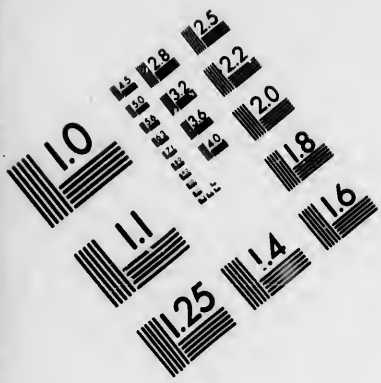

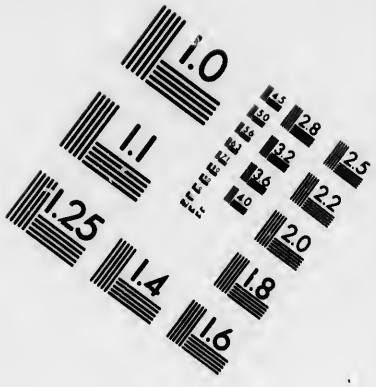

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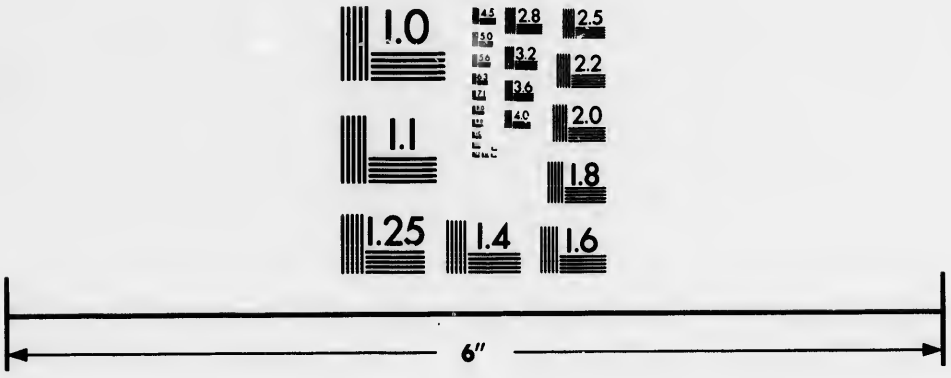

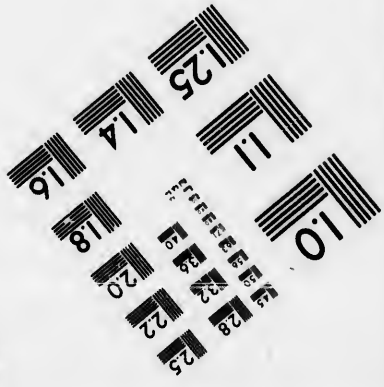

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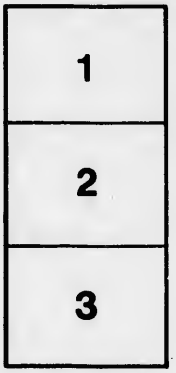

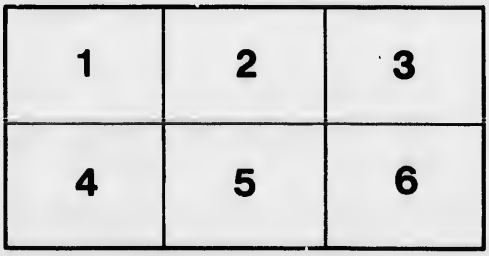

REPORTS

ON THE PROPERTY OF THE

Leeds Mining and Smelting Co.,

COMPRISING

800 ACRES OF LAND,

In Leeds, Megantic County,

CANADA EAST.

October, 1863.

Montreal:
JOHN LOVELL, PRINTER, ST. NICHOLAS STREET.

1863.

1863
(38)

LEEDS MINING AND SMELTING COMPANY.

Introductory Remarks.

