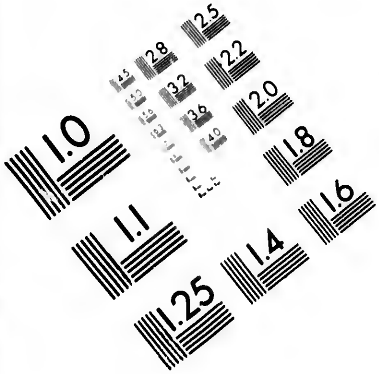

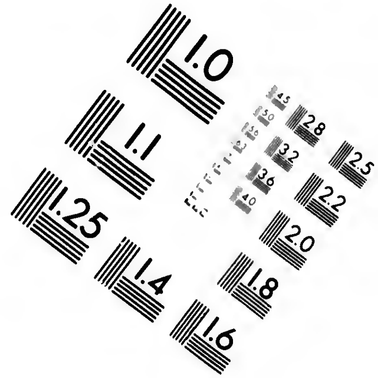

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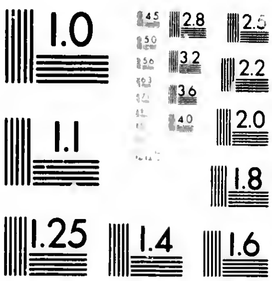

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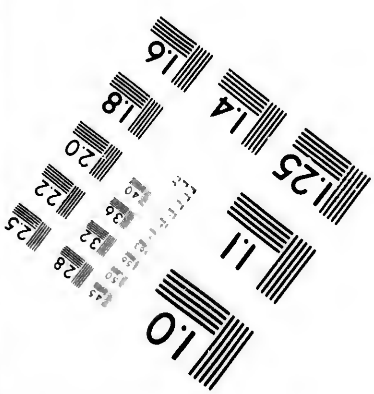

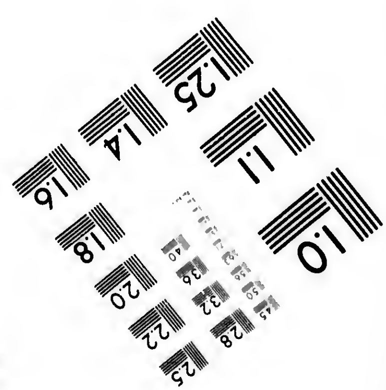

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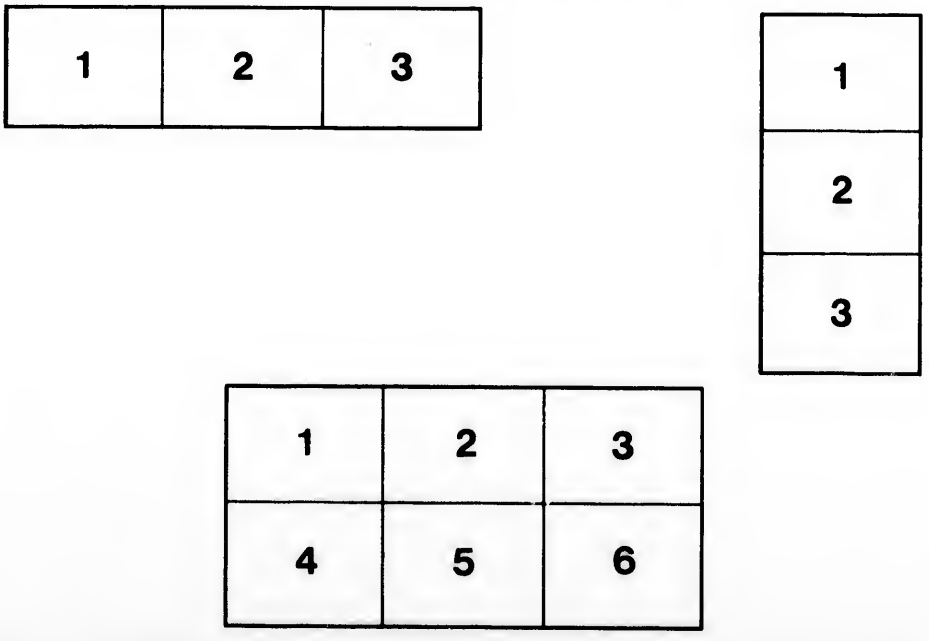

REPORT

ON THE

PLUMBAGO MINES

SITUATED AT

POINTE AUX CHÊNES, GRENVILLE,

PROVINCE OF QUEBEC.

By CHARLES ROBB,

MINING ENGINEER, OF MONTREAL;

WITH A LETTER FROM PROF. ROBERT BELL, OF QUEEN'S UNIVERSITY, KINGSTON.

CAMBRIDGE:
PRESS OF JOHN WILSON AND SON.
1868.

THE Properties described in the following Reports having been secured, it is now proposed to organize a Company for working the same, with such a Capital, and under such direction and code of By-laws as may be agreed upon by the Subscribers, at a meeting duly called for that purpose.

Subscriptions will be received at No. 3, BARRISTERS' HALL, COURT SQUARE, BOSTON; where specimens of the mineral may be examined, together with the crucible made therefrom and tested at the Ballard Vale Works.

PRELIMINARY REMARKS.

In presenting the following Report, it is proper to state, for the information of those who are unacquainted with the author, Mr. Charles Robb, of Montreal, that he is a distinguished mining engineer, whose many years of experience in the practice of his profession, and well-known independence of mind, judgment and integrity, eminently entitle him to respect and confidence. Sir William E. Logan,* the celebrated director of the Geological Survey of Canada, which has been going on under order of the Provincial Government for more than twenty years, places him first among those to whom he acknowledges his obligations for valuable information respecting the "locali-

* We trust that we are not violating any confidence in saying, that we have seen a testimonial given by Sir William, of which the following is an exact transcript:—

"Montreal, 30th August, 1866.

—— —— Esq.,

Dear Sir, — It gives me much pleasure to say, that I am well acquainted with Mr. Charles Robb, mining engineer, of Montreal. I consider him a reliable person, one of strict probity, and possessed of good judgment in a professional capacity. He takes great pains to ascertain the truth, and he gives his opinion with honesty.

I am, dear sir, very truly yours,

WM. E. LOGAN.

ties and modes of occurrence of several mineral deposits of economic importance."

Now, among the minerals of this character, that which forms the subject of this Report claims our attention from the great variety and importance of the uses to which it is applied; such, for example, as the manufacture of lead-pencils, and electrotyping; for both of which purposes the purest article is required, and the highest price is paid, (for the latter, $2.50 per pound). It is extensively used for polishing stoves and other articles of iron; for lining moulds for delicate castings; for lubricating the bearings of heavy machinery; and, especially, when mixed with clay, it is used in the greatest quantity for a purpose we regard as the most important of all; namely, the manufacture of crucibles. Being infusible, and presenting a powerful resistance to the action of caloric, this mineral is indispensable for the composition of melting-pots that will stand the intense heat of furnaces for the making of cast-steel.

