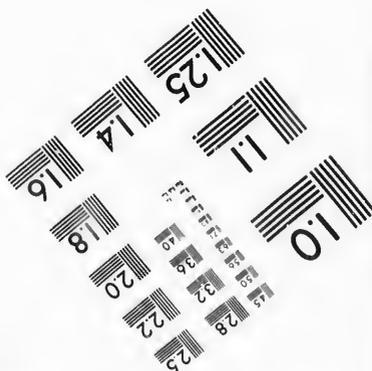
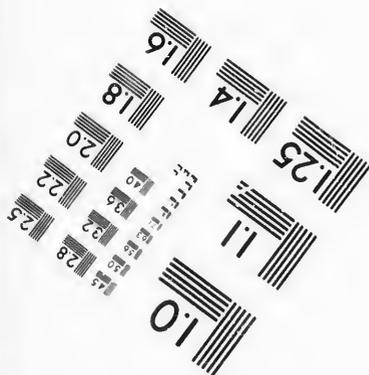
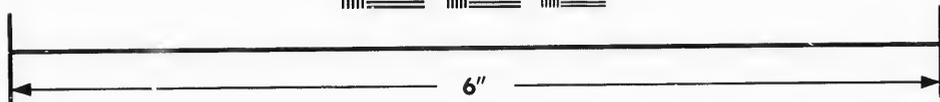
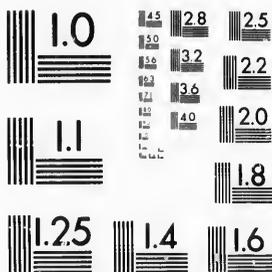


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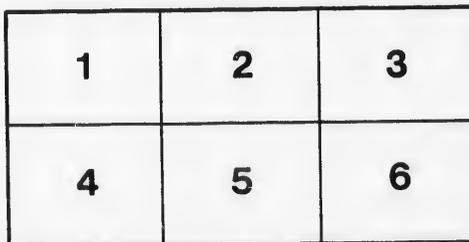
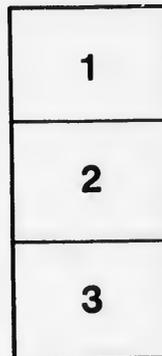
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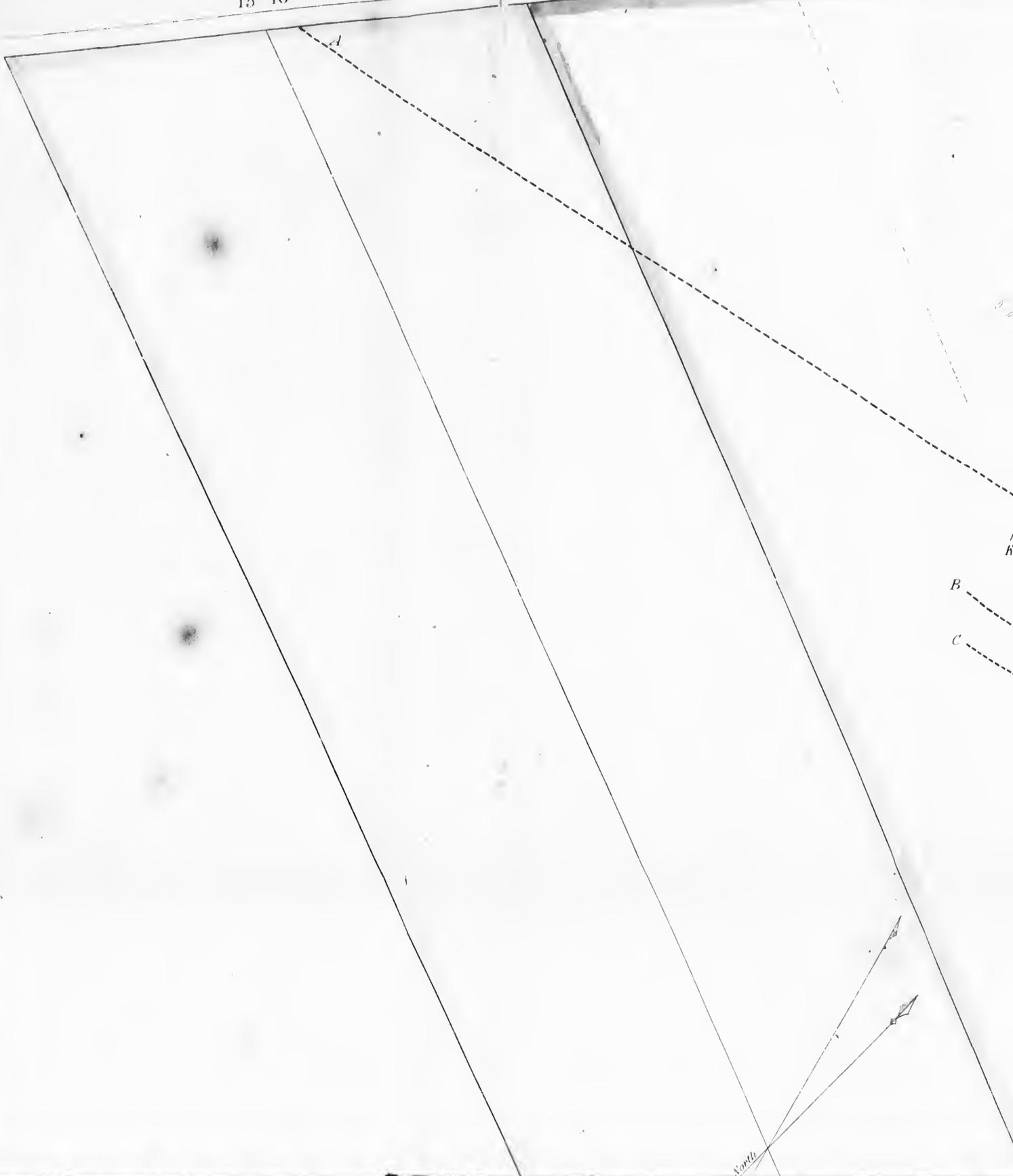
Reports. Harvey Hill Mine.

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RANGE XIV

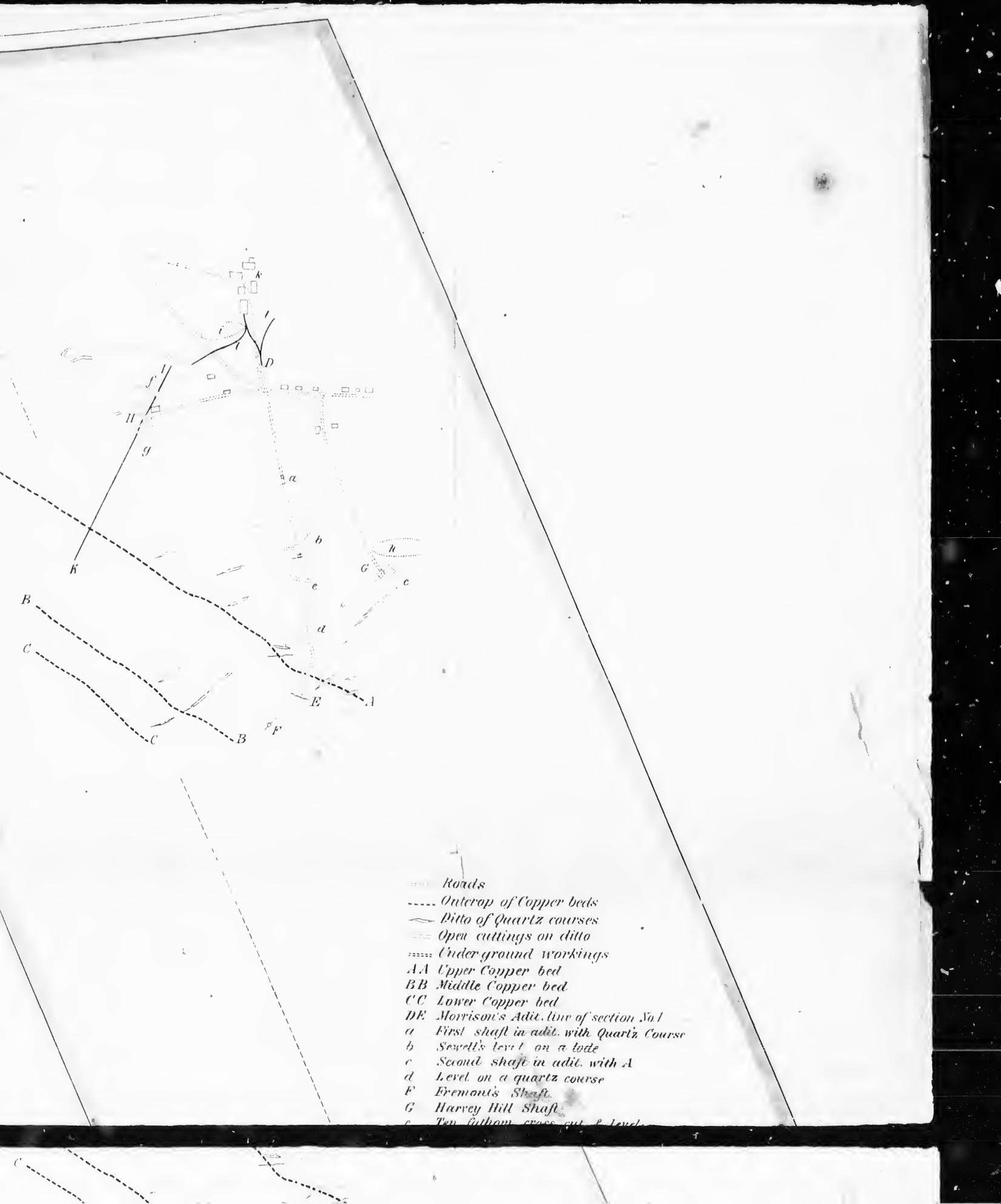
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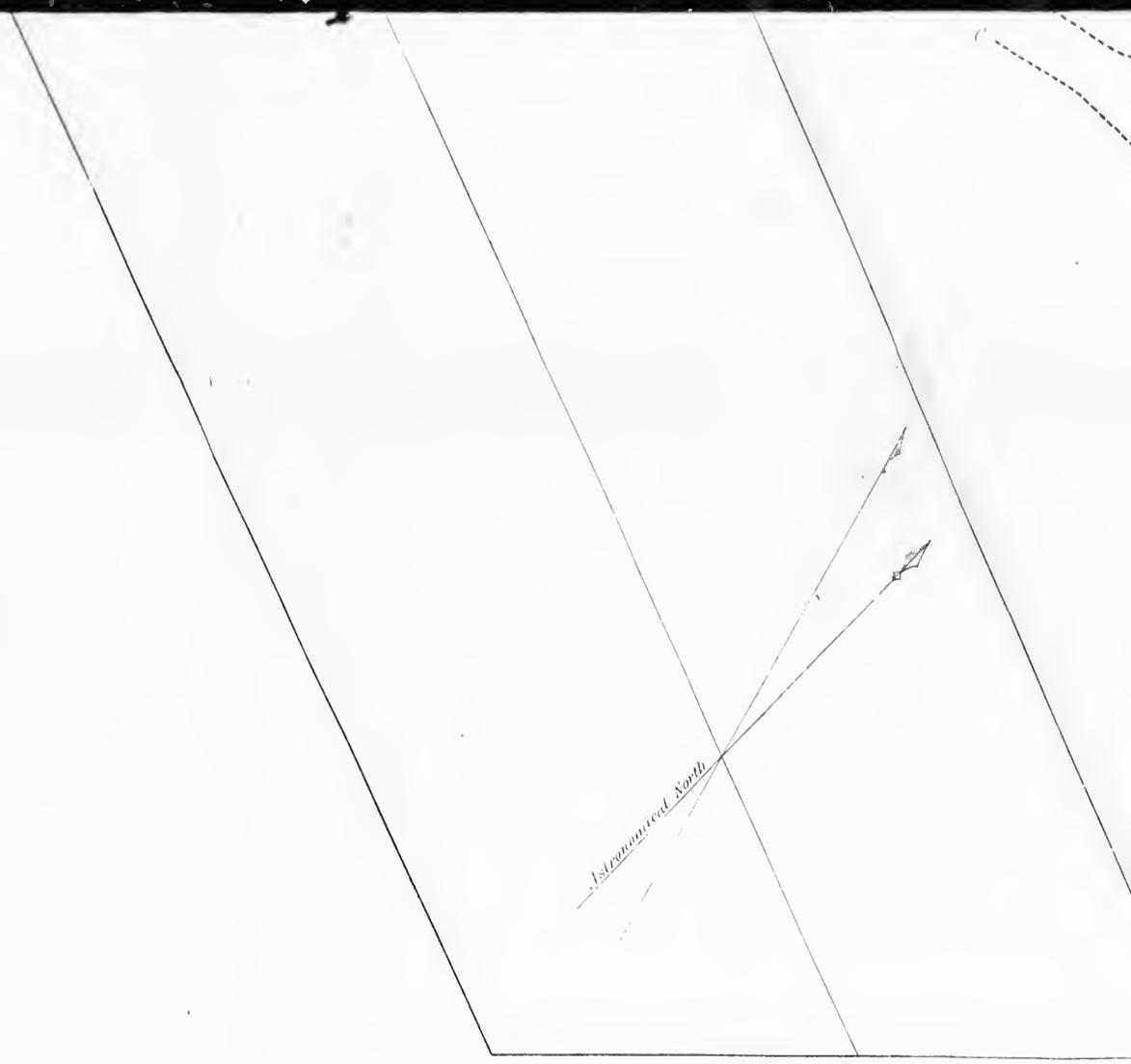


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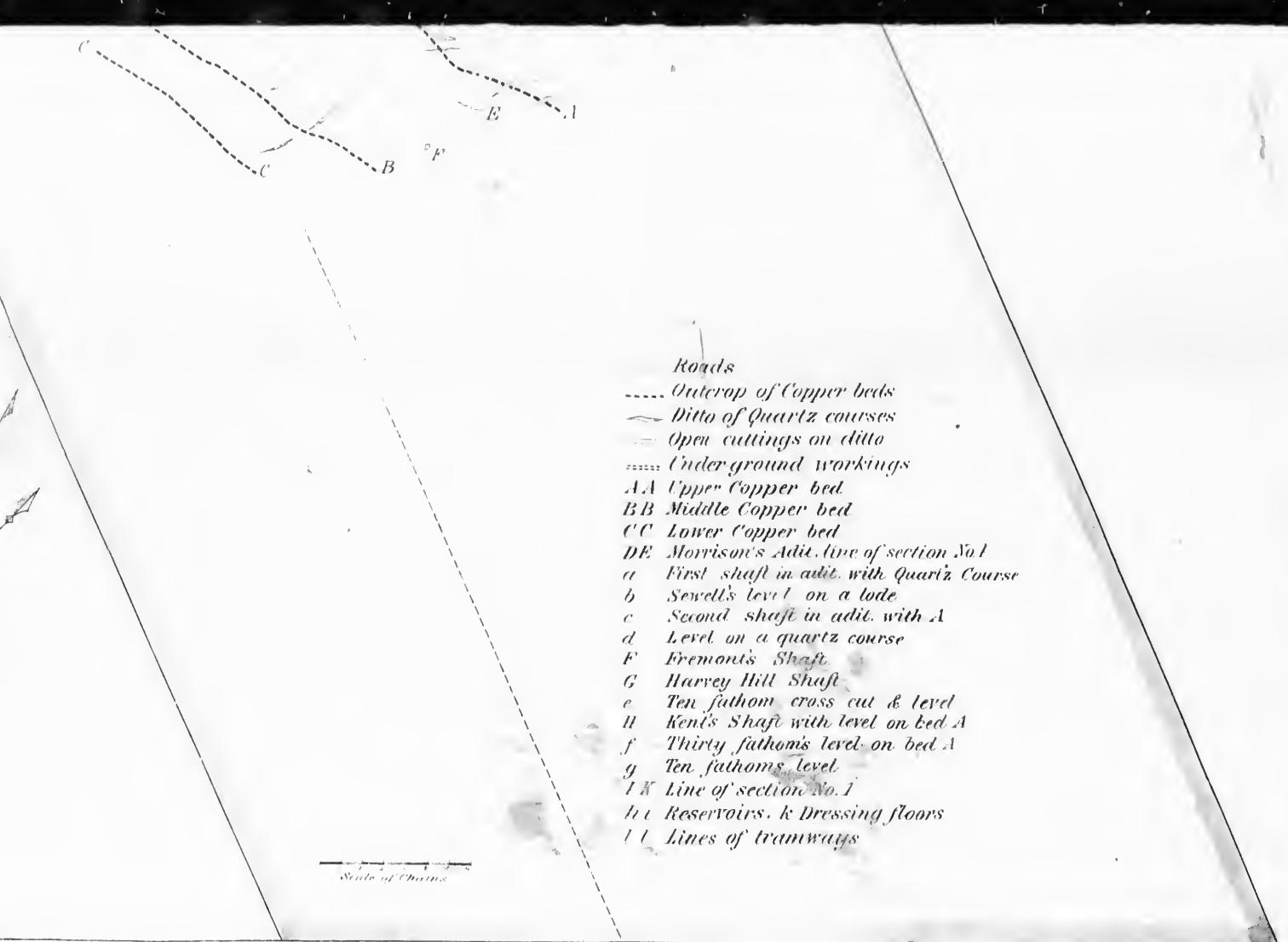
- Roads
- Outcrop of Copper beds
- Pitto of Quartz courses
- Open cuttings on ditto
- Under-ground workings
- AA Upper Copper bed
- BB Middle Copper bed
- CC Lower Copper bed
- DE Morrison's Adit. line of section No. 1
- a First shaft in adit. with Quartz Course
- b Sewell's level on a lode
- c Second shaft in adit. with A
- d Level on a quartz course
- F Fremont's Shaft
- G Harvey Hill Shaft
- e Ten fathom cross cut & level



15 16

Map of
HARVEY HILL MINE

Three hundred acres colored red owned by the Company in fee Simple
Two hundred acres worked on a Perpetual Mining Right.