The recent extraordinary discoveries of mineral wealth extending over large tracts of country in Eastern Canada, have already established its character as a great mining region. Of all the districts hitherto explored in this province, none hold a higher place, or afford promise of a more ample return for the judicious investment of capital, than that of Leeds in Megantic County, where the celebrated Harvey Hill Mine is situated. The concurrent testimony of all scientific and practical visitors, together with the results of actual and extensive operations at that mine and on the adjacent lands, have established the fact that this is, *par excellence*, THE copper mining region of Eastern Canada.

The peculiar value of the cupriferous deposits in this region consists in the fact that their form and mode of occurrence render their extraction a much less precarious and uncertain adventure than most mining operations. The ores are disseminated in thick beds interstratified with the slate rocks; these beds have been traced, both in depth and along their outcrop over a great extent of country, and are found to be extremely regular and persistent; while at the same time their metallic produce is sufficient to yield an ample profit upon their extraction. Numerous rich bunches of ore are found associated with the beds; at once attesting the highly mineralized character of the rocks, and adding largely, by their incidental extraction, to the productiveness of the mines.

The property acquired by the Leeds Mining and Smelting Company is, as will be seen by the accompanying plans, in the imme-

diate vicinity of the Harvey Hill Mine; and the same cupriferous beds which now form the object of mining operations at that place have been proved to underlie, at a very moderate depth, some of the lots in question, while other veins and beds of apparently equal value have been found at several points on this company's property. The value of this property may therefore fairly be inferred from the results obtained in working on Harvey Hill, and from the opinions expressed by eminent scientific men with reference to the condition and prospects of that undertaking. These results and opinions are fully set forth in the following pages, which embody also reports, by competent authorities, upon the property now more immediately brought under notice. It will be observed that Mr. Herbert Williams, the superintendent of Harvey Hill Mine, has expressed a highly favourable opinion of some of the lots acquired by the present company, whose property is both more extensive and better supplied with water than that of the Harvey Hill Company.

REPORTS

ON THE PROPERTY OF THE

LEEDS MINING AND SMELTING COMPANY,

AND ON THE

HARVEY HILL MINE.

REPORTS OF MR. HERBERT WILLIAMS.

LEEDS, 17*th December*, 1862.

GENTLEMEN,—I should have advised you ere this of the result of explorations on your lots numbers 13, in the 14th range, and 14, in the 13th range of this township, but I was anxious to satisfy myself that the formation discovered on your lots corresponded with that of Harvey Hill. From the works since carried on at Harvey Hill, I believe such to be the case, and have accordingly laid them down on the accompanying sketch,* by which you will perceive that your lot No. 14, in the 13th range, is underlaid by both the mineral bands discovered at Harvey Hill; hence, I regard it as a valuable property, and well worthy the attention of capitalists.

Your obedient Servant,

HERBERT WILLIAMS.

LEEDS, 28*th July*, 1863.

GENTLEMEN,—Having at your request made a survey and examination of lot No. 16, in the 14th range of Leeds, I now beg to lay before you the following report on same.

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* The run of the ore-bearing beds, as shewn on the plan accompany these reports, is given on the authority of Mr. Williams.

This property abuts the Harvey Hill Mining lot, and has a superficial area of about 200 acres.

A few exploring trenches were made upon it a few years ago by its former proprietor; and in these vitreous, variegated and yellow sulphurets of copper were discovered in lenticular quartz courses, similar to the numerous outcroppings discovered at Harvey Hill.

The explorations and discoveries at Harvey Hill have very considerably enhanced the prospective value of this lot, as there can be little doubt but it carries under its entire area the valuable ore bearing schists of Harvey Hill, which have been fully and carefully described after actual survey by eminent scientific men, in the reports on same recently published at Boston, and to which I beg to refer you for the valuable details furnished with regard to it.

Yours respectfully,

HERBERT WILLIAMS.

REPORT OF MR. CHARLES ROBB, MINING ENGINEER.