It is to be observed, that plumbago, or graphite, as it is called by Werner, one of the most eminent mineralogists, is of two principal varieties, — the amorphous or uncrystallized and the lamellar or foliated. The former is used for many of the above purposes; but only the *foliated*, in a state of great purity, will answer for crucibles. For this use there is growing up in our country a demand which it will not be easy to supply. Hitherto our dependence has been, and still is, almost, if not altogether, upon the plumbago imported from Ceylon, in the East Indies, either directly to this country, or by the way of England. The

supply from this source, however, is irregular, often insufficient, and liable to be cut off entirely in case of hostilities in the Indian Ocean. Of the quantity imported previous to 1863, we have no reliable data for an estimate. In that year, according to the custom-house returns, the importation into the districts of New York and Boston was only 67,723 pounds. In 1864, it was 5,122,880; in 1865, 5,770,240; in 1866, 3,299,520.

If success in the manufacture of refined steel in the United States is a matter of national concern, it is obviously of very great importance that an ample supply of this valuable mineral should be secured from sources near at hand.

The opinion, however, has very generally obtained, and is still held by many with great pertinacity, that the mineral of the kind and degree of purity required is not to be found in this country. But we venture to affirm, and with confidence from personal observation, that graphite of the foliated variety, and of a quality fully equal, if not superior, to the best of the imported article, exists in abundance in some portions of Canada bordering on the river Ottawa. This is a large and navigable river, having its embouchure into the St. Lawrence by two mouths, forming between them the Island of Montreal. The geological formation of the region, we are told, is identical with that of Ceylon. Throughout an extensive tract of country, the mineral, in a pure and crystallized state, is seen, here and there, to crop out, particularly along the line of contact between the limestone and the gneissoid rock. Generally speaking, the mineral, in its pure state, has

not been found in quantity sufficient for profitable working; but is most commonly disseminated in the adjacent rocks, so as to require crushing and washing, by which it is separated from foreign ingredients, and fitted for the market. There are exceptions, however, to this remark; and the writer, having visited the region referred to several times within the last two years, and, in company with the State Geologist of Vermont, Prof. Hager, examined the principal localities where explorations have been made, has no hesitation in expressing his conviction, that the properties described in the accompanying Report by Mr. Robb afford the best promise of any deposits yet explored for an abundant yield of this important mineral, and in a state of the greatest purity. And this conviction is strengthened by the opinion expressed by Dr. T. Sterry Hunt, in his recently published Report on this subject, that "it will probably be found that the highly crystalline lamellar Graphite belongs, *in all cases*, *to true veins*, where a slow process of deposit has allowed it to assume that mode of aggregation and that purity which characterize other minerals thus deposited." — *Geological Survey of Canada*, 1866, p. 222.

The maps which accompany the Report will give a very correct idea of the situation of the two properties, and of the facility for transportation by the Ottawa and St. Lawrence Rivers, Lake Champlain, Whitehall Canal, and the Hudson River, to New York; or from Burlington by railroad to Boston.

It will be seen by the Report, that Sir William Logan, in his Geological Survey of Canada, referring to

the first of these properties, designated on the Map No. 2 as the Cameron property, states, that the "bed has been traced, at intervals, for a distance of about *three miles*, running a little east of north." By reference to Map No. 1, the limestone band is seen connecting the two properties; and there is the strongest reason to believe that this deposit of plumbago extends from one to the other. The entire tract appears to be a continuation of the high ridge on which is the Cameron deposit, and to be similar in its geological character. The mineral rights of this intervening tract, there is no doubt, could be secured on very reasonable terms; and its acquisition by the company proposed to be formed, would, in all probability, give advantages to place it beyond competition.

A good road passes along the eastern base of the ridge the whole distance, affording great facility of access for working the property, and for direct communication with good water-power.

CAMBRIDGE, Dec. 30, 1867. J. D. G.

The following testimonial to the quality of the Cameron Plumbago is from the Superintendent of the crucible department of the Whipple File and Steel Mfg. Co.'s works at Ballard Vale, in a letter to the Treasurer: —

BALLARD VALE, Feb. 27, 1867.

S. D. SARGEANT, Esq.

Dear Sir, — I now make a report of the trial pots made from Mr. Green's Canada Plumbago.

The first lot he sent me, (10 lbs.) I made into one Steel Crucible, and it has run four heats. I pronounce it A. No. 1.

Yours respectfully, JOHN UNDERWOOD.

REPORT

ON THE

POINTE AUX CHÊNES PLUMBAGO MINES,

SITUATED IN

GRENVILLE, CANADA EAST.

96, St. François Xavier Street,
Montreal, 10th November, 1867.

James D. Green, Esq.,
Cambridge, Mass.

Dear Sir, — Agreeably to your request, I have visited and inspected certain lots of land in the Augmentation of Grenville, in Canada East, of which you have recently acquired control, for the purpose of mining and manufacturing plumbago.

I have now the honor of transmitting to you the following Report, together with a map showing the position of the properties; and also a more detailed plan of one of them, on which considerable work has been done in testing the deposits. I beg also to hand to you copies of certain printed reports upon properties of a similar nature, containing important information on the subject, which need not here be recapitulated.

Your property consists of the north half of Lot No. 3, in the second Range of the township, contain-

ing one hundred acres; and the south half of Lot No. 2, in the sixth Range, containing one hundred acres,—on which lots you have acquired the mineral rights, free from all dues or royalty. Also, the fee-simple of five acres of land on the first-mentioned lot, and of three acres on the north half of the other, at both which points the most extensive developments have been made, and the richest surface indications of the mineral found.

The district in which your property is situated lies on the north side of the great navigable river Ottawa, about midway between Montreal and Ottawa City. It has been long esteemed as the most favorable in the province for the production of graphite; having been specially mentioned by Sir William Logan, in this connection, as far back as the year 1851, when fine specimens from both localities now owned by you were sent by him to the great London Exhibition, where they attracted much attention. Subsequent developments have proved that the region north of the Ottawa, in Canada, is probably destined to be one of the most important in the world for the supply of this useful mineral.

In the district in which you are specially interested, the country is underlaid by rocks of the Laurentian formation, consisting of gneiss, interstratified with crystalline limestone, the bands or beds of the latter rock being penetrated occasionally by the former, as well as by other rocks of an intrusive character. The graphite occurs associated with the limestone, or in its immediate vicinity, both in beds subordinate to, and in veins cutting the stratification; where concen-

trated in the purest form, and least mixed with foreign ingredients, it seems, as is also the case with most metallic ores, to lie between the different kinds of rock. I have indicated by the blue tint approximately, upon the general map, the tracts underlaid by the plumbaginous limestone formation referred to.