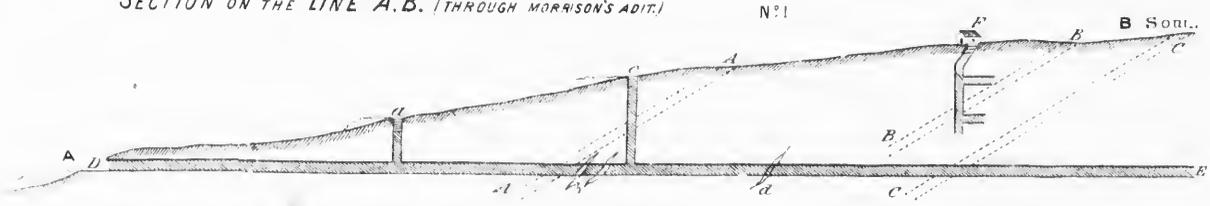


- Roads
 ----- Outerop of Copper beds
 ~~~~~ Ditto of Quartz courses  
 - - - - - Open cuttings on ditto  
 ::::::: Underground workings  
 AA Upper Copper bed  
 BB Middle Copper bed  
 CC Lower Copper bed  
 DE Morrison's Adit. (line of section No 1  
 a First shaft in adit. with Quartz Course  
 b Sewell's level on a lode  
 c Second shaft in adit. with A  
 d Level on a quartz course  
 F Fremont's Shaft  
 G Harvey Hill Shaft  
 e Ten fathom cross cut & level  
 H Kent's Shaft with level on bed A  
 f Thirty fathoms level on bed A  
 g Ten fathoms level  
 I K Line of section No. 1  
 h i Reservoirs. k Dressing floors  
 l l Lines of tramways

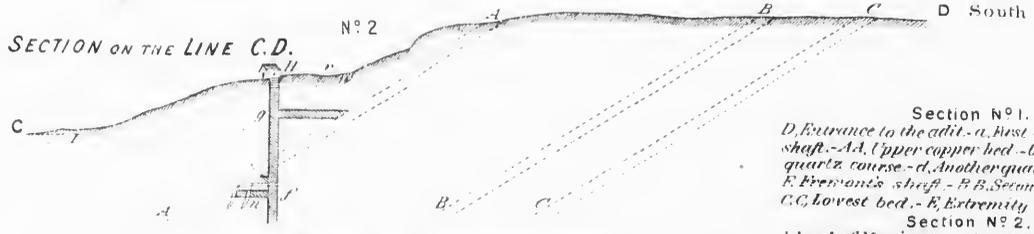
Scale of Chains

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 RANGE XVI

SECTION ON THE LINE A.B. (THROUGH MORRISON'S ADIT.)



SECTION ON THE LINE C.D.



Section No 1.  
 D, Entrance to the adit. - a, First shaft - c, Second shaft. - AA, Upper copper bed - b, Sewell's lode a quartz course - d, Another quartz course - F, Fremont's shaft - BB, Second copper bed - CC, lowest bed. - E, Extremity of adit.  
 Section No 2.  
 I, level of Morrison's adit. - H, Kent's shaft, with three cross-cuts. - AA, Upper copper bed. - BB, Second copper bed. - CC, lowest bed. - f, Thirty fathom cross cut - g, Ten fathom cross cut. - h, i, Quartz courses or veins.

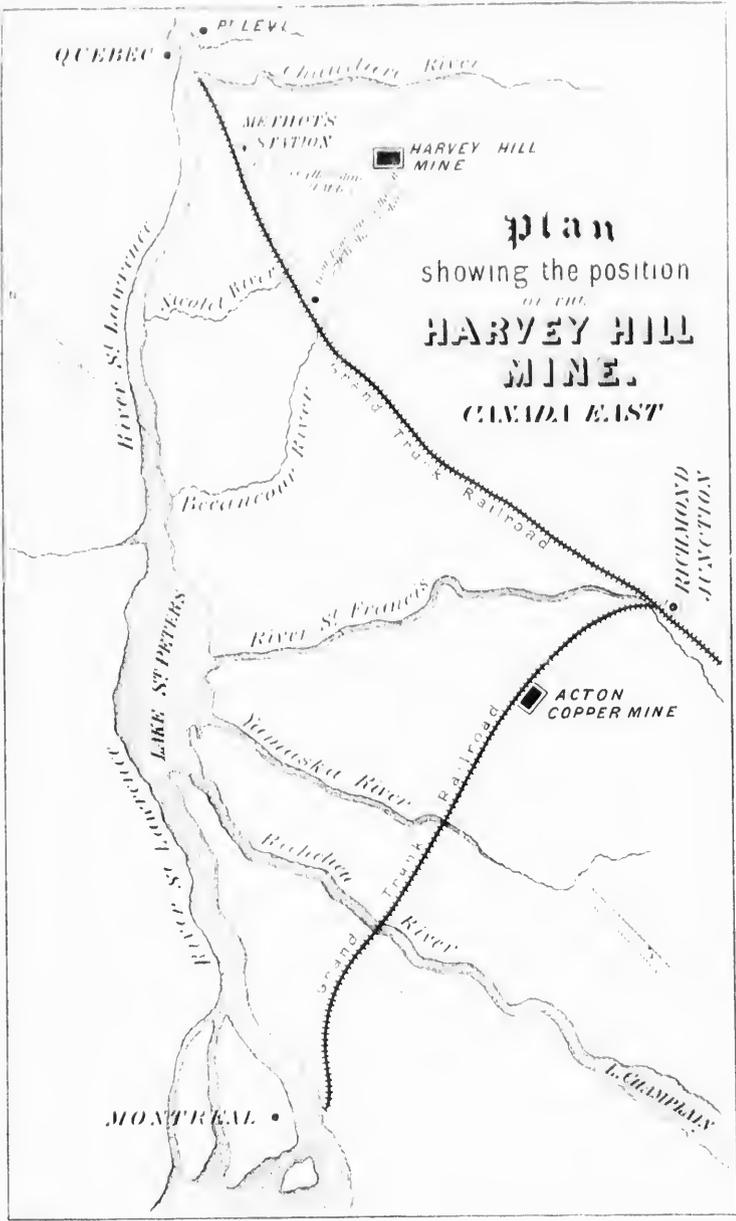
PROFILE OF THE WORK NOW IN PROGRESS  
 Embracing only a small portion of the outline of the workings

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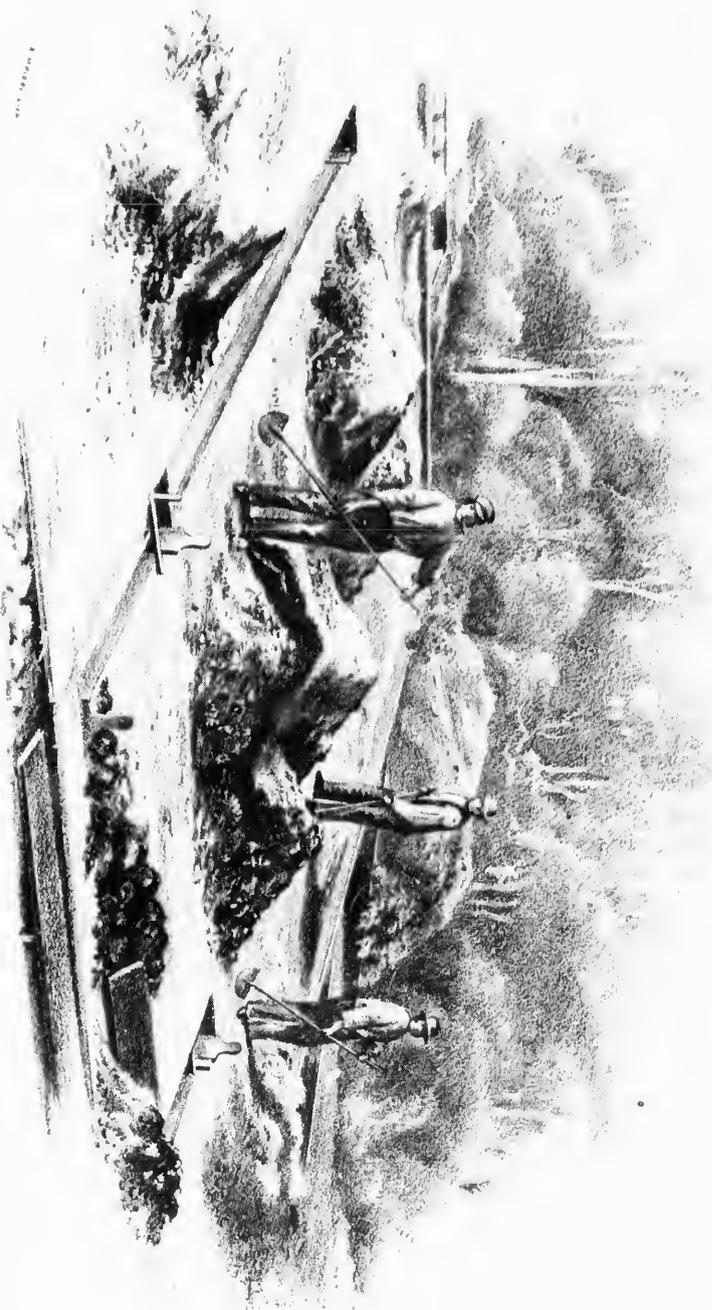
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Plan  
 showing the position  
 of the  
**HARVEY HILL  
 MINE.**  
 CLIVELAND EAST

WASHINGTON No. 2.



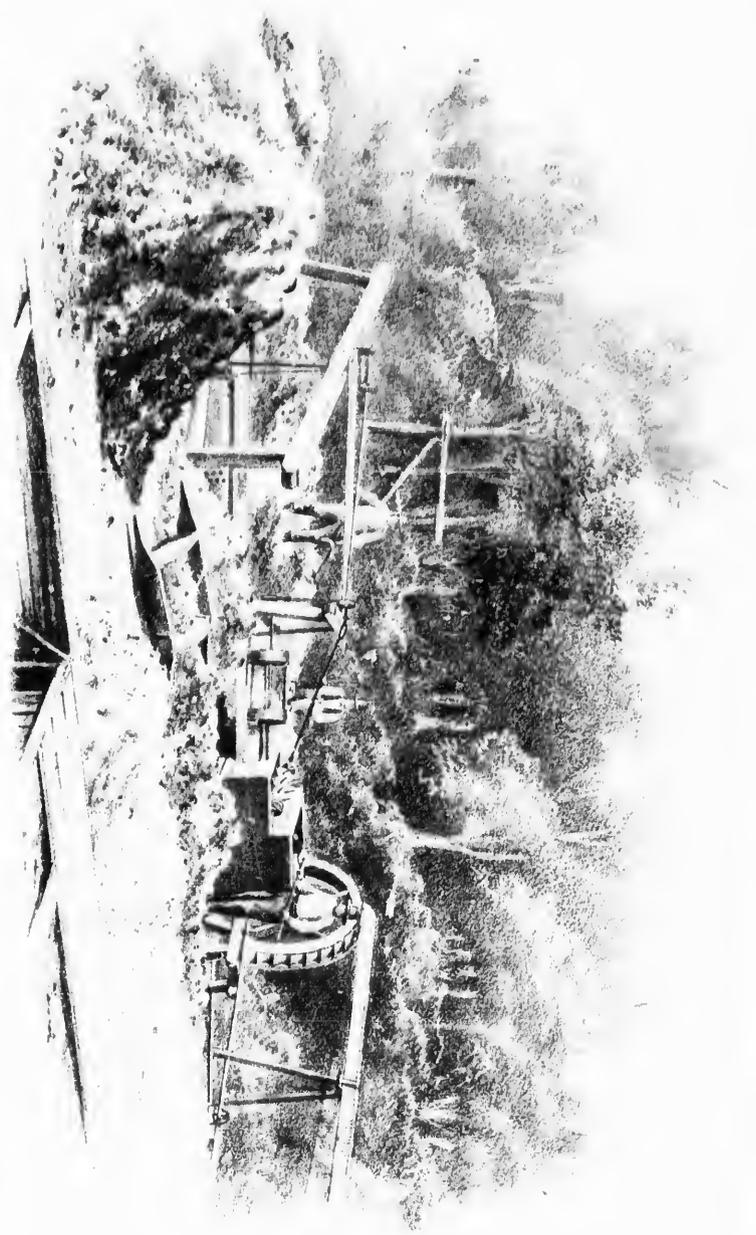
WASHING FLOOR No 2.

AMERICAN LITHO

WASHING FLOOR N° 1 WITH ROUND BUDDLE



WASHING FLOOR N° 1 WITH ROUND BUDDLE





32235

# REPORTS

ON THE PROPERTY OF THE

Harvey Hill Mining and Smelting Co.

LEEDS, CANADA EAST,

JUNE 1, 1863.



BOSTON:

PRESS OF GEO. C. RAND & AVERY, No. 3 CORNHILL.

1863.

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# HARVEY HILL MINE.

## PRELIMINARY NOTES, FROM A SECOND VISIT.

BROOKLINE, May 25, 1863.

GENTLEMEN: Having made a second visit to the Harvey Hill Mine, on the nineteenth and twentieth of May, in company with Mr. Horatio Bigelow, and Mr. James Beck, of Boston, it has occurred to me to call your attention to one or two points of importance, which were left untouched in the previous Reports.

The Company own ten acres of land on the East Branch of the Palmer River, distant one and a quarter miles from the mine, with the right of way for a tram road, to be selected at pleasure. This is a never-failing stream, and here it is proposed to erect a stamp mill and washing floors. They have the right to build a dam 300 feet long, by 30 feet in height, capable of affording, at least, 60 horse-power, at a cost much less than that incurred by the employment of steam, and sufficient for moving all the machinery used in dressing the ores. Twenty thousand dollars is probably ample for the construction of the entire work.

As the estimate of the contents of the interstratified bed might convey the impression that the ore would cease after the exhaustion of forty-one acres of underlie, or in about twenty years' time, it seems proper to state, that there is every reason to believe in the continuance of the bed across the entire length of the Company's property, — about 6,600 feet, — although explorations have not been carried beyond 625 fathoms. This would give a total area of nearly 200 acres of the bed, containing, according to the adopted rules, about 70 acres of rich ground, or enough to last for thirty-five or forty years, on the large scale of work proposed, and worth, at a moderate valuation, \$11,500,000. This computation is from figures given me by Mr. Herbert Williams, the manager.

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Although the transportation of this quantity of ore to the railway would become worthy of serious consideration, were it to be carried on during the early spring and fall, when the roads are heavy, it ceases to be an obstacle, when we consider that during the long Canadian winter the snow offers nearly all the advantages of a tram road, and there seems to be no reason to doubt that the entire annual product of the mine can be delivered, with ease, at Methot's Station, during that period, at one-third less than the estimates. It can be readily hauled for \$9.00 per ton, during the dry summer months, if it were important to meet a high market.

Seven months' work, from October 1, 1862, to May 1, 1863, shows the following result, which is remarkable, when we consider that the entire product, with the exception of the subsidiary yield from the "Fanny Eliza Gash Vein Number Two," has been derived from opening the levels, no stoping having been done in the mine.

The figures are in gold currency, taking copper at twenty cents per pound.