53 ST. FRANCOIS XAVIER STREET,
MONTREAL, 12*th January*, 1863.

GENTLEMEN,—Agreeably to your request I beg to submit the following report on your mining lots in the township of Leeds, together with a map showing the geographical position of this mining district, and a plan of the various lots comprised in your property, exhibiting their relation to the Harvey Hill Mine, and adjacent property acquired by that company. This plan also shews the run of the copper-bearing beds through the property.

I have visited and minutely examined these mines, and made reconnaissance of the surrounding country; and the details herewith given are partly the result of my own observations, and partly given on the authority of Mr. Herbert Williams, the able manager of the Harvey Hill Mine, who has superintended surface explorations on some of your lots.

The property owned by you consists of the following lots and parts of lots, viz.:

1.	Lot No.	16	in the	14th	range,	200	acres.
2.	"	18	"	14th	"	200	"
3.	½ "	17	"	14th	"	100	"
4.	½ "	15	"	15th	"	100	"
5.	½ "	13	"	14th	"	100	"
6.	½ "	14	"	13th	"	100	"

Comprising in all..... 800 acres.

These lots are indicated in the plan by the red shading, while the property of the Harvey Hill Co. is denoted by blue boundary lines. The lots owned by you are freehold property with the exception of the two last enumerated, which are held under a perpetual mineral lease exempt from all royalty or dues.

The value of these lots for mining purposes has been proved by the extraordinary developments made in opening up the Harvey Hill Mine, and by the fact that the same metalliferous formations have been ascertained to traverse your lots ; as well as by the results of actual examination of the lots themselves.

The geological and mineralogical indications presented on these locations are highly favourable to the production of copper ore, the prevailing rock of the country being the so-called "Nacreous Slates," belonging to what has been styled by Sir William Logan, the Quebec group of the lower Silurian system, the equivalent formation to those in which all the most valuable deposits of copper ore have been found throughout the world.

The operations at Harvey Hill, together with the results of costeening and trenching on your lots, have revealed the existence of thick cupriferous beds interstratified with the slate rock, and containing ore in such quantity as to be amply available for mining purposes ; and which, on being traced in depth, have proved to increase both in the thickness of the copper-bearing bands themselves, and in the proportion of ore disseminated in them. The slates are also traversed by numerous quartz courses, cutting the stratification both in the direction of the dip and strike, and carrying large quantities of rich copper ore, associated with chlorite, calc-

spar and bitter-spar, all which minerals are highly favourable to the production of copper ore. These quartz courses, although in many cases of very great dimensions, are not found to be persistent either in length or depth; nevertheless, at Harvey Hill they have yielded a very large amount of ore, and as the most valuable of them are found cutting the interstratified beds, they will be exposed and rendered available by the workings on the latter. The quartz courses have produced, in some instances, as much as two tons of twenty per cent. ore to a fathom, while the beds have yielded, on an average, about twelve tons of three to four per cent. ore in the rough per fathom.

The ore is of the richest kind, consisting for the most part, of the purple, variegated and vitreous sulphurets of copper; and from the manner in which it is associated with the rock, it may be dressed to a high per centage with unusual facility and comparatively little loss.

The ore contained in the interstratified beds on Harvey Hill is estimated by Mr. Williams to yield a profit of $450 per day, "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 the beds, and which will give very large profits on the amount that may be expended in their extraction." The value of ore already obtained by working on the quartz courses is about $45,000. Quite recently Mr. Williams has discovered a considerable proportion of the valuable metal molybdenum, associated with the copper in some of the quartz courses; and gold has been found on this and many of the adjoining lots, which may prove to be of importance.

On your lots considerable work has been done in costeens, shode-pits and other surface examinations. From the accompanying plan and the reports by Mr. Williams, it will be seen that the principal cupriferous bed crops out at the southeast angle of two of your lots; while the dip of the bed, which is at a very low angle, and in the direction of the declivity of the hills, will cause this bed to underlie at a very moderate depth the greater part of the area of these lots. Other beds of equal promise have been found outcropping at various points; and the existence of the cupriferous

quartz courses is abundantly evident from their exposure at the surface on all the lots. The combined results of all the mining operations in this locality afford the strongest grounds for believing that it contains a vast deposit of mineral wealth, and that mining operations here will prove a highly eligible investment.