On your lot No. 3, in the second range, the limestone is penetrated by a mass of syenite, forming a ridge of seventy or eighty feet in height, and of a linear extent of one hundred and sixty rods; on the south side of which, and near to the line of contact of the two distinct rocks, the deposit of graphite occurs. Another description of intrusive rock, consisting of a species of trap or dolerite, also occurs here, being observed at some places to overflow or cap the limestone, and at others to cut it in the manner of a dike. Such changes of rock are everywhere regarded as favorable for the aggregation of minerals and metallic ores; and occurring, as they do here, in a limestone highly charged with graphite, have, no doubt, been conducive to its deposit here in large quantities, and in a state of great purity.

A considerable amount of work has been done in exploring and testing this location; and about three tons of very pure plumbago have been incidentally obtained and sent to market, where it has realized the highest price usually obtained for this article. Four pits have been opened upon a course N. 50° E., coinciding with the strike of the rocks; the distance between the extreme points of the openings is about five hundred yards; and pure plumbago has been obtained at all the openings, which may thus be

regarded as marking the course of an *embedded vein.* The purest plumbago has been obtained chiefly at the pit marked No. 5. At the distance of about two hundred feet across the strike, other openings have revealed the probable existence of another parallel vein of the mineral.

On both of your lots the facilities for mining, as regards drainage, deposit of waste materials, supply of timber, proximity to roads, &c., are of the most favorable description.

Sir William Logan, in writing of the two locations secured by you, remarks: "A bed of pure graphite occurs in the Augmentation of Grenville, and has been traced at intervals for a distance of about three miles, running a little east of north. One of the exposures, occurring on Lot 3, Range 2, has been mined to a small extent by Messrs. Russell & Co. At the opening of the excavation, it showed a thickness of about ten inches; but the pure graphite was found to form a lenticular mass, which appeared to be separated from other masses of the same character by intervals, in which the graphite became intermixed with the limestone. It is probable, that a number of these, running through the rock at the same horizon, may represent the general character of the workable beds. On Lot 2, Range 6, *the bed becomes three feet thick;* but here the quality is impaired by the presence of foreign earthy matters, which, however, can scarcely be detected by the eye." I may here remark, that, on a late visit to your lot, No. 2, in the Sixth Range, I found that, in addition to the *bed* referred to by Sir William, a *vein* had recently been discovered, which

has yielded many fine specimens of the *pure* mineral.

Since the date at which Sir William Logan's remarks were penned, a species of revolution has taken place in the business of producing plumbago for the market. Formerly, the prevailing impression was, that the mineral was marketable only when obtained from the rocks in a state approaching absolute purity; but the irregularity of the deposits of such a nature, not only in Canada, but wherever they have been worked, precludes the possibility, in most cases, of calculating with any degree of certainty upon an adequate supply from this source. Furthermore, the graphite, as it occurs in nature, even in the purest form, invariably contains a certain proportion of foreign matters, such as lime and iron; which, for the most important purpose for which it is used,—namely, the manufacture of crucibles,—renders the previous extraction of these deleterious ingredients absolutely necessary. Recently, processes have been introduced, whereby, in a simple and inexpensive manner, the plumbago may be separated in a state of *absolute purity* from rocks impregnated with it.

The employment of these processes of manufacture, which consist chiefly in crushing and washing the rocks, after the manner of an ore, have established the business on a comparatively permanent, sure and satisfactory basis of calculation. The estimates of the costs and profits,* contained in the accompanying printed reports, although prepared specially with

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* See these estimates, at the end of this Report.

reference to other locations of a similar nature, will not require material modification in the case of your properties. And it only remains for me to say on this head, that on the lots now held by you there exist undoubtedly deposits of the mineral, both in the concentrated and disseminated state, of equal, if not superior, excellence to any yet discovered in Canada.

For the successful prosecution of this business, it is essential to have, in the immediate vicinity of the mines, the control of water-power sufficient to drive the requisite machinery for crushing and washing. In this respect also your properties are favorably situated, having command of the waters of the Pointe aux Chênes Brook, which, though small, is fed by never-failing springs, and connected with a natural reservoir, in the shape of a lake of about half a square mile in extent, and of a very considerable depth. This stream flows in a southerly direction through a table-land elevated at least two hundred feet above the Ottawa River; and affording, at other convenient points, facilities for further damming up and storing its waters, if necessary. For the distance of about half a mile from where it falls into the Ottawa River, its channel descends with a tolerably regular slope; and, if the whole of its waters were conveyed in a close pipe to or near the embouchure, it would afford ample power for driving all the requisite machinery; with the further advantage, by this arrangement, of avoiding all obstructions from ice, incident to the maintenance of water-wheels in winter in this climate. An eligible site for the mill, as shown upon the plans, can easily be obtained at the mouth of the stream, at

the distance of about two miles from one, and six miles from the other, of your locations.

And for the convenience of shipment, a site for a wharf, with ample depth of water near the shore of the river, can be had at the distance of one-third of a mile from the proposed mill-site.

I have the honor to be, dear sir,

Your most obedient servant,

CHARLES ROBB, *Mining Engineer.*

The following are the estimates referred to in the foregoing Report: —

In order to show the grounds for my belief, that a highly lucrative business may be established by mining on such a bed or vein as I have described, and separating its more valuable mineral ingredients by crushing and washing, I beg to submit the following estimate of the costs and profits of working, — premising that the calculation, in all its more important items, is based upon actual experience. The requisite machinery is of a simple and inexpensive description, and abundance of water-power for driving it may be obtained in the immediate neighborhood.

The rock containing 25 per cent by weight of pure plumbago, suppose that 8 per cent is lost in dressing, &c., (which is more than an ample allowance;) then, in order to produce one ton of pure plumbago, about six tons of rock are required to be mined and dressed.

From reliable sources of information I learn, that the usual price of pure plumbago in the New-York market is about seven cents per pound;* but, in the subjoined estimate, I shall, for the sake of safety, assume it to be worth only six cents per pound.

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* These estimates are made upon a specie basis. At present the price is 14 cts. per lb., occasioned, as reported, by the flooding of the mines in Ceylon.

J. D. G., Dec. 26, 1867.

Estimate of Costs and Profits on producing one Ton of Pure Plumbago.

Mining 6 tons of rock	at $2.50 per ton	$15.00
Drawing to dressing-mill	„ .50 „	3.00
Crushing and dressing	„ 1.25 „	7.50
Separating dead rock (if any), say	„ .50 „	3.00
Calcining, to remove lime, &c., say		4.00
Barrels and packing		3.00
Drawing to shipping wharf		1.50
Freight to New York, say		7.00
Cost of one ton pure plumbago, delivered in New York		$44.00
Value „ „ „ „	at 6c. per lb.	120.00
Profits on one ton		$76.00

Suppose now that only 18 tons of rough rock — equal to 3 tons of pure plumbago — were produced per day, and allowing 240 days to the year, this would give (3 x 76 x 240) — annual profits $54,720.00

Deduct interest on capital, say $50,000, at 10 per cent,	$5,000.00	
Exploring, wear and tear, depreciation of stock, &c.	3,000.00	
General management, agencies, discounts and contingencies	5,000.00	
		13,000.00
Net annual profits		$41,720.00

Or nearly 84 per cent on the capital supposed to be invested.