|                                                                                                                                       |                 |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 2,000 tons of $3\frac{1}{2}$ per cent. ore, from the interstratified bed (obtained from driving levels), at \$4.00 per unit - - - - - | \$28,000        |
| Deduct one-fifth for waste in dressing - - - - -                                                                                      | 5,600           |
| Balance - - - - -                                                                                                                     | <u>\$22,400</u> |
| Cost of dressing by steam-power, \$2.00 per ton - - - - -                                                                             | \$4,000         |
| Balance - - - - -                                                                                                                     | <u>\$18,400</u> |
| Carriage to Boston, at \$4.5 per ton, 20 per cent. ore - - - - -                                                                      | \$4,200         |
| Balance - - - - -                                                                                                                     | <u>\$14,200</u> |
| Total expenses at the Mine, taken from cost sheet, - - - - -                                                                          | \$10,800        |
| Balance of net profit on interstratified bed, - - - - -                                                                               | \$3,400         |
| Net profit on "Fanny Eliza, No. 2" - - - - -                                                                                          | \$5,000         |
| Supplies on hand, paid for in seven months - - - - -                                                                                  | 600             |
| Net profit for seven months - - - - -                                                                                                 | <u>\$9,000</u>  |

Respectfully yours,

AUGUSTINE SHURTLEFF.

## REPORT OF HERBERT WILLIAMS.

HARVEY HILL MINES,  
LEEDS, 17th April, 1863.

DEAR SIR: I have much pleasure in complying with your request, by submitting to you the following Report on the Harvey Hill Copper Mines, situate on the 17th Lot, in the 15th Range, in the Township of Leeds, in the County of Megantic, Canada East.

The nature of the metalliferous deposits discovered here, as well as the geological structure of this part of the country, has already been carefully described by Sir W. E. Logan, in the Geological Report of Canada for the year 1858, as also the works then in progress, with a view to proving, in a downward direction, the nature and value of the rich cupriferos deposits discovered cropping out at surface on this property. The accompanying plans and sections will show the nature and extent of the exploratory work executed on the property up to the present time. The adit marked (D) on plan has been driven, altogether, about 248 fathoms, and although some quartz courses have been met within it, similar to those found at surface, they do not appear to be in any way connected with each other, as, by explorations upon them from the adit, we find them to thin out, both vertically and horizontally.

## UPPER BED.

One of the quartz courses met with in the adit was found to lie immediately under the upper inter-stratified bed, at the point of its intersection with that drivage marked (b). It carried some very rich vitreous copper ore, whilst the bed itself presented scarcely a trace of copper, and could only be distinguished from the adjacent slates by its characteristic light gray color, and the amount of quartz and chloritoid distributed through it.

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EFF.

## SECOND BED.

The second copper-bearing bed, which constitutes the top of a six-foot bed of soapstone, marked (B) in Section No. 2, has not been met with in the adit; and I am inclined to believe it has thinned out before reaching that depth, as its outcrop at surface, at a short distance to the east of Fremont's shaft, also ceases, while it can be traced in a westerly direction for a distance of over two miles.

## THIRD BED.

At about twenty fathoms from the extreme end of the adit, after passing through about twelve fathoms of a dark bluish, soft schist, a light gray slate was met with, carrying a little copper pyrites and a considerable amount of chloritoid, and the same kind of ground is now in the end. This last band is irregular in its dip, which is in some places 35 and 40 degrees, and in others 10 to 14 degrees. Some quartz courses have also been met with in it, one of which has been partially explored, and yielded some pieces of copper pyrites, varying from one to three and four pounds in weight, yielding, by assay, about 27 per cent. of pure copper. This mass, from its highly mineralized nature, I regard as of great importance in the future of the undertaking, and likely to carry copper in remunerative quantities, when explored at other points of the property.

The upper interstratified bed was first met with in shaft marked (C), (formerly called grass shaft No. 2,) at a depth of 90 feet from surface. It has since been met with in Kent's shaft, marked (D), which is distant from the former about 170 fathoms, and at a depth from surface of about 20 fathoms. It has also been intersected by a cross-cut from the same shaft, at a depth of 30 fathoms, and followed in the direction of its dip from the 20 fathoms to the 30 fathoms level, a distance of over 20 fathoms on the incline; and we are now following it to the rise of the shaft, as well as on its course east and west, from the 20 and 30 fathoms levels. The distances at present driven in the latter levels is over 40 fathoms, and in the former 28 fathoms.

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In the early part of last year an experiment was made at the 20 fathoms level, where 10 superficial fathoms of ground broken and weighed was found to average 258 cwt. (of 112 lbs. each cwt.,) of three and a half per cent. ore, equal to 1,011 lbs. of copper to the fathom of ground broken. And the ore broken from the 30 fathoms level averages about five per cent. of copper, thus showing a very marked improvement in the quality of the mass as it descends.

In driving the 30 fathoms cross-cut from the shaft, we met with a lenticular course of quartz similar to those referred to in the Geological Report, and obtained from it a little over 50 tons of dressed ore, averaging about 43 per cent. of copper.

#### STOPING.

In stoping this from the back of the level, we found it to thin out as it approached the interstratified bed, and in sinking on the underlay of the bed, between the 20 and 30 fathoms levels, a marked poverty was observable on each side from the point at which the quartz course dropped from it.

In the end driving east on the bed from 30 fathoms level, we met with another lenticular course striking partly on the dip of the bed, and which from its position may be regarded as a continuation or splice of the former. We have followed this on its course for a distance of over 13 fathoms, at a cost of about \$900, and obtained about 12 to 14 tons of ore, estimated worth \$2,500. We are now stoping it along the bottom, where we find it averages from 18 inches to 2 feet wide, and is estimated worth about \$200 per fathom. I may here remark, that, at this point, we have again an instance of the poverty of the bed occurring in the immediate vicinity of a quartz course, and similar to that before referred to as met with in the adit. These facts go far to strengthen the theory suggested by Sir W. E. Logan, "that the quartz courses derive their copper from the interstratified beds;" and I am strongly of opinion that, in the working away of the beds, these rich masses will be frequently met with, and great profit may be expected from them.

In our drivages on the bed we have met occasionally with

patches of quartz imbedded in the slates; these are also lenticular in form, extending in length from a few inches to six and seven feet, and in thickness from a quarter of an inch to eight and ten inches: and in the 20 fathoms level we have met with some as much as two feet thick that would average about seven or eight per cent. of copper in their rough state as broken, whilst the adjacent slates, for a thickness of five to six feet, would average about five to six per cent. of copper. In these masses of quartz we find some pure samples of the very rare metal molybdenum, which, upon inquiry of Dr. T. Sterry Hunt, chemist and mineralogist to the Geological Survey of this province, I learn has found several applications in the arts, notwithstanding its scarcity, and is worth about \$3.45 per pound.

The form and great purity in which this rare and valuable mineral occurs here leads me to the opinion that some quantities of it may be met with in the working of the interstratified beds.

Notwithstanding the fact that our operations up to the present time have been confined almost exclusively to exploring the property, the following quantities of ore, averaging about 35 per cent. of copper, have been met with and shipped from this mine to England.

|                 | Tons | Cwt. | Qrs. | Lbs. |
|-----------------|------|------|------|------|
| 1858 . . . . .  | 9    | 15   | 0    | 2    |
| 1859 . . . . .  | 43   | 7    | 0    | 21   |
| 1860 . . . . .  | 104  | 5    | 3    | 0    |
| 1861 . . . . .  | 70   | 4    | 1    | 6    |
| 1862 . . . . .  | 94   | 17   | 2    | 21   |
| Total . . . . . | 322  | 6    | 3    | 21   |

We have at grass about 1,000 tons of skimpings and halvans to dress, worth in the rough about  $1\frac{1}{2}$  per cent. of copper. We have also about 1500 to 2000 tons of stuff obtained during the winter from our drivages on the interstratified bed, worth between 4 and 5 per cent. of copper, besides about 12 to 14 tons of ore taken from a quartz course during the winter, and estimated worth about \$2,500.

In the early part of last year our provincial government voted a sum of \$2,000 towards the completion of a road, commenced some years since, between this township and Methot's Station on the Grand Trunk Railway, and I have great hopes that a further sum will be voted this year, sufficient to complete the same, by which the distance from the mines to the railway will be lessened about one-third, and the charge for transporting the ores from the mines will be lessened in about the same proportion.

The following estimate, for working our interstratified beds, is based on the present high rate of wages paid in this district, the extraordinary low price at which the ores from this mine sold for in England a few months ago, and the present long land carriage to the railway. And as a very considerable advance may be reasonably expected in the price of copper, and a large reduction in the price of labor when this section of country becomes more thickly settled, and the charge for the carriage of ore to the railway will be reduced fully one-third the present rates when the road to Methot's Station is opened, the figures here set down may be taken as a safe basis of calculation, presuming that the mine will be opened out equal to a yield of 100 tons per day. Hence,

|                                                                                                                 |                |
|-----------------------------------------------------------------------------------------------------------------|----------------|
| 100 tons of $3\frac{1}{2}$ per cent. ore per day, at \$4.50 per unit per ton                                    | \$1,575 00     |
| Less loss in dressing, say one-fifth                                                                            | \$315 00       |
| Less breaking, raising, and delivering to dressing floors, at \$4.00 per ton                                    | 400 00         |
| Less dressing, at \$1.75 per ton of rough ore                                                                   | 175 00         |
| Less agency and contingencies, 25 cents per ton                                                                 | 25 00          |
| Less freight and carriage of 14 tons of 20 per cent. ore from the mine to Boston or England, at \$15.00 per ton | 210 00         |
|                                                                                                                 | <hr/> 1,125 00 |
| Profit per day                                                                                                  | \$450 00       |

which, at the average of 300 working days in the year, amounts to \$135,000, without taking into account the rich masses that

will be met with in working away the bed, and which will give very large profits on the amount that may be expended in their extraction.

In reviewing the prospects of the mine generally, although the openings at Kent's shaft at the present time represent an area of about 1,000 fathoms only of the bed, its extension to shaft (c), a distance of 170 fathoms, is fully identified; and as its outcrop along the surface can be traced for a distance of over 500 fathoms, I am strongly of opinion that it will extend over a very much greater area of the Company's property, and when the other beds shown on plan are farther explored they will be found equally valuable to the one already proved to be so rich.

I am, Sir, your ob't Serv't,

HERBERT WILLIAMS.

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## EXTRACT FROM REPORT OF SIR W. E. LOGAN,

As published in the Geological Report of Canada for 1875.

In Leeds the copper-bearing rocks are exposed in a great number of places, and have been more carefully examined than in any other locality along this synclinal. The explorations at the Harvey Hill Mine, on the Seventeenth Lot of the Fifteenth Range, now the property of the English and Canadian Mining Company, are the most extensive which have as yet been made in the eastern townships. The shafts, and the long adit which has been opened, afford an opportunity not elsewhere presented for studying the structure of this mining region, and it is proposed therefore to give a detailed description of this mine. The accompanying plan and sections are reduced from drawings furnished to the Survey, on a scale of one inch to a chain, by Mr. Herbert Williams, the skilful director of the Harvey Hill Mine; who has also kindly given many details to complete the description. The copper ores at this locality occur both in courses or veins, and in beds. The strata are here, for the most part, finely micaceous slates, which, from their unctuousity, are often called talcose, but are generally not magnesian. A bed of steatite is however met with, and dark bands, approaching to argillite, occur in some parts, while others are whitish or light gray in color, and contain a large amount of chloritoid disseminated. The dip of the strata appears to be from 25 deg. to 80 deg. W. of N., with an average inclination of from fifteen to thirty degrees. The courses are really irregular and interrupted veins, which do not coincide with the strata either in dip or strike. The bearings of eight of them are from north to N. 20 deg. E., while others run nearly eastward. Their underlie is generally to the westward, at from fifty to nearly ninety degrees. These veins, which appear to have filled up fissures in the slates, are more or less lenticular in shape. Some of them have been traced for as much as 100 fathoms on the surface, and are occasionally six or seven feet wide in the thickest part, thinning out however both horizontally and vertically.

These veins have a gangue of quartz, occasionally mixed with calc-spar, pearl-spar and chlorite, and contain rich ores of copper; some of them yielding the variegated and vitreous species, and others copper pyrites. These are sometimes so abundant that as much as two tons of 20 per cent. ore have been obtained from a fathom. Within an area of about thirty acres, open cuttings have been made upon as many as fifteen distinct courses, and shafts have been sunk upon two others. Notwithstanding the richness of portions of these veins, the ore is disseminated in them in such an irregular and uncertain manner, that they are considered secondary in importance to the interstratified beds, in which the sulphurets of copper are disseminated in the slate rock. The first of these beds has a thickness of from two to six feet. Twenty fathoms below it, occurs a bed of three inches, followed, in descending, by fifteen feet of barren slate. This separates it from another ore-bearing bed of six inches, which rests upon a stratum of soapstone or steatite, six feet in thickness. In the plans and descriptions here given, the stratum of steatite, with the two layers of copper-bearing rock, and the intervening fifteen feet, will be represented as a single band, and designated as the second. This band, characterized by the bed of steatite, can be traced for a distance of two miles along the outcrop, but is lost sight of to the eastward of Fremout's shaft. An adit has been carried horizontally into the side of a hill for a distance of 248 fathoms, intersecting in its course the upper bed. The second bed, however, was not seen in the adit, and is perhaps displaced by some fault in the strata. Near the place where it might have been looked for, a quartz course occurs. Several of these courses were met in the adit, but they appear to have no connection with those at the surface, and, according to Mr. Williams, thin out both vertically and horizontally. At about twenty fathoms from the extremity of the adit, after traversing about twelve fathoms of soft, dark bluish slate, a light grey band was met with, holding chloritoid, and a little copper pyrites. A rock similar to the last also occurs at the end of the adit, and contains, besides a little disseminated ore, some quartz courses holding copper pyrites. This band of grayish chloritoid slate is marked C in the plans. The strata in this part of the adit

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appear much disturbed; and the dip varies, being in some places from 10 deg. to 14 deg., and in others from 35 deg. to 40 degrees.

The interstratified beds contain the yellow and variegated ores, the latter generally predominating. These sulphurets are disseminated through the slate in small masses, often of a lenticular form, running with the bedding. They are generally thin and small, but sometimes attain from one-half to three-fourths of an inch in thickness, and occasionally present in section a length of six or even twelve inches. Besides plates and lenticular masses, which interlock and overlap one another, numerous small grains of ore are scattered through the beds, and the average amount of copper in the layer may be stated at from three and a half to five per cent. The copper-bearing beds are sometimes light gray and quartzose, and have at times a chloritic aspect.

In the second shaft of Morrison's adit, the upper copper-bearing bed was met with at a depth of fifteen fathoms. Immediately beneath it was found a quartz course, which contained some very rich copper ore; while the bed itself at this point held scarcely a trace of copper, and could only be distinguished from the adjacent slate by its lighter color and quartzose nature. In sinking Kent's shaft, which is about 170 fathoms to the westward, the same bed is met with at a depth of about twenty fathoms. It has also been intersected by two levels or cross-cuts from the shaft, the lower at thirty fathoms, and followed upwards for a distance of over twenty fathoms on the incline. The working of the bed is now being continued up toward the shaft, as well as east and west from the thirty-fathom level, where it has been wrought for about twenty-five fathoms on its strike, and for ten fathoms in the level above. In the early part of 1862, ten superficial fathoms of the rock from this upper level were broken, weighed, and sampled, and were found to average 258 hundred weight of ore yielding three and a half per cent. of copper (equal to over 1000 pounds of metal) to the fathom of ground. The ore now removed from the working at thirty fathoms averages about five per cent. of copper. In driving the lower cross-cut, a lenticular quartz course was met with, from which there were

taken over fifty tons of rich ore, yielding forty-three per cent. It thinned out as it approached the interstratified bed; and on working this on the incline, it was found to be greatly impoverished for some distance on either side of its contact with the quartz course. In driving east on the bed, from the thirty-fathom level, another lenticular quartz course is met with, running nearly with the dip of the bed; which last is almost destitute of copper on both sides. The course, however, which is being followed, and has a breadth of from eighteen to twenty-four inches, yields about a ton and a half of forty per cent. ore to the fathom. This, with the other two instances already mentioned, seems to show that these veins or courses have been filled with ore derived from the bed. In working this bed, masses of quartz are occasionally met with imbedded in it. These, which are probably in some cases courses running with the strata, and in others small lenticular beds, vary from a few inches to six or seven feet in length, and from a quarter of an inch to a foot or two in thickness. They contain, on an average, from seven to eight per cent. of copper; while the adjacent slate, for a thickness of five or six feet, does not contain more than five per cent. The various workings in Kent's shaft may be said to have tested the bed over an area of over 600 square fathoms; while the extension of this same bed to the adit, a distance of 170 fathoms, and the fact that it has been traced along its outcrop for more than 500 fathoms, show that much may be expected for working this copper-bearing bed.