These important mining locations are distant from Quebec about forty-eight miles, and from the Methot Station of the Grand Trunk Railway about twenty miles. On one of the lots in question there is a creek, affording at all seasons an abundant supply of water for washing the ores, and of power for working the requisite dressing machinery during the greater part of the year. There is also, on all of them, an ample supply of wood for fuel, and other purposes connected with mining. The road to the Harvey Hill Mine passes within a short distance of all the lots.

Your most obedient servant,

CHARLES ROBB.

REPORT OF MR. A. TREGONING.

18, CLARENDON ROAD, NOTTING HILL,
LONDON, 8*th 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 massess, worth about £6,000. Of this quantity about sixty 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 nacreous 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 laminæ 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 orey 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 conclusion, I beg to refer 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. . . . . .

I remain, Sir,

Your obedient Servant,

A. TREGONING.

EXTRACT FROM REPORT OF SIR W. E. LOGAN

As published in the Geological Report of Canada for 1863.

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 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 unctuosity, 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° to 80° W. of N., with an average inclination of from 15° to 30°. 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 N. to N. 20° 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 portion 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 Fremont'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. The strata in this part of the adit appear much disturbed; and the dip varies, being in some places from 10° to 14°, and in others from 35° to 40°.

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 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 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 con-

tinued up toward the shaft, as well as east and west from the thirty-fathoms 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 from 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 unfrequently 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. 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° 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, wasmet. 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 botton 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 talc, holding bitter-spar, 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 the mine

to England. The fractions of tons are here disregarded. In 1858, 10 tons; in 1859, 43 tons; in 1860, 104 tons; in 1811, 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 bed, and containing from four to five per cent. of copper.

Further particulars in regard to this interesting mining region may be obtained by referring to Sir William Logan's Geological Report of Canada for 1858, pp. 61–63.

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 Becancour 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 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 the 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° to 30°. 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 laminæ 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, 3½ 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 40 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 regular 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 Beds.—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 3½ 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 production 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 $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 cupriferous 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 3½ 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 4½ 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 3½ 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.

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 3½ 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 3½ 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 their 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 1¼ 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 constructed 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 the richness over a wide area. The unusual thickness of the bed (4½ 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.

REPORT OF J. C. HOADLEY.

NEW BEDFORD, May 6, 1863.

GENTLEMEN: In compliance with your request, I give y below the result of my examination of the Harvey Hill Coppe. 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 talc, 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 acre 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 4½ to 6 feet; assuming the smaller depth as the mean thickness of the bed, we have 148,830 superficial fathoms, three quarters 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 to yield 3½ 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 resulted in the segregation of the sulphurets of copper and the shale into distinct strata or laminæ, 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, 81,369 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 of 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. *Estimate of annual Profits.*

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 annnm, 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.

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 8½ superficial fathoms, or 17⅓ feet square, 4½ 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.

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* The price includes drivages and dead work.

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 divd. during 20 years average time	1,350,000
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
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.

An Act to Incorporate the Leeds Copper Mining and Smelting Company.

WHEREAS the persons hereinafter named have by petition represented that they desire to engage in the business of exploring, mining, manufacturing and disposing of copper and other ores, in the county of Megantic, in this Province, and that they can do so to better advantage by the aid of a charter of incorporation, and have 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 advice and consent of the Legislative Council and Assembly of Canada, enact as follows:—

1. Thomas Cross, Thomas Bacon, James Muir, H. J. Lawton, and John C. Davie, together with all such other persons as shall become shareholders in the company hereby constituted, shall be, and they are hereby made, a body corporate and politic, by the name of "The Leeds Copper Mining and Smelting Company."

2. The company may carry on the business of exploring for, mining, smelting, manufacturing and selling copper and other ores and metals, and for these purposes only may acquire and hold, by purchase, lease or other legal title, such lands and such mining rights in lands in the county aforesaid, 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 to be for its advantage.