It would appear from the foregoing estimate, which I have been careful in all the items to keep on the safe side, that there is a wide margin for profits even in working the impure plumbaginous rock, of which a regular and steady supply can be always relied on; while the mining operations necessary for its extraction will doubtless bring to light deposits of the mineral in the purer and more concentrated form, which will require no manufacturing process to render it marketable, and on which, consequently, great *additional* profits may be reasonably expected.

Your property is so extensive as to afford scope for a very much greater production, and, consequently, much larger profits, than I have assumed in the estimate above made.

The quality of the plumbago obtained in this section of country is excellent; and the demand for the article is great, and likely to increase as the progress of the arts reveals, from time to time, new applications and uses for the mineral.

In these circumstances, I must regard this as a highly promising field for mining enterprise, for which the property secured by you seems to be in every way well adapted.

I have the honor to be,

Your most obedient servant,

CHARLES ROBB, *Mining Engineer.*

LETTER OF PROF. BELL.

The following letter from Prof. Robert Bell, of Queen's University, Kingston, relates to the Plumbago Mine, on Lot No. 2 of the Sixth Range, containing one hundred acres; which, by way of distinction from the other, is called the McArthur property, of which the mineral rights have been secured in perpetuity.

Prof. Bell is connected with Sir William E. Logan, in the Geological Survey of Canada.

Queen's University, Kingston,
Nov. 27, 1866.

Charles Robb, Esq., Montreal.

Dear Sir, — Your letter, requesting information about the plumbago on McArthur's lot in the Augmentation of Grenville, came to hand yesterday. McArthur is an old friend of mine, and I have often slept in his house in the frequent visits which I made with my late father to the Augmentation several years ago. The plumbago bed on his lot was well known at that time. It is situated on top of a rounded hill of crystalline limestone, which was mostly covered with sandy soil and under cultivation. Where the plumbago occurs the soil is two or three feet thick. The limestone of the hill, wherever exposed, contains more or less plumbago, but often in mere grains

thickly disseminated through the rock. McArthur was induced to dig at the spot where he struck this bed, from the abundance of the loose pieces which his plough turned up in the soil in its immediate vicinity. At the time I speak of, an old axe lay constantly in the hole or small pit which had been dug to expose the plumbago; and the neighbors were in the habit of going to the place, and chopping out pieces, which they took home, and crushed to powder for polishing their stoves and pipes; and the schoolmaster, who used to "whip the cat" amongst them, always had his boots carefully blackened with it. McArthur will remember my father advising his sons to strip the sand off a larger portion of the bed, and get out the plumbago in quantities to send to the New-York market. From the appearance of the bed, he did not doubt, for a moment, that a large amount could be obtained by simple means. A year or two after I became connected with the Geological Survey I was on a holiday visit to my friends at L'Orignal, and one day went on a tour through the Augmentation; and, amongst others, paid a visit to McArthur. I found the "black-lead hole" partly filled up by the falling-in of the sand, but soon removed some of it, and, with an old axe, borrowed from McArthur, I chopped out a hundred weight or more of the plumbago. Some of the pieces I took down to Sir William Logan. The largest of these measured about twenty inches in length, and consisted of solid graphite, with almost invisible particles of calcspar scattered through it. It was taken out *across* the bed, and had the mark of the wall-rock, showing the stratification, at one end.

After lying for some time on one of the shelves of the museum, this specimen was sent to the London Exhibition of 1862. It may be in the museum in Montreal at the present moment; but it is possible that it was sent to the Dublin Exhibition, and lost. However, Sir William can tell you about it, and also show you smaller specimens which I brought him at the same time. My brother, who was with me on this visit, also took home some specimens, which he afterwards brought up here and gave to me, so that, if you want a sample, I can furnish you. I also left a number of pieces under McArthur's ash-house; but it is so long ago, that I suppose they have all disappeared before now. The part of the bed laid bare was too small to enable me to form a very decided opinion about its constancy; but, as far as observable, it appeared very promising and regular. The reason why such a bed as McArthur's had not been tried at that time was the idea that only pure graphite, like that from Cameron's lot, was of much value. The new processes for dressing plumbago like this for market give the matter quite a different aspect. The particles of spar in McArthur's plumbago are small, and form only a trifling percentage of the mass. Judging from what I saw, this is decidedly the most promising locality for plumbago with which I am acquainted. The thickness of the bed is given by Sir William Logan as three feet, which I think is correct. Like all beds of graphite, some irregularity must be looked for in it; but, unless a more complete examination prove it very different from what I expect, it is certainly well worth working.

If I think of any thing more in regard to this place I shall mention it the next time I write. Meantime, I remain

Very truly yours,

ROBERT BELL.

Subjoined is an Analysis, by Dr. C. T. Jackson, of Boston, of a specimen of Plumbago from the above locality :—

Boston, Dec. 7th, 1866.