In some courses in this working, a considerable quantity of sulphuret of molybdenum is found, with a little copper ore, in a gangue of quartz and bitter-spar. Not infrequently these courses hold large masses of the copper ores, which are sometimes perfectly pure and homogeneous, and at other times enclose cleavable masses of bitter-spar, or of limpid transparent quartz, giving to the ore a porphyritic aspect. This quartz, on examination, is found to be in regular prismatic crystals, which however have their angles rounded. In one case a mass of compact variegated copper ore was penetrated by several terminated prisms of quartz, from one-fourth to one-half an inch

in diameter and thickness, and the ore only a few inches thick. It has been shown by the specimen of ore of this

French mine, under the forty-five fathoms level, the same seventy fathoms level, the same with.

bed for about thirty fathoms shown in some of the steatite times bitter-spar, and at G v vitreous fathoms

The per cent. this mine regarded. tons; in 322 tons at the posed to besides and con

in diameter. All the angles of these were much rounded, and the planes of the crystals, which were in close contact with the ore, were concave, and had lost their polish; retaining only a somewhat greasy lustre, precisely like crystals which have been exposed to the action of a solvent liquid. A thin, shining, green layer, apparently of a silicate of copper, covers the surfaces of the ore in contact with the crystals. Similar specimens of quartz have been found in the vitreous copper ore of this locality, and also at the Ham mine.

Fremont's shaft was sunk upon a quartz vein, which had an underlie of 75 deg. to the eastward. After following this for forty-five feet, the underlie changed to the westward, still with the same angle; but the shaft being continued vertically for seventy-five feet more, the second copper bed, with its underlying stratum of steatite, was met. The layer in contact with the steatite was excavated for five fathoms on the incline, in the course of which the vein from the surface was again met with. At the bottom of the incline, a level was driven in the bed for about five fathoms; and the copper ore being continuous throughout these distances, its presence may be said to be shown over about twenty-five square fathoms of the bed. In some parts of this working, the copper ore is found in the steatite; a layer of which, several inches in thickness, sometimes becomes a highly crystalline green tale, holding bitternspar, and rich in disseminated sulphurets of copper. The shaft at G was sunk upon a quartz course, which abounded in vitreous ore. In a cross-cut from this shaft, at a depth of ten fathoms, a second quartz course was met with.

The following quantities of ore, averaging about thirty-five per cent., have within the last five years been shipped from this mine to England. The fractions of tons are here disregarded. In 1858, 10 tons; in 1859, 43 tons; in 1860, 104 tons; in 1861, 70 tons, and in 1862, 95 tons, equalling, in all, 322 tons of ore. In addition to this, there was at the surface, at the close of 1862, about 1000 tons of poor material, supposed to contain about two and a half per cent. of copper; besides 500 tons of material raised from the upper copper bed, and containing from four to five per cent. of copper.

## REPORT OF A. TREGONING.

The following Report was submitted to the English and Canadian Mining Company of London, England, based upon an examination of the mine made a year ago. Although considerable change has been made in the appearance of the mine by increased openings since that time, it has been thought advisable to append it here:—

18, CLARENDON ROAD, NOTTING HILL,  
LONDON, W., 8th August, 1862.

WILLIAM STOBART, ESQ.,

*Secretary English and Canadian Mining Co. (Limited),  
30 Broad-Street Buildings, London, E. C.*

SIR: In accordance with instructions received from you, I proceeded to Canada in May last, and have carefully surveyed the mineral properties belonging to the English and Canadian Mining Company, situate about forty-eight miles south of Quebec, in the township of Leeds, county of Megantic, Canada East.

The freehold property belonging to this Company in the above township is about four thousand acres, and although strong cupriferous mineral indications have been discovered at various points, the principal mining operations have been confined to near the summit and on the northern slope of that part of the Company's property called Harvey's Hill, on Lot 17 of the 15th Range (*vide* Map).

The geological formation of this part of the above township is "Talcoid Mica Slates," which from their lustre are called "Nacreous Slates," and are of the Quebec Group, Lower Silurian. These slates are in bands, varying in color from deep to light blue, buff, and pearly white; they underlie to the north-west at about 20 degrees from the horizon, and some of them are thickly studded with chloritoid, and one near the ridge of the hill is much charged with steatite, and is known as the "Soapstone Bed."

In these slates have been discovered some remarkable

"Lenticular Masses" and "Interstratified Beds" of copper ores, and these ores present, with the slates in which they are embedded, geological features totally different from those of the general mining districts of Northern Europe, but may be considered a type of an extensive cupriferous formation peculiar to this part of Lower Canada, and which there are strong reasons for believing contains a vast deposit of mineral wealth.

From the appearance of the copper ores when discovered at the surface, they were supposed to be the "outcrops" of what in depth would prove regular and well-defined lodes, as they did not coincide with the slates either in strike or dip: but after being opened, and yielding some considerable quantities of valuable (copper) ores, they were found to thin away from their centres both horizontally and vertically, and disappear, having assumed the form of lenticular masses, variable in size, and succeeding each other at irregular intervals, and principally composed of quartz, associated with rich ores and bitter spar. In their occurrence and productiveness they will probably be governed by the bands of slates in which they are embedded. The probable average size of these lenticular masses is from 60 to 72 feet in length, by 30 feet in height, and at the centre from 2 to 4 feet in thickness. Many far exceed these limits, and some are much less. They are equally variable in product, as some have only yielded a few hundred-weight of ore, while others have given several tons. About 300 tons of copper ores have been raised from workings made on these masses, worth about £6,000. Of this quantity about 60 tons, containing from 30 to 40 per cent. of copper, have been obtained from the "Fanny Eliza" alone, which has been discovered and worked at a depth of 30 fathoms from the surface, by a cross-cut from Kent's shaft. *This valuable discovery proves a singular and important feature of this enterprise, and one greatly in its favor, namely, that the lenticular mass found in the deepest point has yielded the greatest quantity of rich ore, and from its appearance, and the favorable geological character of the micaceous slates, there is every reason to believe that at a greater depth these*

"lenticular masses" will be found to *increase in size and productiveness.*

In sinking Fremont's shaft to prove one of these "lenticular masses," the soapstone bed previously referred to was intersected 90 feet from the surface where some portion of it carries copper ore between the laminae of the rock. About 720 feet north of this bed another band of slates has been intersected in No. 2 Grass shaft, at a depth of about 70 feet, where the ore-bearing portion of the slates is termed "interstratified bed." It is at this point about 6 feet thick, and from it 6 tons of good ore have been obtained, "dressed" and shipped. The ore portion of the bed in this shaft terminates abruptly in descending, but appears to enlarge on its westward course towards Kent's shaft (924 feet west of Grass shaft), in which the same or a similar kind of bed has also been discovered at the 20, 24, and 30 fathom levels. At the first level it has a thickness of 12 feet; the upper portion near the "hanging wall" carries yellow, and the lower or that on the "foot wall," purple copper ore. At the 24 or second level, the same size and peculiar division of the ore is observable; an excavation of about 10 cubic fathoms has been made on the lower portion of the bed at this point, the ore from which, after being roughly "picked over," produced 135 tons, containing three and a half per cent. of copper. At the 180 feet level, the thickness of the bed has not as yet been ascertained. From the present appearance of this bed your superintendent and myself are of opinion that when it is properly opened the ore can be raised for about eighteen shillings per ton.

In order to arrive at a more definite and correct opinion of the value and extent of these beds, we would *strongly advise* your having 10 or 20 tons of the 135 tons referred to above sent to this country to be tried by Mr. Henderson's *patent process for the extraction of copper from low percentage ores*; in the mean time, we would urge the continuance of Morrison's adit cross-cut level, to prove the soapstone bed in depth, and also the drivage of the cross-cut from Kent's shaft at the 180 feet level through the "interstratified bed," and to open levels on its course east and west, to prove its continuance,

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regularity, and value at this depth, as, in the event of its proving satisfactory, and Mr. Henderson showing that his process can be successfully applied to the treating of these ores in Canada, returns might be made as soon as the reduction works are established, and for which the Company has an eligible site on their estate near the mine, on the eastern branch of the Palmer River, which affords the necessary water-power.

In conclusion, I beg to refer you to the accompanying plans, specimens of ores, and detailed report, for further particulars, and to state that after *a careful examination of the Company's property*, both with respect to the *rich lenticular masses of ore*, and that occurring in what are termed "*interstratified beds*," and also with regard to the *position of the mine, climate, price of labor, fuel, &c.*, and other conditions that might affect the successful working of the enterprise, I am of opinion that the undertaking is *one of considerable merit, and is worthy of a vigorous prosecution, aided by an adequate capital*; to accomplish which I would advise an engine shaft being sunk to prove in depth the "*interstratified beds*" and highly mineralized nacreous slates, in which the "*Fanny Eliza*" and other "*lenticular masses*" of rich copper ores have been found. This shaft should, in my opinion, be sunk so as to prove the beds and slates about 100 fathoms deeper than the lowest point already reached.

Some good returns may be expected from the "*lenticular masses*" and "*interstratified beds*," especially as they show such evidence of increasing value as greater depth is obtained.

I remain, Sir,

Your obedient Servant,

A. TREGONING.

## REPORT OF PROFESSOR GEORGE I. CHACE.

GENTLEMEN: In the company of a party of gentlemen from Boston and New Bedford, I last week visited and examined the Harvey Hill Mine, situated in the township of Leeds, Canada East. Mr. Thomas Macfarlane of Acton Vale was also of the party, and rendered me valuable assistance in the examination. I have the honor to submit the following Report:—

### LOCALITY OF THE MINE.

The Harvey Hill Mine is situated on the southerly side of the Richmond and Quebec Railroad, in a direct line about 20 miles from it, but, by the only roads now open, thirty-one or thirty-two miles. A road has been commenced and constructed part of the way between the mine and Methot's Mills, a station on the railway, which, when completed, will reduce the distance to a little more than 20 miles. As the roads now run, the points on the railway nearest to the mine are Craig's Road Station, 15 miles from Quebec, and Beaucour Station, 41 miles from Quebec, 127 miles from Montreal, and 275 miles from Portland, Maine. Methot's Mills is between these stations, and by a properly constructed road to it many of the difficult hills which cross the other roads would be avoided, as well as the distance shortened.

### HISTORY OF THE MINE.

The mine was opened in 1858, under the direction of the English and Canadian Mining Company. It has been worked since that time with an average force of about 60 hands. The object kept in view has been exploration rather than the taking out of ore. For the purpose of proving the lodes and beds, shafts have been sunk at different points on the hill, and an

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adit has been carried 248 fathoms into its side. Ore to the value of \$50,000 has been taken out and marketed; while the expenditure upon the mine, as I am informed, has been little short of \$200,000.

Some 1500 tons of rough ore are now on bank, ready for the dressing-house.

CHARACTER OF THE FORMATION IN WHICH THE MINE IS  
OPENED.

The mine is situated on the second of the three copper-bearing belts which extend across the greater part of Canada East, in lines nearly parallel to the St. Lawrence. The first of these belts includes Acton, Wickham and Durham. The ore is here chiefly in limestone. The second includes, besides the Harvey Hill, the Halifax and the Sutton. The ore in this belt is found in slate. The third belt includes the Ascot, the Ham, and the Garthby Mines. The ore in this belt occurs in slate, with more or less carbonate of lime intermixed. These three belts are believed, by the Canadian geologists who have studied the rocks of this province most attentively, to be parts of three great synclinal folds of strata, substantially contemporaneous in origin, and to point back to a period during which deposits of copper were in progress over a wide area. At Harvey Hill, the beds, which consist of various colored slates, have an easterly and westerly bearing, with an underlie to the north of from  $15^{\circ}$  to  $30^{\circ}$ . The bed containing the ore lies upon the northerly slope of the hill, dipping in the same direction as the hillside, but at a greater angle. It is from four to five feet in thickness. This bed is of a lighter color than the associated schists, and can be easily recognized, even where it contains no copper. It has a pearly aspect, which is due to the presence of mica in a finely divided state. Although no fossils have been discovered in it, or in the including strata, it is believed, like the other copper-bearing rocks in Canada, to belong to the lower division of the Silurian series.

## NATURE OF THE ORE.

The ore consists of the yellow and purple sulphurets of copper, principally the former. It is sometimes aggregated into considerable masses, but more frequently occurs in thin laminae or in grains diffused through the rock. That portion of the bed which lies around Kent's shaft (see accompanying plan), and which has been penetrated and explored from it, is so heavily charged with ore as to contain on an average, throughout its whole mass,  $3\frac{1}{2}$  per cent. of copper. Allowing a loss of one-fifth in dressing, this rock will yield 2.24 tons of 20 per cent. ore to the cubic fathom.

Besides this cupriferous bed, there are lying beneath it (see plan) two other beds which contain copper, though not in sufficient quantities at the points where they have been reached to make them workable. At other points they may prove richer, and add to the resources of the mine.

In addition to these interstratified copper-bearing beds, there are found in different parts of the property, without any apparent order or connection, detached masses of very rich ore, having nearly the form of double-convex lenses, and hence designated as lenticular. The central portion of the mass is sometimes several feet in thickness. As you proceed from this outward, the mass grows thinner, until at the circumference it is reduced to a mere edge. Some of these lenticular masses are of great size. From one, the upper edge of which showed itself at the surface, 100 tons of 40 per cent. ore were taken. Another, met 30 fathoms below the surface, yielded 50 tons of 45 per cent. ore. They cut the horizon for the most part at a high angle, and in their bearing conform more or less nearly to the curvature or bend of the hill. The copper-bearing bed in the neighborhood of these masses is said to contain but little ore—a fact leading to the supposition that it has been robbed by them. These lenticular masses occupy what were once local and detached fissures in the rocks, and are undoubtedly the product of segregation. We may, therefore, well suppose that when near the cupriferous bed they have drawn their supplies of ore to a greater or less extent from it. Were they reg-

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ular and continuous, they would be a most productive source of the richest purple and yellow ores. But occurring as they do irregularly and wholly detached from one another, they can be regarded as only incidental and accessory to the principal and permanent sources of supply in the copper-bearing beds. Such as showed themselves at the surface have already been taken out, and have furnished most of the ores which have thus far been marketed. Several below the surface have been reached by drifting in the cupriferous bed, and have also been taken out. It is only as they are met with in this manner that they may hereafter be expected to add to the resources of the mine.

COST OF RAISING, DRESSING, AND MARKETING ORE FROM THE  
CUPRIFEROUS BED.

It is believed that \$4.00 per ton will cover the cost of bringing the rough ore to the surface and placing it on the floor of the dressing-house. In this estimate is included a due proportion of the expense of the drifting and exploration necessary to reach the ore. If we add \$1.75 per ton for dressing the rough ore, and 25 cents per ton for agent's salary and contingencies, we have an aggregate expenditure upon every ton of rough ore of \$6.00. Now, allowing a loss of one-fifth of the copper in dressing, — which is not too much, — it will take seven tons of  $3\frac{1}{2}$  per cent. ore — the average of the bed — to produce one ton of 20 per cent. ore. This will therefore cost \$42.00. If we add \$1.00 for boxes, \$9.00 for transportation to the railway, — the cost by the roads now open, — and \$6.00 for freight on the railway to Boston, we have for the entire cost of a ton of 20 per cent. ore, delivered in the market, the sum of \$58.00. The present value of copper ore, reckoned in gold, — all these estimates are made upon a specie basis, — is \$4.00 per unit. Deducting half a unit for the difference between the dry and the wet assay, we have \$78.00 for the value of a smelter's ton of 20 per cent. ore. If we subtract from this the cost of production, we have a net profit of \$20.00 in gold or \$30.00 in currency. On the basis of the above estimates, if we suppose the daily produc-

tion of the mine to be 100 tons of rough ore, — to which it is believed it might without difficulty be brought, — yielding 14 tons of 20 per cent. ore, we have a net profit per day of \$280 in gold, or of \$420 in currency. By the construction of a shorter and better graded road to the railway, the cost of transportation might be materially reduced and the profits proportionally increased.

