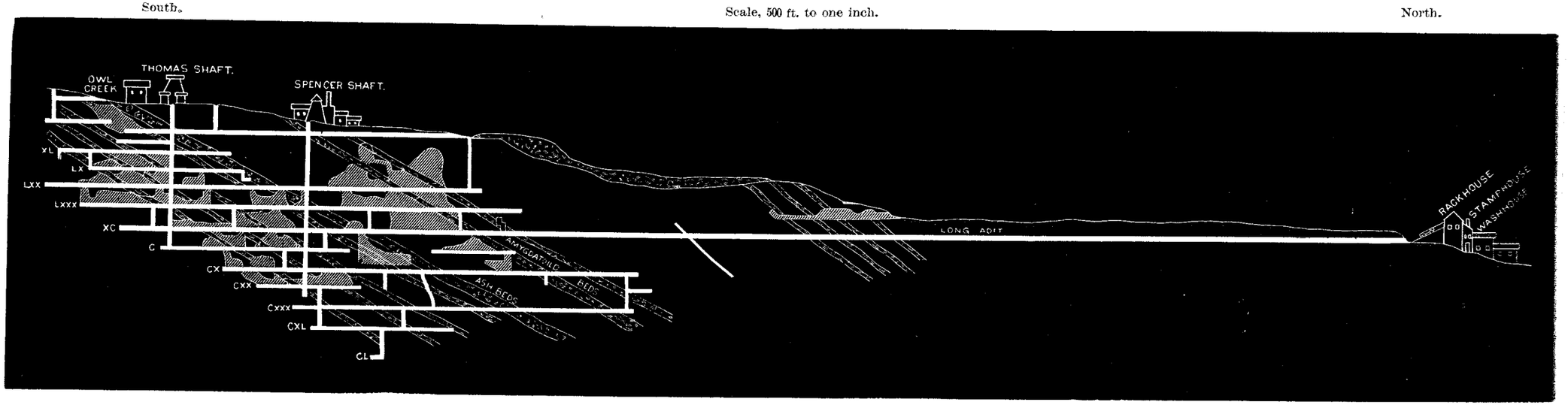
THE ST. CLAIR MINE

has continued to be worked on company account until September last, since which time has been worked on tribute.

The mine is in a small fissure vein which crosses the formation south of the greenstone. It is considered a pretty good vein but has never developed much width. The product was mostly in small pieces. I find nothing to add to previous descriptions. The financial affairs of the company are said to be in a somewhat unfortunate shape.