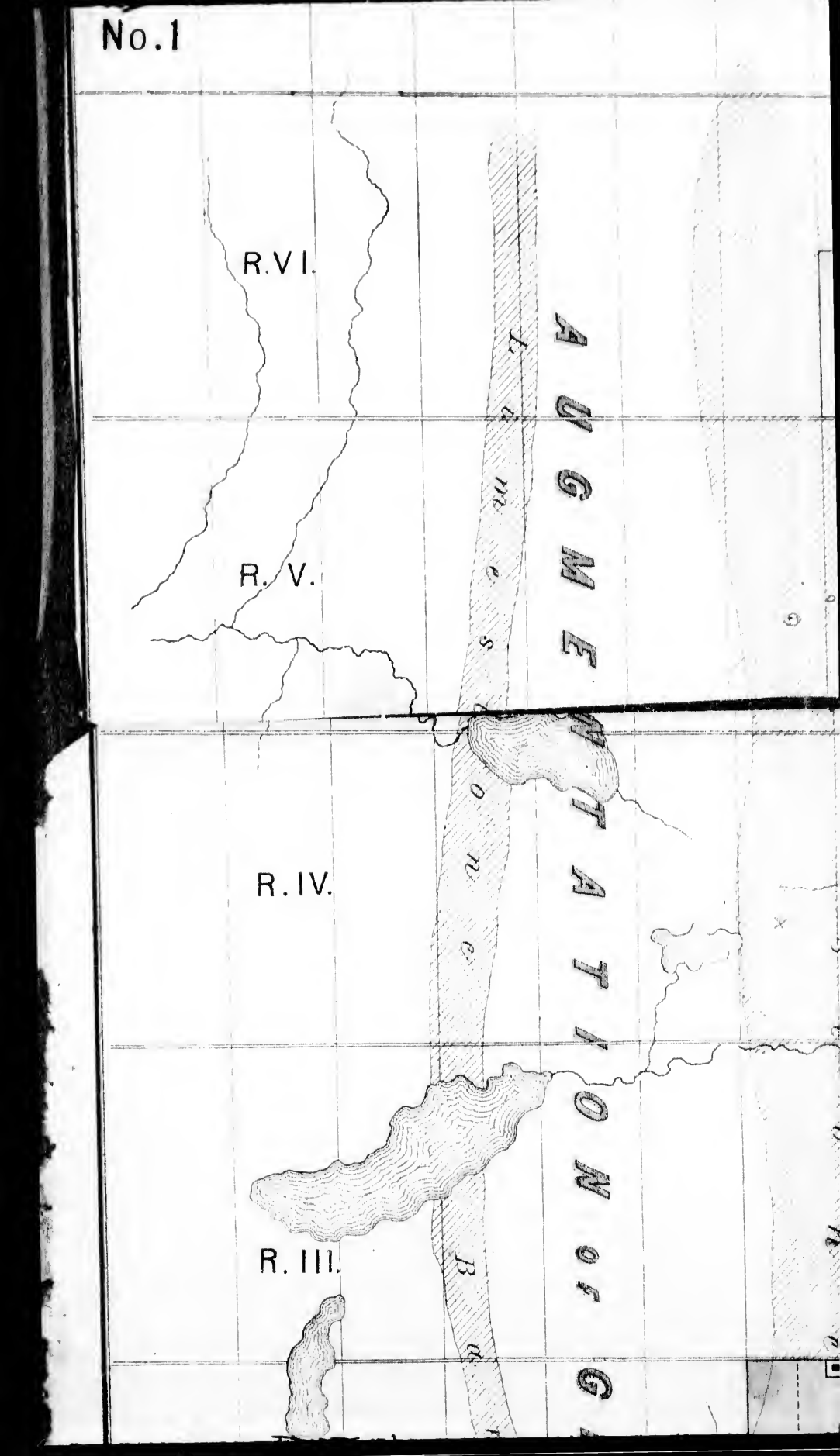
Hon. J. D. Green.

Dear Sir.—I have worked a sample of the Graphite or Plumbago you left with me by Mr. Brodie's process, and find that 500 grains of it give 400 grains of pure foliated Plumbago, and 100 grains of silicious sand, (quartz.) It therefore consists of 4-5ths pure Plumbago and 1-5th quartz.

No Iron Pyrites is present, and I think this Plumbago will serve for making crucibles, since the quartz when ground fine with the plumbago cannot act injuriously in the crucible mixture. It certainly can be mixed with the more expensive Ceylon foliated plumbago with a saving of expense, and yet produce good crucibles. The prepared plumbago is suitable for pencil making.

Respectfully your obt. srvt.,

C. T. JACKSON, M.D., *State Assayer.*


No.1
R.VI.
R. V.
R.IV.
R. III.
ALLEGHANY MOUNTAINS

R.VII.

R.VI.

R.V.

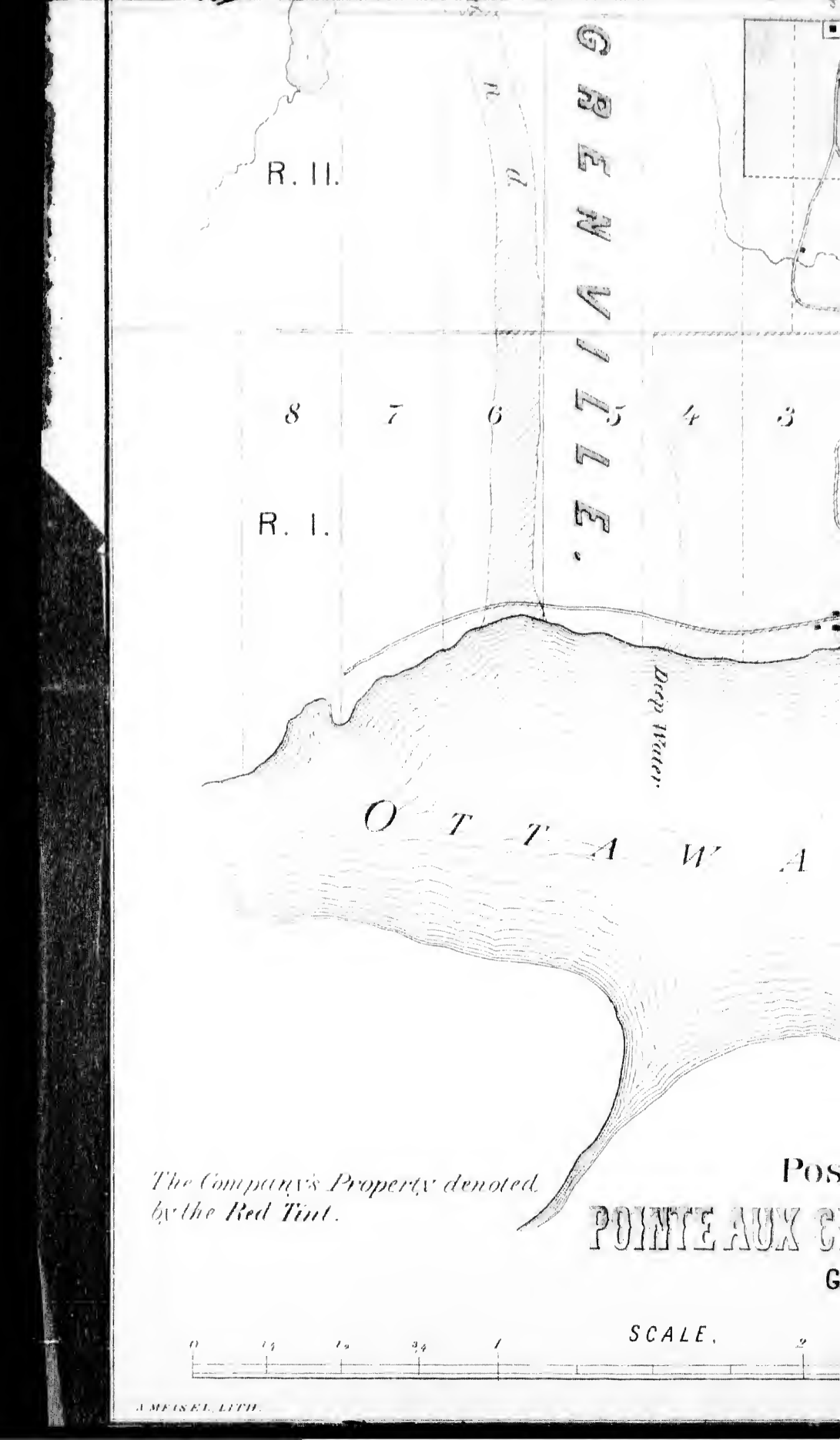
R.IV.