3. The capital stock of the company shall be the sum of five hundred thousand dollars, divided into one hundred thousand shares of five dollars each, and may be from time to time increased, as the wants of the company require, by vote of the stockholders at a meeting of the company called for the purpose, to an amount not exceeding one million dollars in the whole: Provided always, that no such increase of stock shall be made until after the whole amount of the original stock of the company shall have been *bona fide* paid in.

4. The capital stock shall be paid by the subscribers therefor when, where and as the directors of the company shall require, or as the by-laws may provide, and if not paid at the day required, interest at the rate of six per centum per annum shall be payable after the said day upon the amount due and unpaid ; and in case any instalment or instalments shall not be paid as required by the directors, with the interest thereon, after such demand or notice, as the by-laws prescribe, and within the time limited by such notice, the directors may, by vote reciting the facts and duly recorded in their records, 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 the by-laws or votes of the company may provide.

5. The stock of the company shall be deemed personal estate, and be assignable in such manner only, and subject to such conditions and restrictions, as the by-laws prescribe ; but no share shall be assignable until all instalments called for thereon have been paid, unless it has been declared forfeited for non-payment.

6. At all meetings of the company every shareholder, not being in arrear in respect of any instalment called for, 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 is held by a shareholder not in arrear, and is in conformity with the by-laws.

7. The affairs of the company shall be administered by a board of not less than five and not more than seven directors, being severally holders of at least one 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 three members of such board, present in person, shall be a quorum thereof ; 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 ; but a failure to elect directors, or any failure of directors, shall not dissolve the corporation, and an election may be had at any general meeting of the company called for the purpose.

8. The board of Directors shall have full power in all things to administer the affairs of the company, and make or cause to be made any purchase and any description of contract which the company may by law make; to adopt a common seal; to make from time to time any and all by-laws (not contrary to law or to the votes of the company), regulating the calling in of instalments on stock, and payment thereof; the issue and registration of certificates of stock; the forfeiture of stock for non-payment; the disposal of forfeited stock and 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 and place for holding the annual and other meetings of the company; the calling of meetings of the company and of the board of directors, the quorum, the requirements as to proxies, 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 other particulars of the affairs of the company; but every such by-law, and every repeal, amendment, and re-enactment thereof, shall have force only until the next annual meeting of the company, unless confirmed at some general meeting of the company: 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 in all courts of law as *prima facie* evidence of such by-law.

9. Until the first election of such board, the said Thomas Cross, Thomas Bacon, James Muir, H. J. Lawton, and John C. Davie, shall be a provisional board of directors of the company, with power to fill vacancies, to open stock books, assign stock, make and collect instalments, issue certificates and receipts, convene the first general meeting of the company, at such time and place, within this Province or elsewhere, as they shall determine, and to do other acts necessary or proper to be done to organize the company and conduct its affairs: Provided always, that notice of all meeting of the company shall be given in some newspaper published in the district of Arthabaska, and also in the *Canada Gazette*, at least fifteen days before the holding of such meeting.

10. In addition to their ordinary place of business within this Province, the company may establish and have any place or places of business in this Province, in Great Britain, or in the United

States of America, and may at any one thereof order, direct, do, and transact their affairs and business, or any thereof, in such manner as may be prescribed by their by-laws.

11. 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 discharge to the company for any dividend or money payable in respect of such shares, 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.

12. The shareholders of the company shall not, as such, he 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 their shares in the stock thereof.

13. All contracts, promissory notes, bills of exchange and engagements made on behalf of the company by the directors, officers, agents or servants of the company, in accordance with their powers under the by-laws or by vote of the company, shall be binding upon the company, and in no case need the seal of the said company be affixed thereto, nor shall such directors, officers, agents or servants thereby become individually liable to any third party therefor; but the said company shall issue no bank note or notes to circulate as money.