#### QUANTITY OF ORE IN SIGHT.

The only part of the mine at present exhibiting bodies of workable ore is that lying around the bottom of Kent's shaft. Two levels have been pushed from this in either direction into the enpriferous bed, one at the depth of 20 fathoms, the other at the depth of 30 fathoms. The lower level is a little to the north of the shaft, and is reached by a cross-cut running from it. The twenty-fathom level has been extended along the course of the bed for the distance of 30 fathoms. The thirty-fathom level has been extended in a similar manner for a distance of 50 fathoms; these two parallel levels are connected with one another by a winze. The distance between them, measured on the incline of the bed, is 25 fathoms. Samples of ore were taken from all parts of these levels, with the exception of the eastern extremity of the lower one, — which is unproductive, — from the winze connecting them, and also from a drift in the rise above the upper level; these samples were found to contain upon an average  $3\frac{1}{2}$  per cent. of copper. If we add to the body of ore lying between these levels a belt along the outside of each equally exposed to view, we shall have not less than 1,480 superficial fathoms of ore, which in miner's language may be said to be in sight. This, on the supposition that the bed is  $4\frac{1}{2}$  feet in thickness, — which I think it averages, — will give 1,110 cubic fathoms of ore. Multiplying by 16, the number of smelter's tons in a fathom (nearly), we have 17,760 tons of  $3\frac{1}{2}$  per cent. ore. Divide the product by 7, — the number of such tons required to produce one ton of 20 per cent. ore, — we have 2,537 tons of 20 per cent. ore, worth in the market \$197,886.

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## PROBABLE YIELD OF THE MINE.

If we suppose the copper-bearing bed to underlie the entire northerly and northeasterly slope of the hill — for which there is good reason — it must have an area within the limits of the property of not less than 120 acres. The bed has been reached at three different points, at its intersection with Morrison's adit, its intersection with grass shaft No. 2, and at its intersection with Kent's shaft. At the first point, it was not metalliferous; at the second point, it contained copper, but not in sufficient quantities to be worth working. At the third point, and along the drifts extended from it, the entire mass of the rock was found to contain an average of  $3\frac{1}{2}$  per cent. of copper. If we judge of the whole bed from the portions that have been reached, — the only basis we have for forming a judgment, — out of the area of 120 acres we may expect one-third, or 40 acres, to be workable, and to be as highly charged with copper as the section lying about Kent's shaft. This, at 1,210 superficial fathoms to the acre, will give 48,400 superficial fathoms, or 36,300 cubic fathoms of  $3\frac{1}{2}$  per cent. ore. Multiplying by 16, and then dividing by 7, we have 82,971 tons of 20 per cent. ore, worth in the market \$6,471,738. To remove this ore, with a daily production such as we have supposed, would require about twenty years. It will be readily understood that this calculation is of probabilities only. There may be, in the unexplored parts of the bed, much more ore, or there may be much less, than the figures would give us. Their proper and legitimate use is in guiding and restraining conjectures.

Before the production of the mine can be greatly increased, more extensive arrangements for dressing the ore must be provided. Water must also be had in greater abundance than can be obtained in its immediate neighborhood. I should recommend the purchase of a site for the dressing-house on the Palmer River, only  $1\frac{1}{4}$  miles distant, together with the right of way to it. The erection of the necessary structures here, if water-power were used for crushing the ore, would probably cost about \$20,000; if steam-power, about twice that sum. A tramway

would have to be constricted between the mine and the dressing-house.

In conclusion, permit me to say that I have visited no mine in Canada whose permanent character seems to me to be so well established, or whose value can be placed on so reliable a basis of calculation, as the Harvey Hill Mine. The copper-bearing bed in the neighborhood of Kent's shaft has proved rich in ore, and I have little doubt that it will retain its richness over a wide area. The unusual thickness of the bed ( $4\frac{1}{2}$  feet) makes the removal of the ore comparatively easy and inexpensive. The offsets to these advantages are, the distance of the mine from the railway, and the difficult roads over which the ore has to be conveyed in reaching it. Their exact measure is given in the cost of transportation.

Yours truly,

GEO. I. CHACE.

BROWN UNIVERSITY, May 5, 1863.

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## REPORT OF AUGUSTINE SHURTLEFF, M. D.

BROOKLINE, May 5, 1863.

GENTLEMEN: After the foregoing very able and exhaustive report, hardly anything can be gracefully added. I will say, therefore, but a word.

On the twenty-seventh of April, in company with Prof. Chace, I visited the Harvey Hill Mine, and assisted in the rigorous examination of the property which was made at that time.

The samples of cupriferous shale were collected at regular intervals through the levels, in a manner that rendered selection impossible, and such an amount was taken from every part of the pile at the shaft-mouth as to ensure a fair average. The assay was conducted with great care, and several times repeated, furnishing, in my opinion, as true an indication of the value of the rock as can possibly be attained. The estimates based upon this result, and upon measurements, both above and below ground, are, I am confident, considerably within bounds.

Although the two parallel beds are not counted in the estimate of the property, they should by no means be ignored, as all mining history would go to show that at points they may become very productive, and those remarkable gash veins, or lenticular masses, with which the whole hill seems to be permeated, may, from time to time, with their rich massive ore, add materially to the returns.

No one can visit this mine without being struck with its great capabilities. Standing, as it does, upon an elevated point, commanding the most thorough drainage, with this immense stratified bed of copper underlying, at least, one hundred and twenty-three acres of its area, and everywhere within easy reach of the surface, an experienced eye cannot fail to be convinced of its brilliant future. Indeed, the pro-

duct would seem to be limited only by the facilities for hoisting from below.

After a few months, when the new working-shaft shall be completed, its daily yield will, in all probability, fully equal that of its justly celebrated neighbor, the Acton.

Respectfully yours,

AUGUSTINE SHURTLEFF.

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## REPORT OF J. C. HOADLEY.

NEW BEDFORD, May 6, 1863.

GENTLEMEN: In compliance with your request, I give you below the result of my examination of the Harvey Hill Copper Mine, and of my calculations of its value.

As the location of the mine, the extent and nature of the explorations, and the geological formation of the region, will, doubtless, be fully described by Prof. Chace, I need enter into no particulars on those subjects; but may proceed at once to a consideration of the quantity and value of the ore, the cost of mining it and sending it to market, the probable profit per annum, and the total value of the property.

1. *Quantity of Ore.* The principal value of this mine, so far as revealed, lies in a bed of shale, talcoid slate, and tale, interstratified with thin veins or strata of copper in the form of purple and yellow sulphurets, the whole evidently of sedimentary origin, and forming a deposit of nearly uniform depth and value.

Deposits in all respects similar have been cut at Halifax, at Sutton, and at other points; and the evidence is very strong that a bed or beds, analogous in form to coal measures, will be found to extend over a wide area.

Two conclusions will follow from this consideration: First, that deposits extending over whole townships must underlie entire tracts below the outcrop, in the direction of the dip of the strata, however deeply covered by superimposed formations; and, second, that the deposits *may be expected to increase in depth or thickness* as they recede from the outcrop towards the more deeply buried portions of the bed.

The first of these conclusions is sustained by the explorations. At the Kent shaft, an area of about one and one-quarter acres has been explored, by a gallery north and south, on the

dip of the bed, 30 fathoms in length, and by two galleries east and west, one at the 20 fathom level, 31 fathoms in length, and the other at the 30 fathom level, 52 fathoms in length,—the whole nearly in the form of a letter H, with its horizontal line extending north and south, on the dip of the bed. The bed holds its character with great uniformity over this limited area: this fact, in connection with the nature of the deposit, leads irresistibly to the conclusion that it extends to a great distance below the outcrop, although possibly broken by faults and displacements.

The quantity of land within the limits of the property, below the outcrop, is said to be about 123 acres; and as the dip of the bed at the lowest explorations is very low,—no more than six or eight degrees,—the surface may be taken without material error as the measure of the bed.

The depth or thickness of the bed, so far as explored, is from  $4\frac{1}{2}$  to 6 feet; assuming the smaller depth as the mean thickness of the bed, we have 148,830 superficial fathoms,  $\frac{3}{4}$  of a fathom in thickness, amounting to 111,623 cubic fathoms. What abatement should be made from this, will be considered when discussing the next point, viz.:—

2. *Value of the Ore.* The bed, where explored by the galleries at the Kent shaft, was found, by methods of sampling and assay (which will doubtless be fully described elsewhere, and which seem open to no objection), to yield  $3\frac{1}{2}$  per cent. of copper, which result agrees exactly with the careful and repeated assays by Capt. Williams.

This gives 82.32 lbs. of copper to the miner's ton (21 cwt.) of crude ore; but in dressing the ore up to 20 per cent. for transportation to market, there will be a loss of one-fifth, leaving 65.86 lbs. of pure copper, or 329.30 lbs. of 20 per cent. ore per ton of rough ore.

The weight of the crude ore is about 170 lbs. per cubic foot, equal to 36,720 lbs., or 15.61 tons per cubic fathom. The yield, therefore, of 20 per cent. ore per cubic fathom will be 2.18 tons, or 1.64 tons per superficial fathom.

It is not to be expected that the bed will prove of uniform richness throughout. Causes analogous to those which have

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resulted in the segregation of the sulphurets of copper and the shale into distinct strata, or laminae, may have produced more extensive absorption, enriching portions of the bed, or contiguous masses of rock, at the expense of the bed, or of portions of the bed. It seems a safe assumption, in view of the facts, to say that one-third of the area of 148,830 superficial fathoms will prove productive ground, yielding 1.64 tons of 20 per cent. ore per superficial fathom, amounting, in the aggregate, to 81,360 tons of 20 per cent. ore.

It is a safe estimate of the market value of copper ores to call them worth, in the market, \$4.00 per unit per ton, giving, for 20 per cent. ore \$80.00 per ton.

It is now worth \$6.00 per unit in currency, equal to about \$4.00 in gold.

Therefore, 81,360 tons of 20 per cent. ore, when mined, dressed, and sent to market, would be worth \$6,508,800 in gold.

The cost of mining, dressing, and sending to market, as estimated by Capt. Williams, is as follows:—

|                                       |                 |
|---------------------------------------|-----------------|
| Breaking and raising to grass . . . . | \$4.00 per ton. |
| Dressing . . . . .                    | 1.75 " "        |
| Agency and contingencies . . . . .    | 25 " "          |

Total, per ton, crude ore . . . . \$6.00

The cost of sending to Boston is stated to be:—

|                              |                 |
|------------------------------|-----------------|
| Hauling to railway . . . . . | \$9.00 per ton. |
| Freight to Boston . . . . .  | 6.00 " "        |

Total, per ton, of 20 per cent. ore . . . \$15.00

Now the crude ore to be mined, to produce 81,360 tons of 20 per cent. ore, will be 581,143 tons.

We may therefore make the following general estimate:—

### 3. Profit per annum.

#### ESTIMATE.

|                                                    |             |
|----------------------------------------------------|-------------|
| Product, 81,360 tons of 20 per cent. ore, at \$80, | \$6,508,800 |
| Cost, 581,143 " " crude ore, at \$6.00             | 3,486,858   |
| 81,360 " " 20 per cent., at \$15                   | 1,220,400   |
| Total cost . . . . .                               | 4,707,258   |
| Profit . . . . .                                   | \$1,801,542 |

It is calculated, that with certain additional facilities for raising and dressing the ore, 100 tons per day may be mined and dressed regularly, yielding say 14 tons of 20 per cent. ore per day.

The quantity of ore assumed in the foregoing estimate would therefore be taken out in 19.37 or say 20 years, showing the average net earnings to be \$90,000 per annum, for 20 years.

I see no reason to doubt the substantial accuracy of these calculations and estimates. It will, of course, be said that contingent and unforeseen expenses will be incurred in prosecuting work of such magnitude, for so long a period. But, on the other hand, the assumed cost of mining and transportation is very ample, and the assumed price of the ore very moderate; and all is reduced to gold, so that the effect of our inflated currency is eliminated.

The cost assumed for mining and raising to surface, \$4.00 per ton of crude ore, was furnished by Capt. Williams, and taken without criticism.

But it must certainly be considered high, if not exorbitant. The weight of the ore being 15.61 tons per cubic fathom, the assumed cost, \$4.00 per ton, is equal to \$62.44 per cubic fathom, or \$46.83 per superficial fathom, or \$7.80 per cubic yard, or 29c. per cubic foot, or 17c. per 100 lbs. Now, it must be obvious, on mere inspection, that for all the ordinary stoping and raising, that is, for the bulk of the work, this price is excessive.\* It considerably exceeds the cost of the work done in the galleries and headings already made, which are obviously more expensive, per ton of ore removed, than plain stoping. The assumed cost must, therefore, be considered large enough to cover the opening of new galleries, and all the contingencies of future operations.

The assumed cost of transportation to the railway is the actual cost at the present time. But a certain expenditure upon roads would reduce this cost, both by improving the road-way and lessening the distance.

\* The price includes drivages and dead work.

It does not, therefore, seem to me doubtful that the crude ore can be mined and dressed at \$6.00 per ton, and the dressed ore carried to Boston at \$15.00 per ton.

As little does it seem doubtful that 100 tons can be mined per day. This quantity is equal to only 6.38 cubic fathoms, or  $8\frac{1}{2}$  superficial fathoms, or  $17\frac{1}{4}$  feet square,  $4\frac{1}{2}$  feet deep, or 51 cubic yards. The daily removal of this quantity of slate rock, at a depth of only about 180 feet below the surface, cannot be thought difficult.

4. *Value of the Property.* We have seen that the net annual earnings of the mine should amount to \$90,000. It is probable that a year must elapse before the product can be brought up to 14 tons of 20 per cent. ore per day; but if the net earnings are smaller during that year, the exhaustion of the mine will proceed at a slower rate, and the total net earnings in 20 years may be set down at \$1,800,000.

If all dividends were to be deferred until the expiration of 20 years, and if, meantime, the accumulated earnings could earn no interest, the present value of the mine might be called one-fourth of that sum, say \$450,000; assuming that capital should double itself twice in 20 years, which is rather more than it will do at compound interest, at 6 per cent. per annum, semi-annual rests.

But if dividends were paid annually, or semi-annually as would be the case, interest should be computed on such dividends; and it will be certainly considered moderate to call the average time 10 years, compounding the interest, equal to 75 per cent.

|                                                       |             |
|-------------------------------------------------------|-------------|
| We then have, total net earnings . . . . .            | \$1,800,000 |
| Int. on divid. during 20 years average time . . . . . | 1,350,000   |
|                                                       | <hr/>       |
| Total net earnings and interest thereon . . . . .     | \$3,150,000 |
| Present value, one-fourth of earnings . . . . .       | 787,500     |

As all these estimates are made on the gold basis, it would be proper to add 50 per cent. to ascertain the value in currency.

|                                     |             |
|-------------------------------------|-------------|
| Then, present value in gold . . . . | \$787,500   |
| Add 50 per cent. . . . .            | 393,750     |
|                                     | <hr/>       |
| Present value in currency . . . .   | \$1,181,250 |

It will thus be seen that if the property can be bought for \$700,000 in currency, it will in all probability prove of much greater value, even without the discovery of further deposits of copper, and that it would turn out a good investment, returning the principal and 6 per cent. per annum, semi-annual payments, though the net earnings were to fall to two-thirds their probable amount.

Yours respectfully,

J. C. HOADLEY.

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## REPORT OF THOMAS MACFARLANE.

GENTLEMEN: In accordance with your request, I examined the Harvey Hill mining property, accompanied by Professor Chace and other gentlemen, on the 27th and 28th April last. I beg to present the following report as to the result of my investigations:—

The Harvey Hill Mine, belonging to the English and Canadian Mining Company, is situated on the 17th Lot of the 15th Concession of the Township of Leeds, in the County of Megantic, Canada East. This lot and the adjoining east half of the 16th Lot, same concession, are held by the Company in fee simple, and have an area of about 300 acres. On the other two half lots (the western half of Lot 16 and the eastern half of Lot 15), situated to the westward, and proposed to be included in the sale, the Company only possess the mining right.

The rocks of the district are micaceous clay slate, dark roofing slate, clay slate with intercalated quartz, nacreous slate, soapstone, &c. They have a general strike from east to west (all the bearings are given in relation to the magnetic north), and a dip to the north of from  $5^{\circ}$  to  $37^{\circ}$ . They contain, distributed through them, many irregular quartz courses or masses, of very variable thickness, which cut the strata, and contain more or less copper pyrites, purple copper and copper glance, as well as calcespar, bitterspar, and chlorite. The mining on the property of the Company was commenced on these irregular masses. Although many of them were found to be exceedingly rich in ore, others again did not repay the expense of working them. Moreover, it was found that they were altogether isolated from each other, incapable of being followed underground, and, on the whole, the result was arrived at, according to the able manager, Mr. Herbert Williams, that of themselves they could not be explored and mined with advantage. Some of them were, however, found to be connected with a stratum of slate impregnated with ore, and although the

latter alone has been found to be eminently worthy of excavation, it is probable that some of the irregular quartz masses in its neighborhood will also become sources of profit.