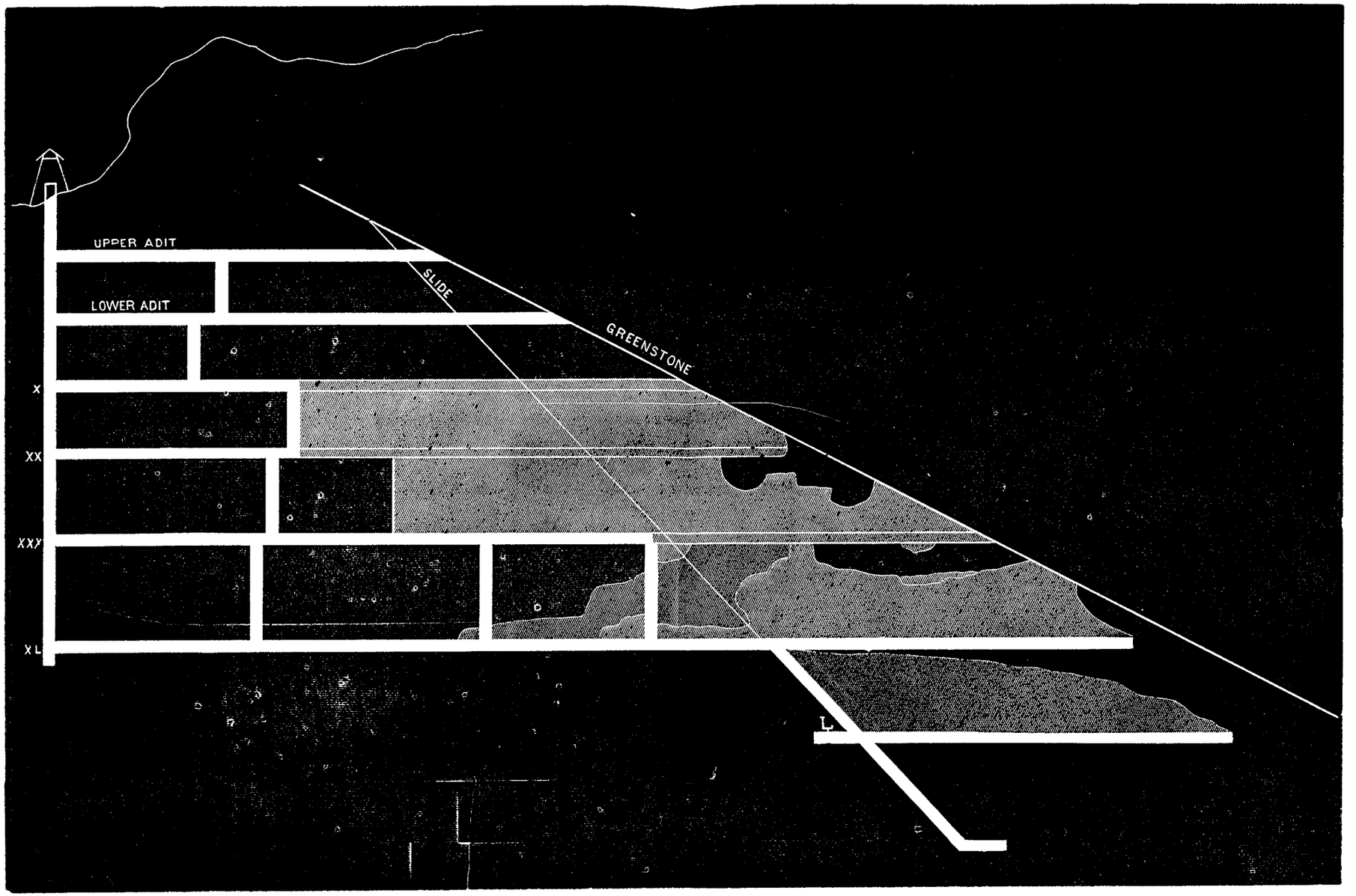
LONGITUDINAL SECTION OF THE COPPER FALLS MINE, THROUGH THE OWL CREEK VEIN, JAN., 1886.

South. Scale, 500 ft. to one inch. North.



LONGITUDINAL SECTION OF THE ST. CLAIR MINE, JAN.. 1886.

Scale, 120 ft. to one inch.



The product of the mine:

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1865	4	815	1874	2	1,700
1866	31	200	1880	6	1,195
1867	43	1,783	1881	62	1,493
1868	65	665	1882	43	1,126
1869	23	197	1883	62	1,225
1872	9	72	1884	69	1,407
1873	40	1,867	1885	39	1,686
Total tons				505	1,071

M. A. Delano, Prest., Phœnix Mine, Mich.

THE PHŒNIX COPPER CO.

No company on the lake has had a longer struggle against adversity than the Phœnix. The original company was organized in 1844, and the capital stock has been exhausted by assessments and the company reörganized several times in the course of its history. But the impression prevails that the company is now bankrupt, that its affairs are involved beyond the hope of redemption.

The indebtedness is given as $80,000.

The estate is a large one, lying on both slopes of the Mineral range. The mine on this property that has given the best results is the one of which the section is herein given, known as the Old Bay State mine. This has produced nearly all the copper that the company has obtained. The section shows the mine up to the close of the year 1885.

Since July, 1883, the mine has been worked on tribute by the former agent, Mr. M. A. Delano. I have written it up very fully heretofore, especially in the reports for the years 1880 and 1881, and I have nothing of interest to add.