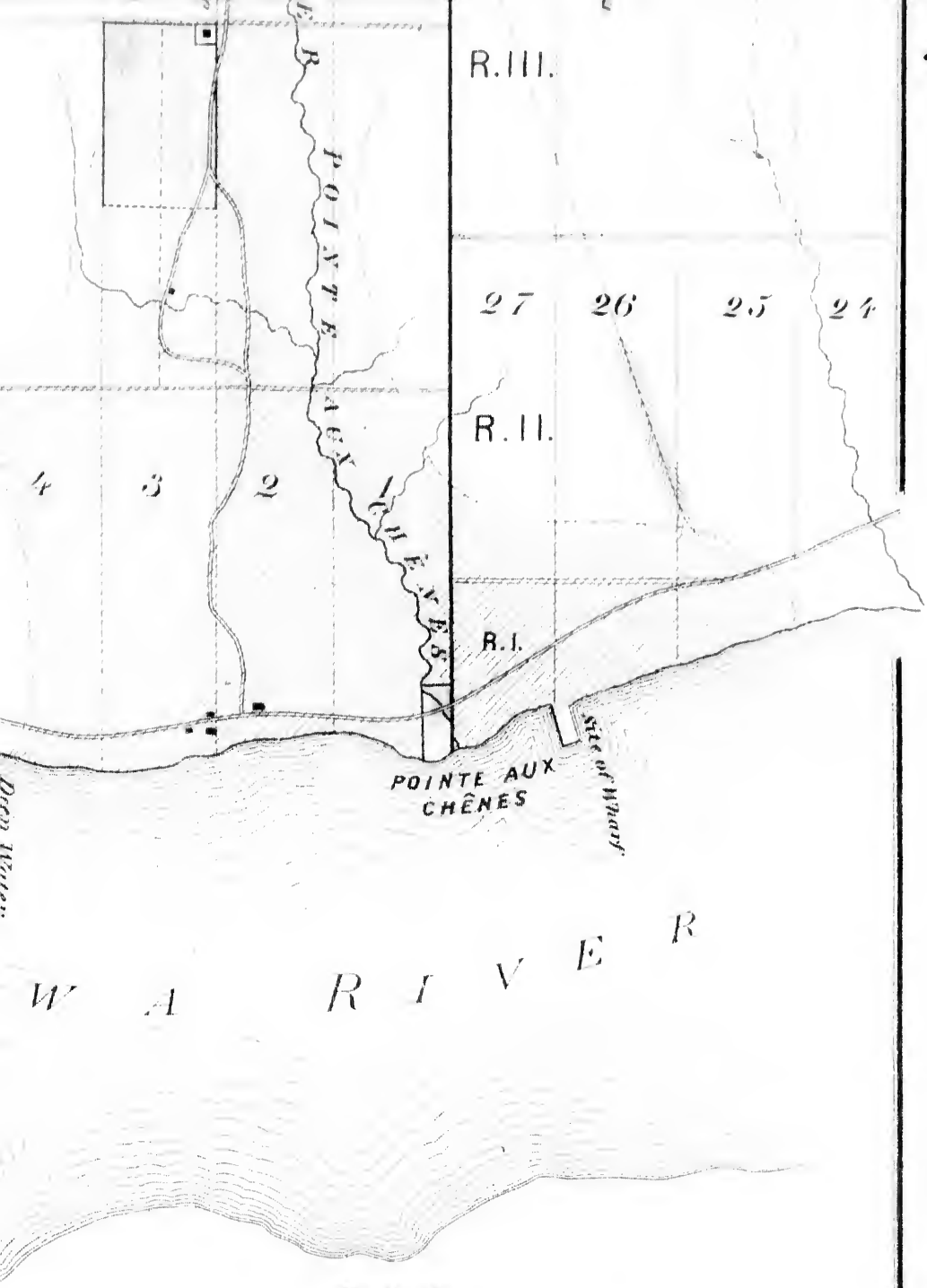
R.III.

GREENVILLE.

L. Cross

Cross River


R. II.
R. I.
8
7
6
5
4
3
2
1
GREENVILLE.
Deep Water.
OTTAWA
The Company's Property denoted by the Red Tint.
POINTE AUX
SCALE.
0
1/4
1/2
3/4
1
2
A MEISEL LITH.