The first indications of the existence of the so-called copper beds were, I believe, discovered in Fremont's shaft in 1859; but it was not until recently that their importance became fully apparent, and preparations were made for their excavation. They consist of micaceous slate, generally studded with chloritoid, from four to eight feet thick, with which small lenticular masses of copper pyrites, purple copper and quartz, are interstratified. Although there are evidences of the existence of several of these beds, it is only the uppermost of these which has been explored to any considerable extent. This deposit, usually called the upper copper bed, is intersected at a depth of 22 fathoms by Kent's shaft, the position of which may be seen by a reference to Mr. Williams's map. At this point the bed has been explored by 80 fathoms of levels and 30 fathoms of winze and drift to rise. The dip varies from  $24^{\circ}$  to  $30^{\circ}$  (to the north), and the strike is almost exactly east and west. The area of bed explored by the workings in Kent's shaft we estimate at 1,665 *square fathoms*. Assuming the thickness of the bed to be  $4\frac{1}{2}$  feet, this area corresponds to 1,249 *cubic fathoms*. These, at 16 tons each, will yield 19,984 tons of rough ore. With regard to the copper contents of this rough ore, we have been very anxious to determine it correctly. A series of samples taken in the mine were found to average 3.6 per cent. copper. The heap on the surface, resulting from the excavation of the 20 and 30 fathoms levels, was also sampled in as thorough a manner as possible, and the result gave by common humid assay 3.4 per cent.; by the volumetric method 3.65 per cent. I therefore concluded that the percentage stated by Mr. Williams at the outset, viz.  $3\frac{1}{2}$  per cent., was essentially correct, and adopted it in my calculations. The loss in dressing up the crude ore to 20 per cent. I estimate at one-fifth of the copper contents. I consider this a reasonable estimate from experience gained in dressing ore elsewhere. On this estimate the 19,984 tons rough ore, mentioned above as exposed in the workings of Kent's shaft, would yield (at 2.8 per cent.)

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2,798 tons of 20 per cent. ore, or, after deducting the difference betwixt Inmid and dry assay, 19.5 per cent. The value of this ore, delivered at the smelting work, assuming the price per unit to be \$4, and per ton \$78, is \$218,244. (The estimates of cost being wholly in Canadian currency, the above value is to be understood as in gold.) The cost of producing and sending to market the above 2,798 tons of dressed ore would, according to Mr. Williams's estimates, which I consider *very liberal*, be as follows:—

|                                                                                                |              |
|------------------------------------------------------------------------------------------------|--------------|
| Drifting, stoping, and raising to surface 1,249 cubic fathoms of ore ground, at \$44 . . . . . | \$54,956 00  |
| Cartage of 19,984 tons rough ore to dressing-house, at 25 cents . . . . .                      | 4,996 00     |
| Dressing 2,798 tons of 20 per cent. ore, at \$12.50 . . . . .                                  | 34,975 00    |
| Packing same, at 80 cents . . . . .                                                            | 2,238 40     |
| Cartage to station, at \$9 . . . . .                                                           | 25,182 00    |
| Freight to Boston, at \$6 . . . . .                                                            | 16,788 00    |
| General expenses, \$1 per ton . . . . .                                                        | 2,798 00     |
|                                                                                                | \$141,933 40 |

Besides this ore ground, exposed at Kent's shaft, two of the irregular quartz courses have been discovered at this point connected with the bed. One of these, which has been worked out (Fanny Eliza, No. 1), yielded ore to the value of \$8,500. The other (Fanny Eliza, No. 2), which is now being excavated, promises equally as good a yield. In the neighborhood of these masses it would seem that the bed is to some extent impoverished, which would lead to the supposition that the ore of the quartz masses had been derived from the bed. However this may be, the connection to some extent of the quartz courses with the bed would lead me to expect that the former *may hereafter be mined with much greater advantage than previously.*

The upper copper bed has also been struck at a depth of 15 fathoms in grass shaft No. 2, about 170 fathoms to the east of Kent's shaft. It is here seven to nine feet thick, has a strike of N. 67° E., and a dip to the north of from 14° to 22°. The bed promised well at first, and at one point, from a bore-hole

of 19 inches depth, a sample assaying 7 per cent. was obtained. About 20 fathoms were driven horizontally upon it, when it became thicker, but the copper ore became more diffused through it, and the working was temporarily suspended. There has also been a drift on the rise excavated, seven fathoms long, two-thirds of which are somewhat impregnated with ore.

The upper copper bed has also been intersected by Morrison's adit, which has been driven 248 fathoms into the hill, in a direction such as to cut the strata obliquely. On entering the adit, the slates are found to dip only  $10^\circ$  to the north. They gradually, however, become more inclined, often very much contorted, in which latter case they contain much quartz. About 140 fathoms from the mouth of the adit, nacreous slates, with chloritoid, have been penetrated, which represent the upper copper bed. They are, however, destitute of copper, but this is said to be attributable to the presence underneath of an irregular quartz vein, called "Sewell's Lode." The dip of the strata continues pretty much about  $30^\circ$  until the end of the adit is reached, where they dip only  $5^\circ$  to  $10^\circ$ , still to the north.

The upper copper bed has thus been intersected at three different points, at two of which it was found unremunerative, at the other *eminently productive*. It would thus appear reasonable and just to assume that two-thirds of the area of the bed may be unproductive. It is certainly the case that neither in grass shaft No. 2, nor in the adit, has the bed been explored to the same extent as in Kent's shaft. But it must be remembered, on the other hand, that these three workings test but a comparatively small portion of the whole area of the bed. According to Mr. Williams's map, the total area of the same within the Company's property (making no allowance for dip, which, judging from the position of the strata at the entrance of the adit, may not be so considerable) is 123 acres. Of this, I estimate 41 acres to be as productive as the ground near Kent's shaft. The area there explored is 1.37 acres, consequently the 41 acres would contain about 30 times as much ore as the ground around Kent's shaft, or 83,940 tons of 20

per cent. ore. This, at \$78 per ton, would be worth \$6,547,320 at the smelting works. The cost of producing this quantity is estimated as follows:—

|                                                                                                                                                                                                                                 |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Mining and producing 83,940 tons dressed ore, at,<br>as in former calculation, \$50.73 per ton . . .                                                                                                                            | \$4,258,276 70 |
| To this we must add the cost of sinking shafts<br>for raising the ore and driving levels, &c.,<br>through the dead ground. This we estimate<br>at \$10 per fathom of ground, or \$4.46 per ton<br>of 20 per cent. ore . . . . . | 374,312 40     |
|                                                                                                                                                                                                                                 | <hr/>          |
|                                                                                                                                                                                                                                 | \$4,632,588 60 |
| This deducted from . . . . .                                                                                                                                                                                                    | 6,457,320 00   |
|                                                                                                                                                                                                                                 | <hr/>          |
| Leaves as net profit . . . . .                                                                                                                                                                                                  | \$1,914,731 40 |

It must, of course, be remembered that this estimate is only approximate. It may exceed the truth, and may fall short of it. It is also to be remembered that this profit is altogether *irrespective of that which might result from working the quartz courses* which would probably be discovered in exploring the bed. If we may judge from the results obtained in excavating the Fanny Eliza masses already referred to, *the profits from this source would not be inconsiderable.* The uncertain nature of these deposits, however, renders any reliable estimate of their value impossible.

With regard to the ore-producing capabilities of the mine, it would seem quite practicable at once to raise the production of the mine to 100 tons crude ore, equal to 14 tons 20 per cent. ore, per day, at which rate about 20 years would be necessary for excavating the quantities above estimated. With the present dressing-house and supply of water, it would be impossible to dress 14 tons daily. The erection of a dressing establishment on the Palmer River would be indispensable, and would cost, with road to it from the mine, about \$20,000. The present condition of the road from the mine to the railway, at Craig's Road or Becaneour station (31 miles), would also seem to present hindrances to the production of such a quantity of

ore daily as that indicated. Wherefore, it would be highly necessary at once to complete the road from the mine to Methot's Mills (21 miles).

In the foregoing report, I have presented you with all the data possible, to enable you to form an idea of the value of the property.

I remain, Gentlemen,

Yours, most respectfully,

THOMAS MACFARLANE.

ACTON, 4 May, 1863.

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## REPORT OF GEORGE H. PIERCE.

RICHMOND, Oct. 25, 1862.

JACOB SLEEPER, Esq., Pres. H. C. M. Co.

DEAR SIR: As proposed in my last note, I paid during the past week a visit to the "Leeds Mines," in order to ascertain what analogy, if any, existed between it and our own, so that we might be enabled to take advantage of their experience, — far as possible, in the development of the Halifax Mine.

Through the kindness of Mr. Herbert Williams, the gentlemanly superintendent of the mine, every facility was afforded me for a thorough examination of the various workings of the mine, as well as much valuable information and many statistics given, which otherwise I should have been unable to obtain. As the analogy between the two mines will, I think, warrant, you will pardon me, I trust, if I give you somewhat in detail my observations at Leeds.

The Leeds or Harvey Hill Mine, situated on Lot Seventeen of the Fifteenth Range, of the Township of Leeds, is the property of the "English and Canadian Mining Co." The outcrops, so far as explored, occur on the north-west slope of a hill of some two hundred feet in height; the strike of the rock — which is composed principally of a dark-colored clay-slate, with bands of light-colored nacreous clay, interstratified — is north-east and south-west, dipping to the north-west at an angle of from 12 to 25 degrees.

In these slates at surface, several quartz courses occur, running in various directions, and dipping at all angles, some running with the stratification, but cutting it in dip, while others cut both in trend and dip.

These courses, which from their form are termed "Lenticular Masses," are very rich in copper, containing the gray, purple, and yellow sulphurets, as well as various proportions of chlorite, brown spar and calcspar, intermixed with a considerable quantity of green carbonate of copper.

All of these courses that have yet been worked, after yielding from a few tons to several hundred tons of rich ore, gradually thinned out both horizontally and vertically, or branched out into small spangles which finally lost themselves in the slates and ceased to yield copper.

It was judged by the superintendent, and correctly, as the result proves, that these rich masses could not occur isolated and alone, but that they had their connection in some way with a cupriferous deposit.

In order to test this, a shaft was commenced at a distance of about one-third from the bottom to the top of the hill, and an adit at the same time started some 100 fathoms to the north of the shaft, the mouth of the adit being on lower ground by some 10 fathoms than the mouth of the shaft, so that the relative position is something as given in sketch. The working shaft, after passing through a dark-colored clay-slate for 20 fathoms, cut a *bed* of light-colored nacreous slate, carrying some three per cent. of copper, disseminated through the bed, which was at this point about five feet in thickness.

At the 22 and 30 fathom levels of the shaft, drifts were run in a north-westerly direction, meeting the bed in the rise, and an incline shaft run between the two points of the bed thus cut on the bed for 20 fathoms. At the 22, as well as at the 30 fathom level, the bed has been driven on some seven or eight fathoms on each side of the incline shaft. So far as the bed has been explored it shows a thickness of about six feet, and holds its character remarkably well. It also increases in richness in depth. Some samples brought up by me from the 30 fathom level, and which I took as an *average* sample, gave by measurement from nine to ten per cent. The yellow sulphuret which was found in the bed at the 22 fathom level, associated with purple ore, has disappeared at the 30, and is replaced by more purple.

The bed itself, as before mentioned, is nacreous slate; interstratified with, as well as disseminated through it in grains, varying in size from those so fine as hardly to be detected with the naked eye, up to those of the size of a kernel of corn, the copper occurs. The interstratified flakes vary in thickness,

from that of a sheet of paper, to one-half an inch in the thickest part, and in length run from a couple of inches to one foot; these form splices by overlapping one another, so that the general appearance of the edge of a stone taken from the bed is very uniform as far as the relative proportion of copper to dead rock is concerned.

In driving from the shaft, at the 30 fathom level, to meet the bed, a rich mass of ore in quartz, similar to the surface outcrop, was met with at about eight fathoms from the shaft. This mass (called the "Fanny Eliza") was of lenticular form, some four feet in thickness, and running out in lens form both horizontally and vertically.

At the time of my visit, another of these masses had been met with, in the drift on the bed, toward the north-east, at the 30 fathom level. This seems to cut entirely through the bed and run into the dark slates on either side, while the "Fanny Eliza" was entirely below the bed, with its upper extremity only coming to the bed. The connection existing between the bed and these masses is as yet unexplored: the lenticular mass either cuts the bed, or has one of its points in the vicinity of a cupriferous bed; the bed at the same time is poor, and sometimes, even, divested of its ore, on approaching one of these masses, for a distance of two or three fathoms.

The *adit*, by computation, should have cut the same bed at a distance of 120 fathoms from its mouth, but met instead another of those masses, in what appears to be the same light-colored bed of slate, but carrying very little copper; however, the adit shaft No. 2 cut the cupriferous bed 12 fathoms above adit level, as it should, and we may consider the bed has been tolerably well proven over the limit of the *two workings*.

All the ore is left in reserve, and only that raised which is cut in these explorations, so that as yet the mine has not been a paying one, for the reason that their primary object has been to develop it and allow the ore to remain in reserve until better facilities for dressing and transporting on a large scale would be warranted. We may perhaps form some idea of the value of ore in sight, as well as the probable value of the bed between the working shaft and adit. At the work-

ing shaft we have in sight  $1 \times 20 \times 15$  fathoms = 300 cubic fathoms of  $3\frac{1}{2}$  per cent. ore, at the very lowest. This at \$4 per unit will give, if we allow the stone to weigh 20 tons per fathom, about \$84,000, or, if we consider the bed continuous from the working shaft to the adit, we have  $100 \times 80 \times 1$ , or 8000 cubic fathoms, which at \$280 per fathom gives \$2,240,000 as the gross value of ore above the 30 fathom level between the adit and working shaft.

On the whole, I look upon the Leeds Mine as one of the richest, if not the very richest yet opened in Canada, and I believe there is a great future before it; and many years of labor will require to be spent before the deposit will be sensibly diminished.

Yours very truly,

GEO. H. PIERCE,  
*Agent H. C. M.*

GENTLEMEN: In compliance with your request, I have given an estimate of cost of the proposed tramway from the Harvey Hill Copper Mine to the Grand Trunk Railway, based on the most reliable information I have been able to obtain, both from Government maps and my own knowledge of the country through which the line would pass.

It should be borne in mind, however, that without an actual survey of the route an estimate cannot be given that will be perfectly reliable; still, I anticipate the figures given below will be found in the vicinity of the truth, and serve to give you an idea of what the cost would be.

Assuming that the road is to be sufficiently well built to admit of being worked by a light tram engine capable of hauling some thirty or forty tons, and that the line of road will follow the river Becaneour and branches, giving a length of line of about 25 miles, that the roadbed be eight feet in width at rail level, and that the average cutting and filling be from three to

four feet, the cost of the road per mile will, I estimate, be as follows:—

|                                                        |             |
|--------------------------------------------------------|-------------|
| Right of way—8 acres, at \$15 . . . . .                | \$ 120.00   |
| Clearing “ “ “ 12½ . . . . .                           | 100.00      |
| Excavation, 10,000 cubic yds., at 10c. per yd. . . . . | 1,000.00    |
| Bridging and trestle work . . . . .                    | 500.00      |
| Strap rails, 17 tons, at \$40 per ton . . . . .        | 680.00      |
| Stringers and cross-ties . . . . .                     | 205.00      |
| Laying track . . . . .                                 | 100.00      |
| Rolling stock . . . . .                                | 500.00      |
|                                                        | <hr/>       |
|                                                        | \$3,205.00  |
| Add 20 per cent. for contingencies . . . . .           | 641.00      |
|                                                        | <hr/>       |
| Cost per mile . . . . .                                | \$3,846.00  |
| Or for 25 miles a total cost of . . . . .              | \$96,150.00 |

To obtain the cost per ton of freight, let us suppose the road to pay seven per cent. on its cost per annum, and that the running expenses be 50 per cent. of the gross earnings of the road, then we have—

|                                                  |             |
|--------------------------------------------------|-------------|
| Interest on cost of road, at 7 per cent. . . . . | \$6,730.50  |
| Running expenses . . . . .                       | 6,730.50    |
|                                                  | <hr/>       |
| Gross earnings . . . . .                         | \$13,461.00 |

Suppose one-fourth the freight over the road is freight going upward or toward the mine, then three-fourths of the above earnings must be chargeable to down freight or ore from the mine, or \$10,095.75.

Suppose the mine to raise 100 tons of three and one-half per cent. ore per day, that the loss in dressing to 20 is 20 per cent., then we have 14 tons of 20 per cent. ore to be sent over the line per day, or, for 300 days in the year, say 4,200 tons. This is at a cost of \$10,095.75, or \$2.40 per ton. This is the cost per ton, the road paying as an investment.

If the cost of building the road is charged to the mine, then the cost of freight will only be that of running expenses, that is, \$1.20 per ton.

Should other freights than those for the mine pass over the road, they will contribute, of course, to the revenue and lessen proportionally the cost per ton.