The following table prepared from the books of the company gives the summary of the results of the mining work since 1872 for each year. It will be seen that for this period of 14 years the average yield of the ground stoped in the mine has been 473 lbs. of refined copper to the fathom of rock. It would seem that the mine has yielded well for the opening made. For many years it has been with the company, a struggle for existence. They have opened no faster than the ground was stoped. Those best acquainted with the Phœnix mine regard it well and say if it were opened as it should be, and provided with suitable machinery, it would be a paying mine. The maximum depth is 1,200 feet. It is looking as well as usual in the bottom. Mr. M. A. Delano, the agent, is still working the mine on tribute and has a force of 20 miners:

PHŒNIX MINE.

Table Showing Results of Fourteen Years' Work.

Year.	Sinking, Feet.	Drifting, Feet.	Cross Cutting, Feet.	Stoping, Fathoms.	Total Ground Broken, Fathoms.	Tons Rock Hoisted.	Tons Rock Stamped.	Percentage of Rock to Mill.	Percentage of Ingot in Rock Hoisted.	Mineral Produced, Pounds.	Ingot Produced, Pounds.	Yield in Smelting.	Ingot per Fathom Stoped.	Ingot per Fathom Broken.	Year.
1872	170.7	589.5	212.2	775.29	965.81	20,408	6,324	.3100	.0086	453,342	350,660	.7735	452	363	1872
1873	952.3	1,357.5	126.8	920.50	1,468.65	37,287	12,908	.3462	.0087	858,655	647,769	.7544	704	441	1873
1874	967.3	1,525.8	86.6	1,244.46	1,835.62	47,499	18,527	.39	.0145	1,765,770	1,374,652	.7785	1,105	749	1874
1875	599.6	1,391.6	137.8	2,014.99	2,469.76	54,778	20,633	.3767	.0135	1,884,198	1,479,896	.7854	734	599	1875
1876	755.3	1,359.7	126.7	2,365.98	2,865.46	53,822	20,893	.3882	.0110	1,548,918	1,183,183	.7639	501	413	1875
1877	513.7	1,180.3	104.	2,414.23	2,799.51	56,453	22,985	.4072	.0078	1,182,120	874,480	.7414	362	312	1877
1878	513.2	1,536.5	179.4	1,345.41	1,802.46	30,376	10,964	.3613	.0073	600,545	443,880	.7391	330	246	1878
1879	.....	234.9	.....	2,235.42	2,274.57	25,421	18,121	.7128	.0109	707,280	551,678	.78	246	243	1879
1880	126.3	342.7	118.5	1,424.62	1,543 59	28,962	9,542	.3295	.0077	580,480	445,518	.7675	313	289	1880
1881	247.	556.4	.....	1,085.34	1,260.40	25,172	11,561	.4593	.0090	607,075	452,192	.7449	417	359	1881
1882	231.6	959.4	.....	1,174.99	1,489.63	30,205	8,246	.2730	.0085	664,350	515,090	.7753	438	346	1882
1883	129.3	742.2	42.5	1,831.16	2,000.24	34,353	14,255	.4149	.0092	818,765	637,408	.7785	348	319	1883
1884	.....	409.5	.....	1,320.68	1,388.93	27,390	9,176	.3350	.0133	729,510	568,698	.7795	431	409	1884
1885	26.	225.3	.....	723.67	768.92	15,163	5,079	.3349	.0151	458,680	351,235	.7657	485	457	1885
.....	$5,232\frac{3}{10}$	$12,311\frac{3}{10}$	$1,134\frac{5}{10}$	$20,876\frac{74}{100}$	$24,933\frac{55}{100}$	487,289	189,214	$38\frac{83}{100}$	.01.01	12,859,688	9,876,339	$76\frac{80}{100}$	473	396	.....

LONGITUDINAL SECTION OF THE PHŒNIX MINE, JAN., 1886.

Scale, 300 ft. to one inch.