14. The company shall not commence operations under this Act until at least ten per centum of the amount of their capital stock shall have been paid in: Provided always, that unless mining operations be *bonâ fide* commenced under this Act within three years from the passing thereof, this Act of Incorporation shall be null and void, saving only to the said company the power and right to part with any real estate which they may hold, and to make such conveyance as may be necessary for that purpose.

15. This Act shall be deemed a public Act.

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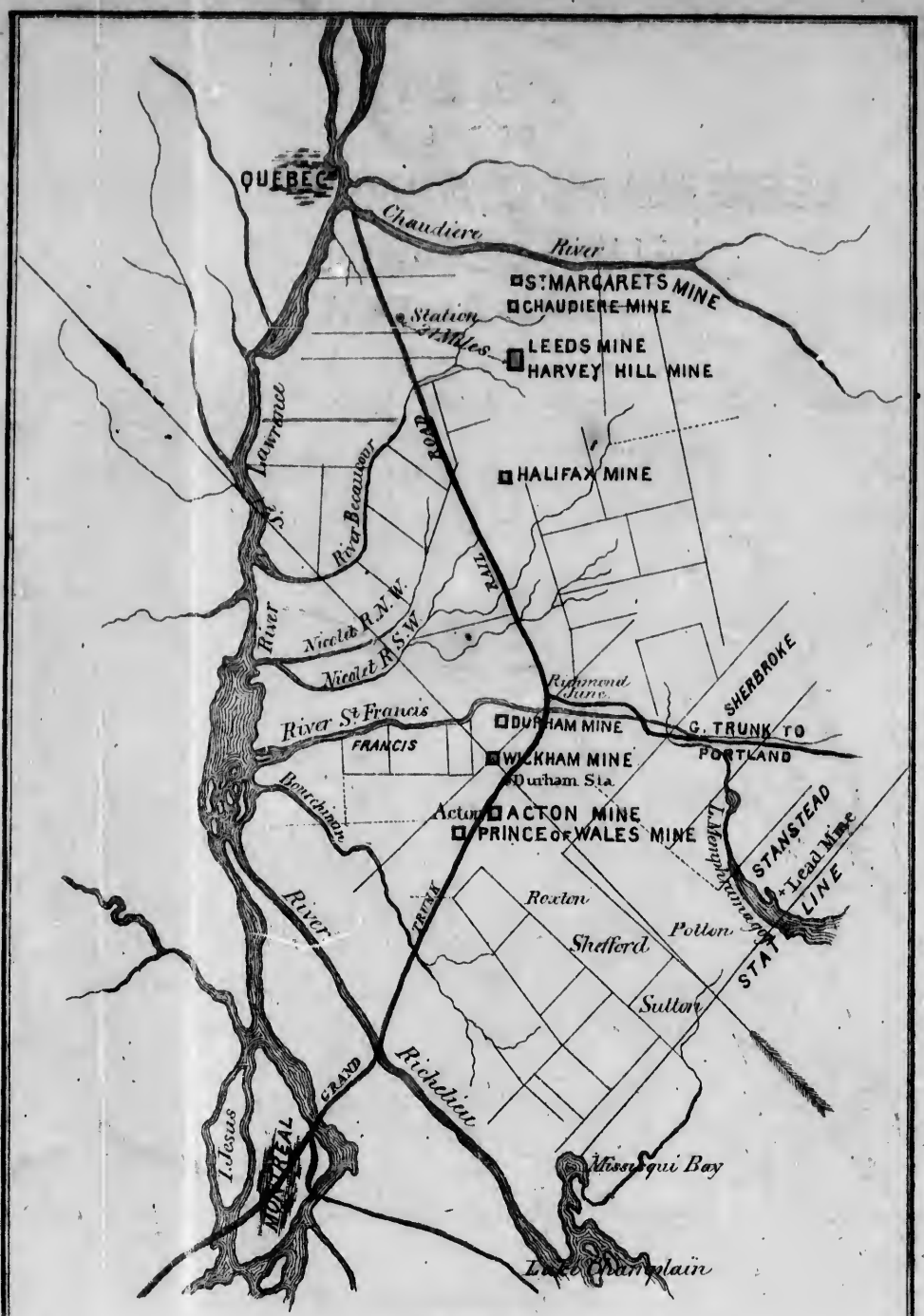