Trusting these figures will be found approximately correct,

I remain, &c.,

GEO. H. PIERCE,

*Civil Engineer.*

RICHMOND, May 11th, 1863.

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## MOLYBDENUM.

EXTRACT FROM GEOLOGICAL REPORT OF CANADA FOR 1863.

This rare metal exists in nature for the most part as a sulphuret, known as molybdenite, or in the form of molybdate of lead. The former ore is the more common, but is very seldom met with in any considerable quantity. Notwithstanding its scarcity, it has however found several applications. The combination of molybdic acid with ammonia is used as a reagent for the detection and determination of phosphoric acid, in chemical analysis. A fine blue pigment has also been prepared from molybdenum; and a few years since a German chemist proposed the blue of molybdenum as a substitute for indigo in dyeing silk, cotton, and linen. Experiments to test the applicability of this substance were made by Kurrer, and are reported in Dingler's Polytechnical Journal for 1853; from which it appears that by the use of molybdenum, and a salt of tin, blue dyes of every shade, and of remarkable durability, when exposed to sun and air, were readily fixed upon silk. Durable blues, inferior to those given to silk, are imparted to cotton by the same dye. The molybdates may also be employed in printing, to give what are called topical colors to both silks and cottons. The molybdic acid for this purpose is said to have been manufactured at Prague, from a massive molybdate of lead, which is found in some quantity in Bavaria. It does not appear that these processes have ever become adopted to any great extent, one cause of which is undoubtedly the rarity and costliness of molybdenum. At the Industrial Exhibition of 1855, Batka, a manufacturing chemist from Prague, presented specimens of an impure molybdate of soda, prepared for dyeing silks, and containing less than one-half its weight of molybdic acid. Its price was \$1.20 the pound, while that of the native sulphuret of molybdenum, exhibited by him, which may be made to yield about nine-tenths its weight of molybdic

acid, was \$3.45 the pound. The small supply of the material, conjoined with the demand for it for the uses of the laboratory, has probably prevented its more general employment.

On page 504, several localities of molybdenite have been mentioned; but the only one of them, so far as known, which affords any available quantity of the mineral, is that described as occurring in Quetachoo-Manicongan Bay, on the north shore of the Gulf of St. Lawrence; where it occurs disseminated in a bed of quartz six inches thick, in the form of nodules from one to three inches in diameter, and in flakes, which are sometimes twelve inches broad by one-fourth of an inch in thickness. The bed, which is interstratified in a white coarse-grained gneiss, holding garnets and black mica, was traced about fifty yards, with a dip N. 15° E. < 58°, and would probably furnish a considerable quantity of molybdenite. This mineral, which has a specific gravity of about 4.5, has a leaden-gray color, and a metallic lustre. It is soft and malleable to the touch, and is often mistaken for plumbago, from which it is distinguished by its much greater weight, by a peculiar greenish hue in the metallic streak which it leaves on white paper, and by the fact that when heated to redness in the open air it gives off the odor of burning sulphur, and is slowly converted into a yellowish-white substance, which is molybdic acid.

Since writing the previous chapters, sulphuret of molybdenum has been found at Harvey Hill, in Leeds, by Mr. Herbert Williams, the director of the works of the English and Canadian Mining Company at that place. The mineral occurs in some of the short courses or veins of quartz and bitter-spar, which intersect the copper-bearing slates of this locality. It forms small masses, generally rounded in their outline, and sometimes an inch or more in diameter. Judging from the specimens sent, the mineral would seem to be abundant. The molybdenite of this locality, instead of being foliated, as is generally the case, is finely granular, with an uneven fracture; it is very soft, and assumes a polish when rubbed with the nail. It is not improbable that some among the numerous localities in which molybdenite has been met with on Lake Superior, may be found to yield considerable quantities of this metal.

## REPORT

OF THE DIRECTORS OF THE ENGLISH AND CANADIAN MINING COMPANY, LIMITED, FOR PRESENTMENT AT THE FIFTH ANNUAL GENERAL MEETING, TO BE HELD ON THE THIRTIETH APRIL, 1863.

This being the Fifth Annual Meeting of the shareholders of the ENGLISH AND CANADIAN MINING COMPANY (LIMITED), the Directors have now to report the progress of works at the mines in the year 1862.

The funds at the disposal of your Directors being so nearly exhausted, it has been their study to suspend, as far as possible, all works not tending towards immediate profit. The only exception to this rule was the continuation of Morrison's adit, at the urgent recommendation of Mr. Herbert Williams. But this also was discontinued at the end of October, so that now all expenditure is applied to the development of the important mineral deposits in Kent's shaft. It will have been observed by the shareholders that there is a remarkable increase in the balance of results obtained from ores sold in this country, the net proceeds of sales at Liverpool and Swansea of ores shipped in 1862 amounting to £2,835 9s. 2d. These parcels have principally consisted of very high percentage ore, from two lenticular masses, called Fanny Eliza, No. 1, and Fanny Eliza, No. 2, found in Kent's shaft. Besides this, great progress has been made in opening out, in various directions, the great interstratified bed in the same shaft, which, at the close of the year, had been found continuous from above the 20 fathom to below the 30 fathom levels, to an already ascertained length of 625 fathoms of ground, yielding ore of an average richness of  $3\frac{1}{2}$  per cent. This would be equivalent to a quantity in sight of 7,500 tons, according to Mr. Williams's opinion, of which about 600 tons were then at grass. The accounts received of subsequent progress are equally favorable. What the limits of this remarkable deposit are, can of course only be a matter of conjecture, but judging from appearances, there

is great probability that it extends throughout a large portion of the Company's estate. An important feature observed in the progress of these works is, that wherever the percentage of the ore in the interstratified bed has diminished considerably, it has been found to be an invariable indication of an approach to lenticular masses of the rich quality above described, and which, by an inexpensive system of dressing, are easily brought to more than 40 per cent. produce.

These results established by Mr. Williams, in the accuracy of which Mr. Tregoning fully concurs, and similar opinions frequently expressed by Sir W. E. Logan, the government geologist of the colony of Canada, satisfy your Directors of the enormous value of the minerals underlying the Company's estate. Your Directors have diligently studied the best means of utilizing these important discoveries, by economizing the dressing cost of the moderate quality ores from the interstratified bed; and Mr. Williams's recent visit to England was made principally with this view. Your Directors have not yet come to any conclusion on this subject, but they have satisfied themselves that by the ordinary process of dressing, and whilst operating only on small quantities and with defective machinery, these ores can be dressed to a profit, which profit may certainly be considerably increased when large quantities are dressed with more powerful and better machinery. But they have also found that whatever system of dressing may be finally adopted, the quantities of ore extracted and dressed must be very large in order to yield a corresponding profit, and that consequently a considerable floating capital will be necessary for the purpose. It was on this account that your Directors called the special general meeting held on the sixth March last, to consider the propriety of raising fresh capital, when it was resolved that the present meeting be made special, to take into consideration the said plan.

At the aforesaid special meeting, your Directors, at the request of the Canadian shareholders, called the attention of the meeting to their desire for a change in the mode of management of affairs at Quebec, and for the appointment of an agent to represent the interests of the Canadian shareholders at all

meetings of the shareholders in England. These suggestions were referred by the special general meeting to the Directors; but your Directors, considering that, even if practicable, they could not be carried into effect without a change in the constitution of the Company, have not thought fit, in the present position of the Company's affairs, to take any steps in the matter. It must be remembered that the Canadian shareholders already possess, by means of proxies, the faculty of complete representation at the meetings of shareholders here, — a faculty, however, of which they have never availed themselves.

With reference to the propositions which have been made to your Directors, for a sale of a portion or portions of the Company's estate, as the negotiations are still pending, your Directors abstain from entering into particulars. But they may state that these propositions appeared sufficiently serious to induce your Directors to send to America your able and zealous superintendent, Mr. Herbert Williams, and that, subsequently, their colleague, Mr. Stobart, who during the last three years has performed gratuitously the duties of secretary, and who so deservedly possesses the full confidence of the Board, has proceeded thither for the purpose of carrying on the negotiation. Under such auspices, your Directors are persuaded that the interests of the Company will be carefully attended to.

Two of your Directors, Mr. Alexander Morrison and Mr. Henry Sewell, now go out by rotation: being eligible, they offer themselves for re-election. It also devolves on the meeting to elect two auditors.

By order of the Board,

JOHN L. BENNETT,  
*Secretary pro tem.*

ITEMS FROM THE BALANCE-SHEET OF THE ENGLISH  
AND CANADIAN MINING COMPANY, LONDON.

The items given below were taken from the Company's Balance-sheet for December 31, 1862, and show the amount expended in the development of the property to that date, exclusive of the original price paid for the mine,—in sterling currency.

|                                                 | £       | s. | d. |
|-------------------------------------------------|---------|----|----|
| Cash expended in buildings . . . . .            | 1,878   | 3  | 10 |
| Salaries . . . . .                              | 3,081   | 7  | 8  |
| Other office expenses . . . . .                 | 365     | 8  | 6  |
| Labor cost . . . . .                            | 17,468  | 12 | 1  |
| Steam engine, apparatus, utensils, etc. . . . . | 1,070   | 1  | 4  |
| Oxen, horses, harness, carts . . . . .          | 124     | 10 | 5  |
| Metal, fuel, powder, etc. . . . .               | 503     | 3  | 4  |
|                                                 | £24,491 | 16 | 2  |

The above is exclusive of large amounts for surveys and other preliminary expenses.

LONDON, April 20, 1863.

Examined and found correct.

THOMAS H. GLADSTONE, }  
ROBERT PORTER, } *Auditors.*

REPORT OF CHAS. T. JACKSON, M. D., GEOLOGIST  
AND STATE ASSAYER.

GENTLEMEN: In accordance with your request, I visited and examined the Harvey Hill Copper Mine, during the first half of the present month, and have now the honor of reporting my observations.

SITUATION OF THE MINE.

Harvey Hill Copper Mine is situated in the township of Leeds, Megantic County, Canada East. According to the large government map, its latitude is 46 deg. 15 min. North, and longitude 71 deg. 14 min. West. The mining land you have arranged to purchase comprises Lots 15, 16, and 17 of the 15th Range, principally Lot 17 in the 15th Range, on which the work is carried on, or so much of those lots, with so much of the other lots as may be agreed upon, as will make up with the opened mine 500 acres of land, each concession lot comprising 200 acres.

The country around the mine is moderately hilly, is partly cleared and cultivated; the region is not thickly populated, but scattered farms, owned mostly by English settlers, occur here and there along the way and around the mines.

The mine is sixteen miles in a direct line from the Grand Trunk Railroad to Quebec, twenty-one by the nearest road yet opened, and about thirty miles by the common roads. To Craig's Road Station the distance by the old road is thirty-two miles, and twenty-one miles by the new road now in course of formation from the mines to the Methot Station on the Grand Trunk Railway. In a direct line Quebec is forty miles north of this mine.

GEOLOGY OF THE DISTRICT.

The rocks of Harvey Hill are talco-argillaceous slates, of the Taconic group, and are styled in the Canadian Geological

Reports nacreous slates, on account of their pearly lustre. They are of various shades of color, from nearly white through shades of green to common roofing-slate blue. No fossils have ever been found in this formation, which evidently belongs to the Azoic epoch of geology. The slate strata bear numerous beds, veins, and lenticular masses of quartz, some of which occurs in crystals in the copper veins. Gold is found occasionally in the quartz veins, and probably it is also disseminated in fine particles in some of the slate strata.

According to the Canadian Geological Survey, Harvey Hill Copper Mine is on the south-east side of the Shipton and St. Armand synclinal, and therefore the general dip of the strata will be to the north-west.

Masonite, since named chloritoid, occurs abundantly in the nacreous slates of this mine, but no other crystallized minerals were observed excepting quartz, which occurs in the veins.

#### SITUATION AND NATURE OF THE ORES.

The copper ores of Harvey Hill Mine exist in the state of interstratified beds, gash veins, and in lenticular masses associated with quartz. Some of the lenticular masses are of large size, and, consisting of the richest and purest ores, are very valuable. The gash veins are not reliable, and generally run out to mere strings. It is upon the interstratified beds, which are of great dimensions and extend with the strata to unknown depths, that the miner chiefly relies in mines of this character. The quartz veins, bearing rich bunches of copper ore, are apt to split into string veins, and to run out, while the *interstratified ores are persistent with the strata* inclosing them. This result has been obtained by observation in many localities in Canada East. Veins running with the "country," or imbedded veins, are found to be more certain than cross veins in the "slate mines;" but these beds are not so rich as those which occur in bunches associated with quartz, the strata yielding from three and a half to four per cent. of metallic copper, while the pure bunches yield 71 per cent., and, on an average, of broken ore, about 40 per cent. The

interstratified beds are however very thick in one locality, certainly more than 10 feet, for they have been cut into to that extent without finding their borders, their average, however, being about five feet. I shall give the details in my notes written in the mine, and therefore now pass to the designation of the nature of the ores. These are, first, yellow copper pyrites, containing 34 per cent. of copper: bell-metal ore, containing 24 per cent.: erubescite, or purple copper ore, containing from 60 to 70 per cent.: copper glance, or vitreous copper ore, containing  $78\frac{1}{2}$  per cent.

These ores are mixed with each other in variable proportions, and most of the erubescite is mechanically mixed with the copper glance, and the two ores may be distinguished by the eye, since the erubescite turns of a beautiful purple and blue very soon after exposure to the air, and when cut has a purple color, while the copper glance is of nearly a tin or bright lead bluish white, and preserves this color, and cuts with a tin-white surface. The two ores are much more distinct than they are in the Acton Mine, and the richer ore is more abundant at Harvey Hill. On chemical analysis of a specimen of the pure copper glance, I obtained the following results *per cent.*:—

|                                     |        |
|-------------------------------------|--------|
| Metallic copper . . . . .           | 78.47  |
| Sulphur . . . . .                   | 18.54  |
| Iron . . . . .                      | 1.66   |
| Silica . . . . .                    | 0.33   |
|                                     | <hr/>  |
|                                     | 99.00  |
| To which add sulphur lost . . . . . | 1.00   |
|                                     | <hr/>  |
|                                     | 100.00 |

I also made a chemical assay of a sample of the mixed erubescite and copper glance, with the following results:—

|                           |        |
|---------------------------|--------|
| Metallic copper . . . . . | 71.20  |
| Sulphur . . . . .         | 20.00  |
| Iron . . . . .            | 8.30   |
| Silica . . . . .          | 0.50   |
|                           | <hr/>  |
|                           | 100.00 |

These specimens were taken from the Fanny Eliza Winze, and came from one of the large lenticular masses of ore associated with hyaline quartz. Interstratified with the slates we find the same kind of ore, with bell-metal and yellow copper pyrites.

#### THE MINE AND DRESSING-HOUSES.

Descending by ladders to the 30 fathom level, 180 feet from the surface, we examined the different exposures of the ores in the levels and winzes where the miners were at work. An adit level, which penetrates this hill across the strata, some 248 fathoms in length, being blocked up by deep snow, was not examined, and I found that little information could be obtained in it beyond that shown in Mr. H. Williams's diagram, made when the rocks were freshly cut.

The following notes were made in the mine and dressing-houses:—

At the bottom of the 30 fathom level we see, at the rising level, or winze, an interstratified bed of copper ore, which is cut for nine feet in thickness without finding its limits. The dip of the strata was found to be at this place 20 degrees north-east. Numerous lenticular masses of quartz, with copper ores, of the purple and vitreous species, were also observed.

This rise is to be carried up to the 10 fathom level, and will pass up with the interstratified bed of ores. At the 26 fathom level, in its eastern end, the strata were found to dip 20 deg. and 30 deg. eight or ten degrees west of north, there being a way from the strata. The interstratified bed was examined for the extent of 15 fathoms, pieces of ore being freshly broken off as we proceeded.

Four backs can here be stoped, twenty-seven fathoms in height, one of 20 fathoms and one of 10 fathoms in length being now opened. The cost of this level was sixty dollars per fathom, and it is six feet wide and seven feet high. Four men did the work on contract. One hundred and thirty-five tons of three and a half per cent. rough ore was raised from this work.

The west end of this level is quite rich in copper ore. The dip of the strata was found to be 32 degrees.

We then followed a winze twenty-seven fathoms in length, extending from the 30 fathom level, and also examined a tram-road in the same level for transportation of the ores. In the winze we saw very rich purple copper ore, extending 35 fathoms to the westward. Six miners are at work on the heading of this winze, on a contract to mine it for \$58 per fathom.