MAP

Showing the

POSITION OF THE PROPERTY

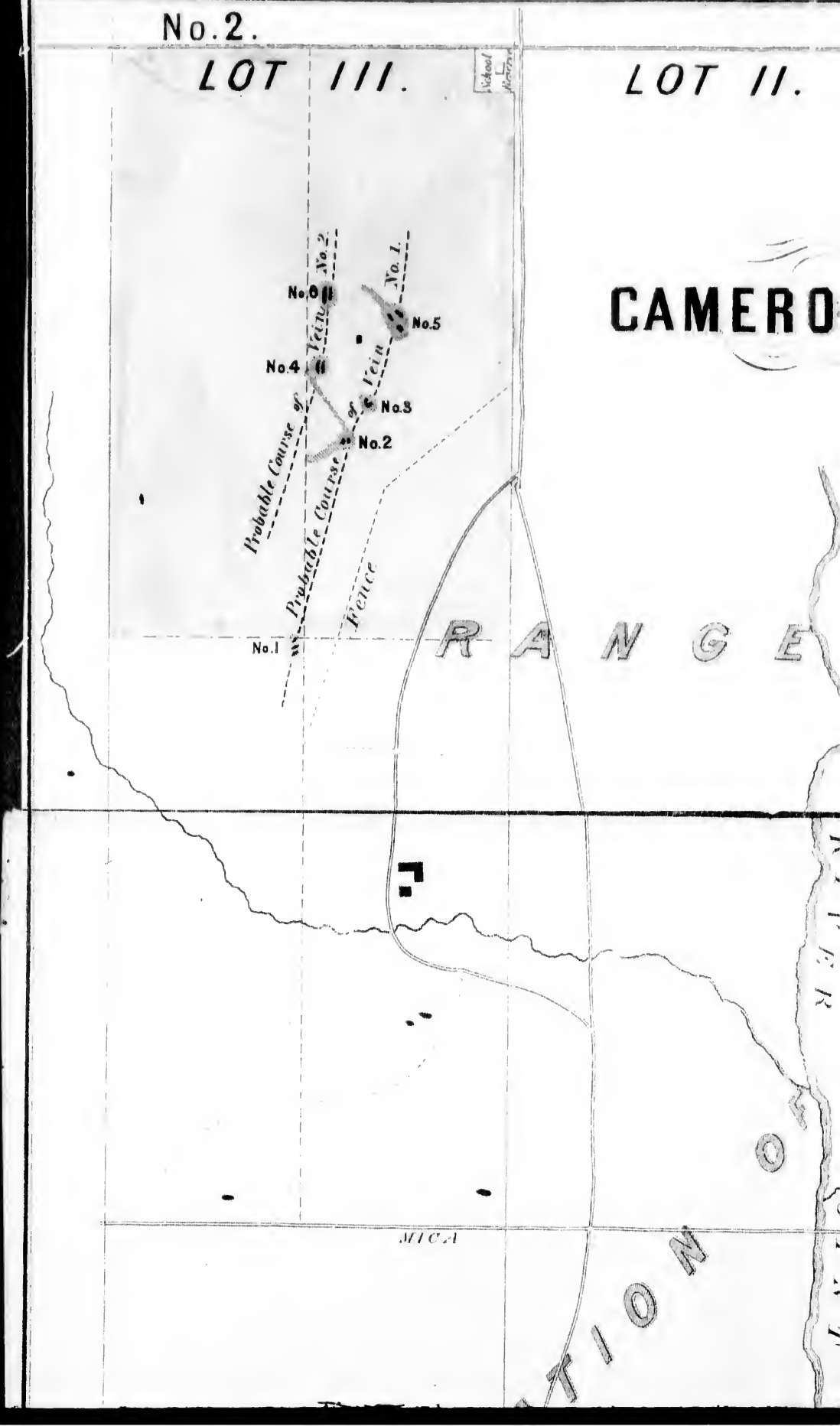
OF THE

NTE AUX CHÊNES PLUMBAGO COMPANY,

GRENVILLE, CANADA EAST.

ALE. 2 3 Miles.

C. Robb, M.E.
Montreal.

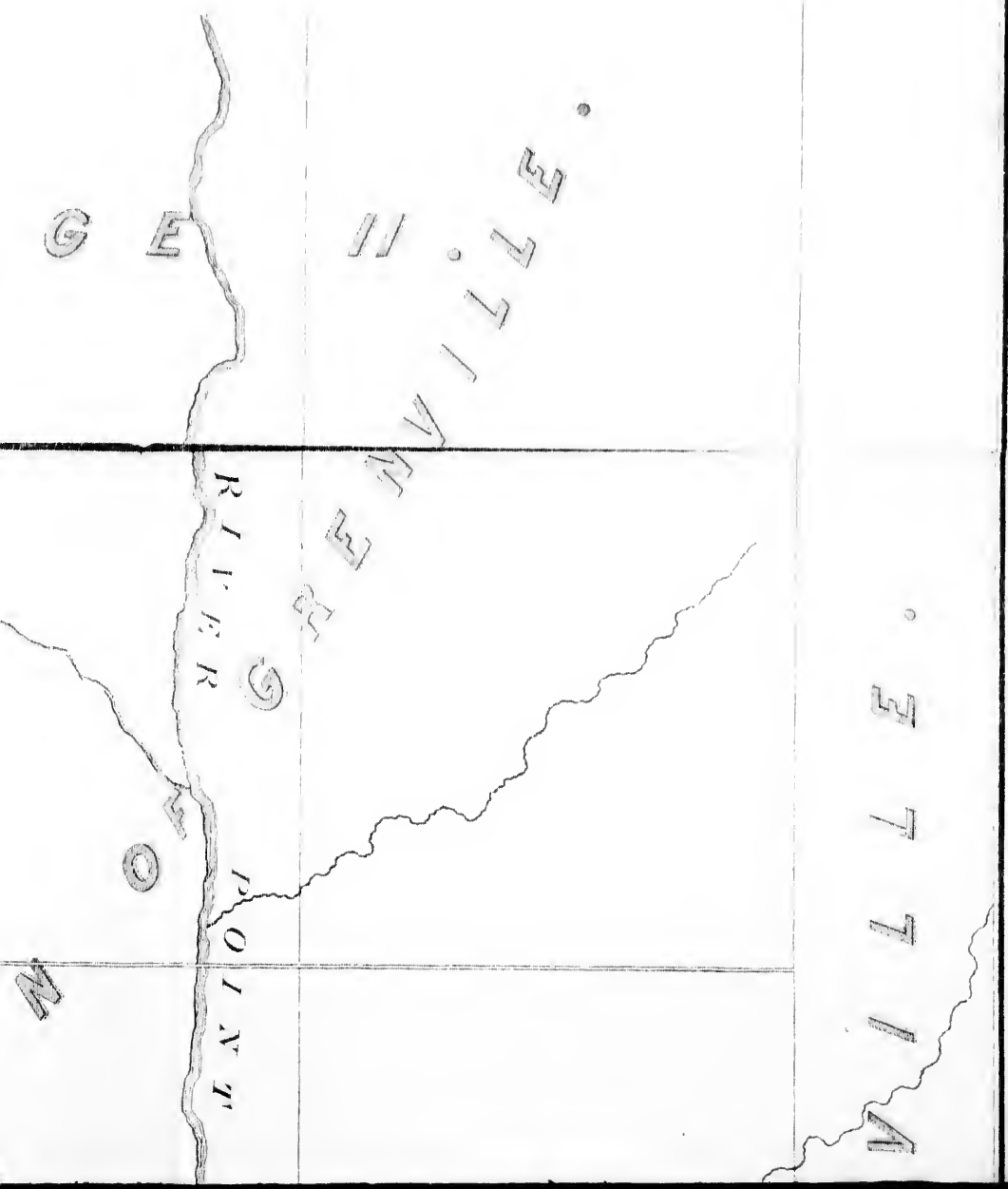

No.2.
LOT III.
LOT II.
School Reserve
No.6
No.5
No.4
No.3
No.2
No.1
No. 2 Vein
No. 1.
Vein
Probable Course of
Probable Course of
Fence
CAMERO
RANGE
MICA