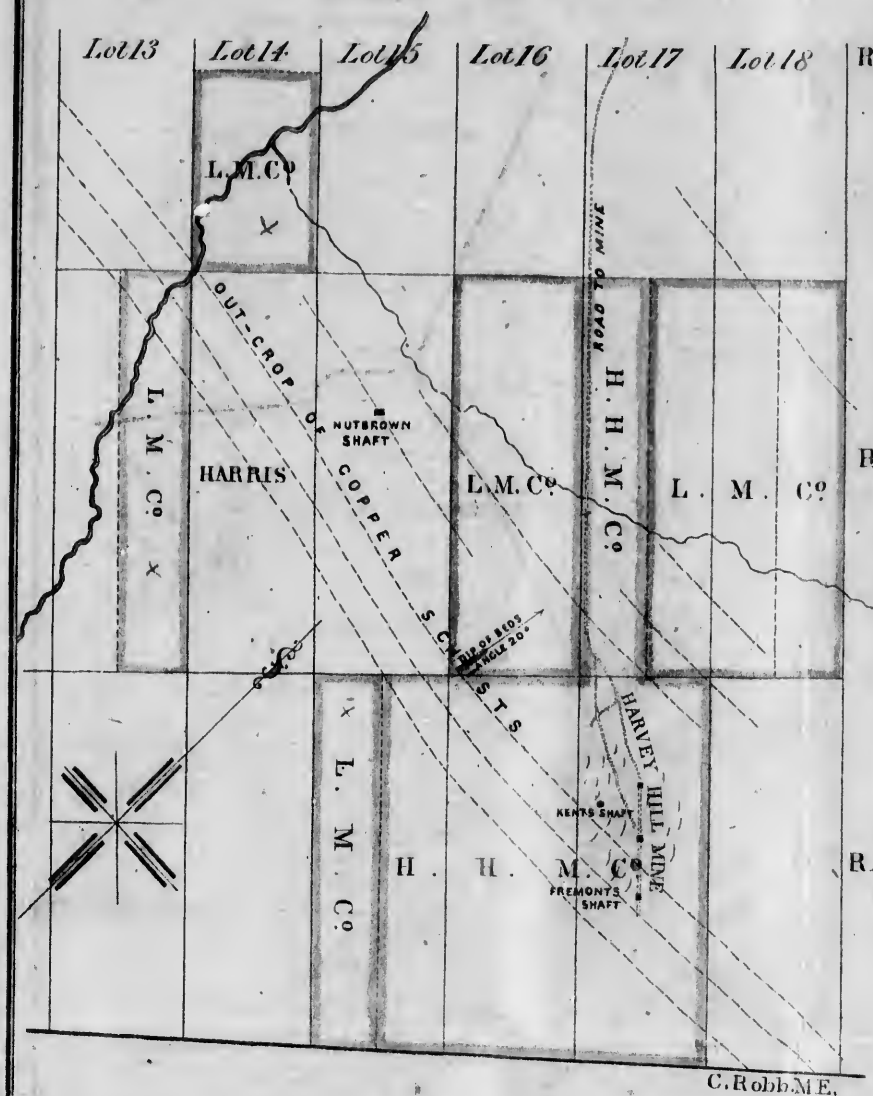
PLAN

SHEWING THE POSITION OF THE

LEEDS COPPER MINES.

MEGANTIC Co. C.E.

PLAN
OF THE
LEEDS MINING COMPANY'S LOCATIONS
LEEDS, MEGANTIC Co.
CANADA EAST.



Scale Two Inches to a Mile

Lots shaded Red the property of the LEEDS MINING Co

..... Blue ..... HARVEY HILL Co