Fanny Eliza Winze No. 2 extends northwardly nine fathoms, and the Fanny Eliza Winze No. 1, which is worked through, gave 50 tons of 43 per cent. purple copper ore. The course of the strata measured here N. 25 deg. to 30 east, and the angle of dip was 20 deg. to the north-west. In the winze now cutting there were six miners, who have contracted to do the work for \$70 per fathom, and take the ore up to the shaft.

At the bottom of the shaft I found the strata to dip 25, 28 and 30 deg. at different points, showing a wavy structure in the rocks.

On inquiry, the underground mining captain, Sinecock, and the present superintendent, Capt. Rogan (Mr. Williams being in England), informed me that the quantity of copper ore raised and sold during the past year was from 97 to 100 tons. This was dressed in two months. The yellow ore averaged twenty-three and three-quarters per cent. of copper; the purple ore averaged forty-one and twenty-one hundredths per cent., and the mean of the whole was thirty-five and ninety-five hundredths per cent.

The mine yields 12 tons per fathom of rough ore, yielding from three and a half to four per cent. of copper, but the "bed stuff" and "vein ore" were far richer.

The cost per ton of the dressed ore, ready for market, was from \$11 to \$12, and they estimate that, when they have an abundance of water for washing, the cost will be reduced to \$8 per ton.

Transportation of the ore, packed in boxes, to Craig's Road Station on the railroad, thirty-two miles, is at present \$9 per ton; and it costs but 80 cts. per ton to carry the ore from Craig's Road Station to Quebec, and from thence to England the freight is \$3.50 per ton only.

Transportation of the ore from Craig's Road Station to Boston is estimated at \$6 per ton.

The pine boxes in which the ore is packed cost twelve and a half cents each, and sell for the same price in England, so that they really cost nothing. These boxes contain from 300 to 400 pounds of ore, according to its density.

There are now employed in this mine fifty to sixty miners and laborers, the miners being paid \$40 per month, and the strikers \$22, while the "grass men" receive but 75 cts. per day.

Twenty boys, at from 1s. to 50 cts. per day, are employed in the summer at the dressing-house, where they tend the jigs, buddles, and trunks, and also pick and sort the ores.

The machinery and dressing-houses contain a Cornish tubular steam engine of fifteen horse-power; a battery of eight heads of stampers; a crushing mill, much worn; three jiggging frames; two ties; one round buddle; two dolly-tubs; six trunks; two slime-pits; six drags; one shaking-trunk; two small slime-pits, and one fan-tail or V buddle.

Besides this machinery, the Company own twenty dwelling-houses, which are occupied by their workmen and various employes.

Last summer, in two months, 100 tons of 36 per cent. copper ore was prepared at this establishment and was sent to England. One thousand tons of 4 per cent. ore is now on the surface, to be dressed. This will yield 40 tons of copper at least.

If the ore is stamped it costs \$5 per ton to do the work, the battery yielding one ton of stamped ore per hour. The stampers weigh 168 pounds each. The steam engine has a cylinder twelve inches in diameter and is estimated at fifteen horse-power. It is a coal-burner, and does not work to advantage with wood fuel. It is a portable engine, and may be removed to any place where it may be needed. Three cords of wood are consumed in its furnace in twenty-four hours, costing from three to four shillings per cord.

It is proposed to lay a tram road from this mine to Palmer's River, the distance being only one mile and a quarter, and the ground gradually descending. Then all the ores will

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be carried to the river on this road, and be dressed where the supply of water is abundant.

The ore can be dressed by water only during the spring, summer and fall months, say from May to the last of November.

Heretofore the want of water in sufficient quantities has prevented the dressing of much ore.

There are some other shafts in other parts of Harvey Hill mining district, which, owing to the violent storms and great depth of snow, I could not visit. They are the Fremont shaft, 21 fathoms deep; Harvey's Hill, 11 fathoms deep; No. 1 "Grass shaft," 15 fathoms deep; No. 2 "Grass shaft," 27 fathoms deep.

On Harris's lot, two miles from the Harvey Hill Mine, is the Victoria Mine, where a shaft, 11 fathoms deep, has been sunk in a coarse soapstone or talcose rock. In this, native gold was found associated with copper glance, and carbonate of iron or brown spar.

At a suitable season it may be desirable to examine all these mines, since some useful information may be obtained, applicable to your mines, and to the region generally. They also show how extensive are the deposits of copper ores in this region of the country, and indicate the locality as truly a mining district.

By the new road to Methot's Mills, now in course of formation, the distance to the railway will be reduced to 21 miles of good road, which will reduce the cost of hauling the ores to that station to about \$4.50 per ton, or to half of what is now paid.

I am also informed that water power, adequate to moving the stamping and crushing machinery, may be readily obtained on Palmer's River, at the point where the proposed tram road will terminate. This will reduce the cost of dressing the ores very considerably, since the expense of fuel will be saved, and also attendance on the steam engine, with all its costs.

From a consideration of all the data, I am of opinion that the Harvey Hill Mine may be wrought at a large profit, and that the supply of copper ores within reach of mining opera-

tions at that place will be enough to employ miners for a great number of years.

If the ores extend to an unlimited depth, the mine of course will prove inexhaustible, and thus far the ores have been found to be most abundant and rich in the lower parts of the mine.

CHARLES T. JACKSON, M.D.,

*Geologist and State Assayer.*

BOSTON, February 26, 1863.

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## STATISTICS.

The consumption of copper in this country in ordinary years is about 25,000,000 pounds. Last year it was nearly forty millions of pounds. The home consumption in other countries is estimated as follows, viz. : —

|                   |                 |
|-------------------|-----------------|
| England . . . . . | 60,000,000 lbs. |
| France . . . . .  | 30,000,000 “    |
| Germany . . . . . | 40,000,000 “    |

Total amount consumed by the four nations, annually, say 160 millions of pounds. Estimated product of Lake Superior likely to reach market this year, 12,000,000 lbs., which is less than half the amount we consume annually.

The average price for refined ingot copper during the past twelve years has been as follows, per pound (from actual results) : —

|                       |                       |                       |         |                       |                       |
|-----------------------|-----------------------|-----------------------|---------|-----------------------|-----------------------|
| 1850                  | 1851                  | 1852                  | 1853    | 1854                  | 1855                  |
| 20 cts.               | 20 $\frac{1}{4}$ cts. | 21 $\frac{1}{4}$ cts. | 28 cts. | 26 $\frac{3}{4}$ cts. | 27 cts.               |
| 1856                  | 1857                  | 1858                  | 1859    | 1860                  | 1861                  |
| 25 $\frac{3}{8}$ cts. | 26 $\frac{5}{8}$ cts. | 22 $\frac{5}{8}$ cts. | 22 cts. | 21 cts.               | 20 $\frac{1}{4}$ cts. |

and in 1862, 27 cents.

At present, with gold at 148 $\frac{1}{2}$ , job lots command 31 cents, 32 cents for Lake Superior ingot.

All estimates in the foregoing reports are based on 20 cents in specie.

## CHARTER.

The advantages of the following Bill or Charter granted by the Canadian Government, expressly with a view to forming a Company of American capitalists, will be readily appreciated.

No. 227.]

BILL.

1863.

*An Act to incorporate the Harrey Hill Mining and Smelting Company of Leeds, in the County of Megantic, Canada East.*

Enacted by

Whereas, the persons hereinafter named have, by petition, represented, that certain of them have acquired and hold divers valuable properties and mining rights, and have entered into contracts and made arrangements at much cost for prosecuting researches for mineral ores and locations favorable for mining in the County of Megantic and elsewhere in Lower Canada, and that they are desirous unitedly and with others to prosecute such researches and carry on the business of mining on an extensive scale in Lower Canada, but cannot do so to advantage unless by the aid of an Act of incorporation, and have therefore prayed for the passing of an Act to that end; and whereas it is expedient that such prayer be granted:

Therefore, Her Majesty, by and with the consent and advice of the Legislative Council and Assembly of Canada, enacts as follows:

Getampersons  
incorporated

1. James Foley, Peter Clarke, Lester M. Clark, B. S. Rotch and L. A. Plummer, Esquires, together with all such other persons as shall become shareholders in the Company hereby constituted, shall be, and they are hereby constituted a body corporate and politic, by

the name of the "Harvey Hill Mining and Smelting Company of Leeds, in the County of Megantic, Canada East."

2. The Company may engage in and follow the business business of carrying on explorations for, and of mining for, finding and getting copper, lead and other ores, metals and minerals within the limits aforesaid, and of manufacturing, dealing in and disposing of such ores, metals and minerals; and may do all things necessary to such ends, consistently with the rights of other parties, and with the conditions of any title under which the Company may hold the lands in or upon which such things are to be done.

3. The Company may, by any legal title, acquire Real-estate and hold any land or mining necessary or requisite for the carrying on of such business, not exceeding two thousand acres in superficies, and construct and maintain such buildings and machinery and other improvements thereon, and sell and dispose of the same, and acquire others in their stead, as the Company may deem for its advantage.

4. The Capital Stock of the Company shall be the Capital Stock sum of One Million Dollars, divided into Two Hundred Thousand Shares of five dollars each, and may be increased as hereinafter provided.

5. All calls of money upon the respective share-holders, in respect of such stock, shall be paid when, where, and as the Directors of the Company shall from time to time require, in conformity, always, with such rules, as to notice or otherwise, as the by-laws of the Company may ordain, and interest shall accrue and fall due, at the rate of six per centum per annum, upon the amount of every unpaid call, from the day appointed for payment of such call.

Enforcement of  
calls.

6. The Company may enforce payment of such calls and interest by action in any competent Court of law, and in such action it shall not be necessary to set forth the special matter, but it shall be sufficient to declare that the defendant is a holder of one share or more, stating the number of shares, and is indebted in the sum of money to which the calls in arrear amount, in respect of one call or more upon one share or more, stating the number of such calls, and the amount of each, whereby an action hath accrued to the Company under this Act, and a certificate under their seal, and purporting to be signed by any officer of the Company, to the effect that the defendant is a shareholder, and that such call or calls have been made, and that so much is due by him, and unpaid thereon, shall be received in all Courts of law as *prima facie* evidence to that effect.

Forfeiture.

7. If, after such demand or notice as by by-law of the Company may be prescribed, any call made upon any share or shares be not paid within such time as by such by-law may be limited in that behalf, the Directors in their discretion, by vote to that effect, reciting the facts and duly recorded in their minutes, may summarily forfeit any shares whereon such payment is not made; and the same shall thereupon become the property of the Company, and may be disposed of as by by-law or otherwise they shall ordain.

Stock personal  
estate.

8. The stock of the Company shall be deemed personal estate, and shall be assignable and transferable in such manner only, and subject to all such conditions and restrictions, as shall be prescribed by the by-laws of the Company.

Transfers.

9. No share shall be transferable until all previous calls thereon have been fully paid in, or until declared forfeited for non-payment of calls thereon.

10. If the said amount of stock be found insufficient, the Company, by a vote of not less than two-thirds, at any general meeting called for that purpose, may, from time to time, increase the same, either by admission of new shareholders, or otherwise, to a total amount of not more than two million dollars; and in such case, the new stock shall be paid in upon such conditions, at such times and places, and in such manner, as the Company at such meeting shall have ordained, or (in default of express provision to that end, then) upon such conditions, at such times and places, and in such manner as the Directors thereafter, by by-law or otherwise, shall ordain, and such new stock shall be in all respects part of the capital stock of the Company; and upon such increase of their capital stock, the Company, for the purposes of their business only, may acquire and hold real estate to a proportionately increased amount, with power always to sell, lease, or otherwise dispose thereof, as they shall see fit.

11. At all meetings of the Company, every shareholder, not being in arrear in respect of any call, shall be entitled to as many votes as he holds shares in the stock of the Company, and no shareholder being in arrear shall be entitled to vote, and all votes may be given in person, or by proxy; provided always the proxy be held by a shareholder not in arrear, and be in conformity with such requirements as the by-laws of the Company may prescribe, and not otherwise.

12. The affairs of the Company shall be administered by a Board of five Directors, being severally holders of at least two hundred shares of stock, who shall be elected at the first general meeting, and thereafter at each annual meeting of the Company, to hold office until their successors are elected, and who (if otherwise qualified) may always be re-elected; and four

members of such Board present in person or by proxy shall be a quorum thereof; and such Directors may vote by proxy, and in case of the death, resignation, removal or disqualification of any Director, such Board, if they see fit, may fill the vacancy until the next annual meeting of the Company, by appointing any qualified shareholder thereto.

**Failure to elect.** 13. If at any time an election of Directors be not made or do not take effect at the proper time, the Corporation hereby constituted shall not be held to be thereby dissolved; but such election may take place at any general meeting of the Company duly called for that purpose.

**Provisional Directors.** 14. Until the first election of such Board, the said James Foley, Peter Clark, Lester M. Clark, B. S. Rotch and L. A. Plummer shall be the Provisional Board of Directors of the Company, with power to fill vacancies occurring therein, to open Stock-books, to assign stock, to make calls thereon, and grant certificates and receipts therefor, to make provisional by-laws on any matters admitting of regulation under this Act by by-law, such provisional by-laws to have force until the first general meeting of the Company, to convene such meeting, and to do all other acts required to be done in order to the organization of the Company and the conduct of its affairs.

**Powers of Board.** 15. The Board of Directors of the Company shall have full power in all things to administer the affairs of the Company, and may make, or request to be made, any description of contract which the Company may by law enter into; and may from time to time make by-laws not contrary to law, to regulate the making of calls on stock, the payment thereof, the issue and registration of certificates of stock, the forfeiture of stock for non-payment, the disposal of forfeited stock and of

the proceeds thereof, the transfer of stock, the declaration and payment of dividends, the appointment, functions, duties and removal of all agents, officers and servants of the Company, the security to be given by them to the Company, their remuneration, and that (if any) of the Directors, the time at which and the place where the annual and other meetings of the Company shall be held, the calling of meetings, general and special, of the Board of Directors, and of the Company, the requirements as to proxies, and the procedure in all things, at such meetings, the site of their chief place of business, and of any other offices which they may require to have, the imposition and recovery of all penalties and forfeitures admitting of regulation by by-law, and the conduct in all particulars of the affairs of the Company; and may from time to time repeal, amend, or re-enact the same; but every such by-law, and every repeal, amendment or re-enactment thereof, unless in the meantime confirmed at a special general meeting of the Company, called for that purpose, shall only have force until the next annual meeting of the Company, and shall require to be confirmed thereat; and every copy of any by-law under the seal of the Company, and purporting to be signed by any officer of the Company, shall be received as *prima facie* evidence of such by-law, in all Courts of law.

16. In addition to the ordinary place of business Agencies. within the Province, the Company may establish and have any place or places of business in Great Britain or in the United States of America; and may, at any one thereof, open books of subscription for their stock, and may receive there subscriptions for such stock, transferable there respectively, and may make all instalments thereon to be called in, and all dividends thereon to be declared payable there respectively; and may at one of such places of business order, direct, do

and transact their affairs and business or any thereof, in such manner as may be prescribed by the by-laws.

**Trusts.** 17. The Company shall not be bound to see to the execution of any trust, whether express, implied or constructive, in respect of any shares; and the receipt of the person in whose name the same shall stand in the books of the Company shall be a valid and binding discharge to the Company for any dividend or money payable in respect of such shares, and whether or not notice of such trust shall have been given to the Company; and the Company shall not be bound to see to the application of the money paid upon such receipt.

**Responsibility of Shareholders.** 18. The shareholders of the Company shall not, as such, be held responsible for any act, default or liability whatsoever of the Company, or for any engagement, claim, payment, loss, injury, transaction, matter or thing whatsoever, relating to or connected with the Company, beyond the amount of their shares in the stock thereof.

**Contracts, &c., effect of.** 19. Every contract, agreement, engagement or bargain made, and every bill of exchange drawn, accepted or endorsed, and every promissory note and cheque made, drawn, or endorsed, on behalf of the Company, by any agent, officer or servant of the Company, in general accordance with his powers as such under the by-laws of the Company, shall be binding upon the Company; and in no case shall it be necessary to have the seal of the Company affixed to any such contract, agreement, engagement, bargain, bill of exchange, promissory note or cheque, or to prove that the same was made, drawn, accepted or endorsed, as the case may be, in pursuance of any by-law or special vote or order; nor shall the party so acting as agent, officer, or servant of the Company, be thereby subjected individ-

ually to any liability whatsoever to any third party therefor: provided always, that nothing in this Act contained shall be construed to authorize the Company to issue any note of a character to be circulated as money or as the note of a Bank.

20. Any description of action may be prosecuted and maintained between the Company and any shareholder thereof, and no shareholder, not being himself a party to such action, shall be incompetent as a witness therein.

21. This Act shall be deemed a public Act. Public Act.