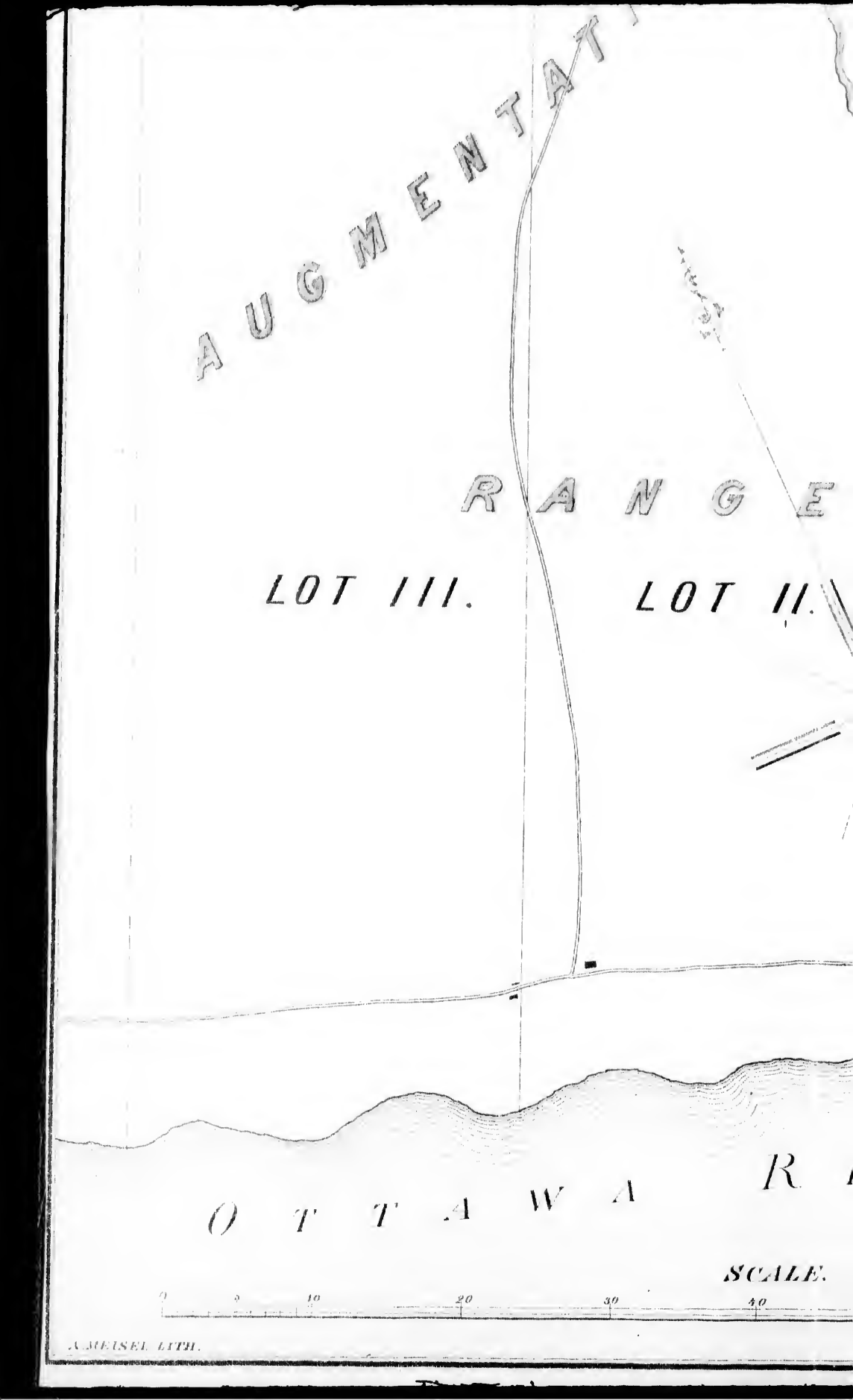
OT II. LOT I.

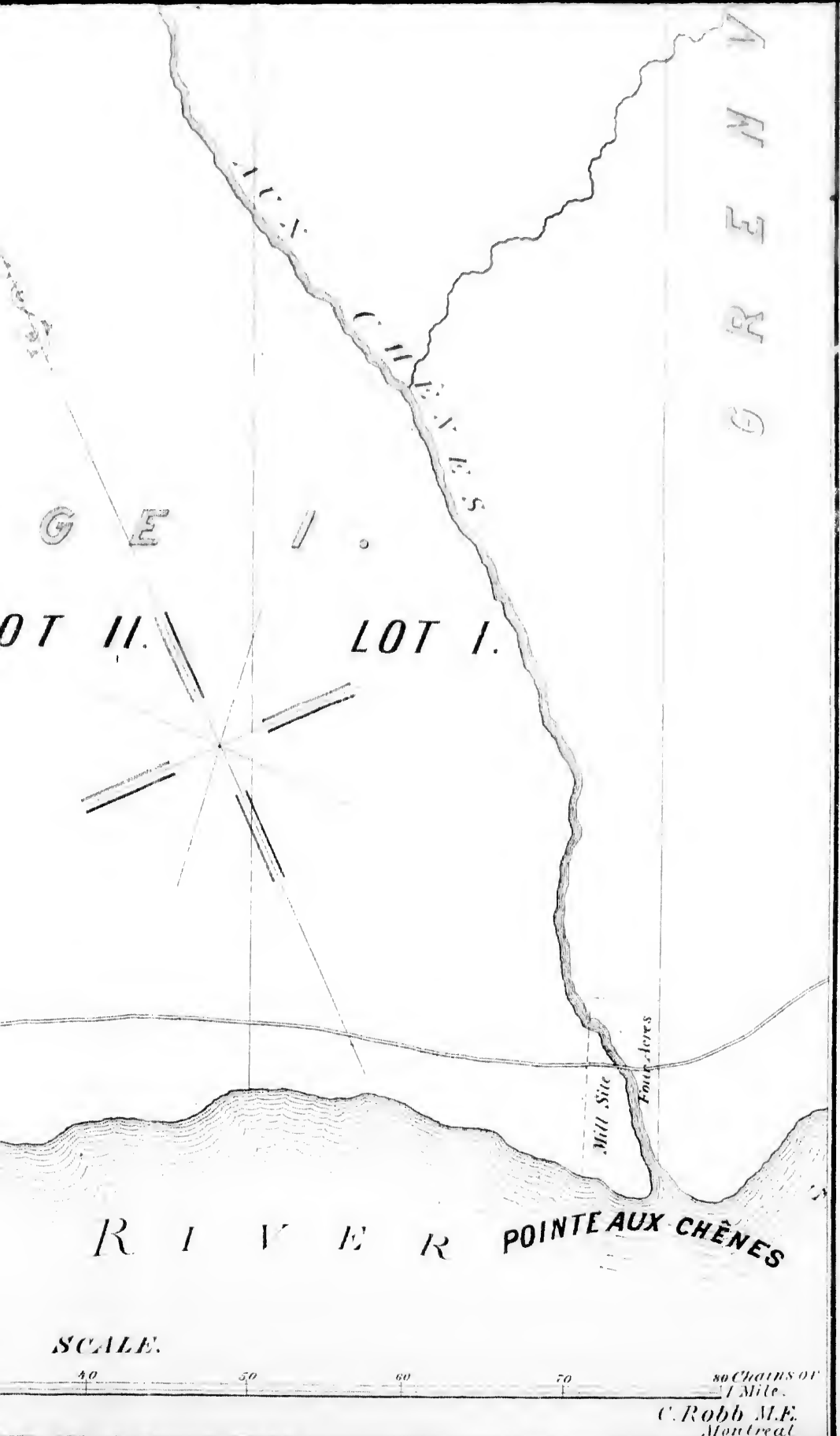
MAP

of the

AMERON PROPERTY.




AUGMENTAT
RANGE
LOT III.
LOT II.
OTTAWA R
SCALE.
0
5
10
20
30
40
A. MEISEL LITH.


ARGENTEUIL
GE I.
OT II.
LOT I.
Mill Site
Four Acres
RIVER
POINTE AUX CHÊNES
SCALE.
40
50
60
70
80 Chains or 1 Mile.
C. Robb M.E.
Montreal