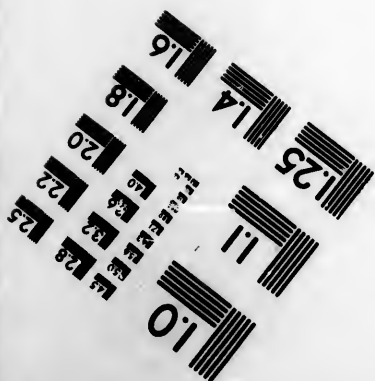
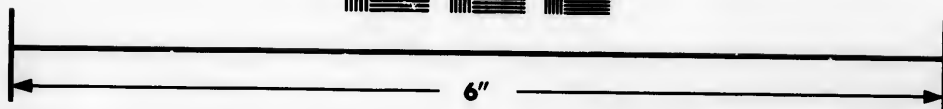
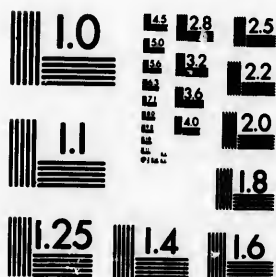


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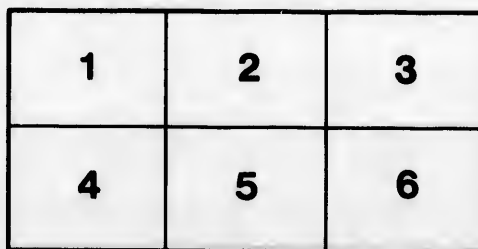
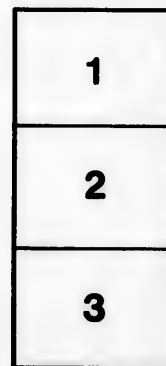
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IRON MINES ¹⁵
OF
NOVA SCOTIA.

THE LONDONDERRY
IRON MINES.

LONDON:
WILLIAM PENNY,
PRINTER, LITHOGRAPHER, AND ENGRAVER,
87, LINCOLN'S-INN FIELDS.

1857.

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IRON MINES OF NOVA SCOTIA.



LONDONDERRY IRON MINES.

UNTIL within a very recent period, we have been accustomed to look to Sweden and Russia as the only favoured sources of supply of the higher qualities of iron manufactured with wood fuel, which are so essential to the production of steel, and the success of many important branches of industry. From the evils of the late war, however, this advantage has resulted, — that it has taught us that this indispensable material can be supplied to any extent, and of the very first quality, from our own colonies. The government authorities, after long and careful investigation, have discovered that the charcoal iron of Nova Scotia is the very best they have been able to find, and have accordingly adopted it for the purposes of the War Department. The most eminent engineers have declared it to be admirably suited for machinery, and all uses where great strength with lightness of material is wanted; and for the higher qualities of steel, it is admitted to be of unrivalled excellence.

The township of LONDONDERRY (NOVA SCOTIA), which is situated upon the northern shore of the Basin of Mines, is what is called a *free grant*, and as regards iron, is entirely exempt from quit-rent or royalty of any kind. This township, which has a frontage of twenty miles upon the waters of the Bay of Fundy, embraces the southern flank of the Cobequid Mountains, a range of highlands of moderate elevation, which traverse this part of the country in the direction of south-east and north-west. It is upon the slope

of these hills, and at a distance of from five to six miles from the shore of the bay, that the extensive deposits of iron described in the following reports are found, and a reference to the map of the country will show how very favourably they are situate for manufacture and transport. The ores of this district have been carefully examined and tested by several eminent scientific and practical men, both in England and America, who all concur in the opinion that they are unrivalled in point of purity and richness of yield, and for the excellence of the iron and steel which they produce.

The most remarkable varieties are—First, the *specular* or *glance* iron ore, which Dr. Ure says “is a pure peroxide of iron, 100 parts containing 99 per cent. of the peroxide, and consists therefore of very nearly 70 of metal, and 30 of oxygen. When smelted, 100 parts yield 75 of cast iron—the increased weight above 70 being due to combined carbon. Its specific gravity is 4.72.”

Of this ore, Mr. Mushet says:—

“I am enabled to pronounce that no ore of equal excellence has hitherto been discovered in the United Kingdom, nor have I met with any that will bear comparison with it from abroad; and this has been confirmed to my mind by a series of experiments, from which it has resulted that cast steel of the most perfect quality can be produced at once by simple fusion from this most remarkable iron ore. The results I attained placed this ore upon an equal footing with the Wootz ore of India; and I, therefore, consider it a source from which steel-iron and steel may be derived of a quality even surpassing the produce of the Swedish Mines.”

SECOND.—*Micaceous Specular Iron Ore.*

“This ore consists of soft unctuous masses of micaceous oxide of iron, resembling black-lead in its appearance, and staining the fingers after the manner of rich plumbago. It contains no trace of sulphur, arsenic, or any other earthy or metallic alloy which may prove injurious to the quality of the iron or steel manufactured from it; and its composition is as follows:—

Peroxide of iron	97.57
Moisture	2.43
	100.00 parts.

“The produce, therefore, from the ore, as taken from the mine is 68.29 per cent. of pure iron.”

Mr. Dawson, the eminent Geologist, says:—

“This ore, as it occurs in masses and veins in the ankerite, is a pure peroxide of iron, containing 69.3 per cent. of iron.”

THIRD.—The *Magnetic Specular* or, *Ologisto Magnetic*

Ore.—This is a pure peroxide, and contains 70 per cent. of pure iron.

“For purposes of steel-iron and steel, the great object is to obtain a perfectly pure oxide to operate upon, and the simple abstraction of the oxygen, and a subsequent alloy of carbon, affords at once a perfect quality of steel. Perfectly pure peroxide consists, in 100 parts, of iron 69·97 × oxygen 30·03— or, in round numbers, of iron 70 × 30 oxygen. These ores approximate so nearly to these proportions, that they stand unrivalled as steel-producing minerals.”

FOURTH.—The **RED ORE**, of which there are several varieties, —

“Is a splendid ore for the charcoal blast furnace, mild, fusible, and free from all injurious alloy, more like a chemical preparation of an oxide than a natural mineral production. It yields no less than 69½ per cent. of iron, and that of a quality not easily surpassed. This is also a steel ore. Another variety was found to contain 65 per cent. of iron.”

Mr. Dawson says of this ore:—

“That it is very abundant. It is of a deep red colour, exhibits in the recent fracture an imperfect lamellar structure, and is easily scratched by the nail, or crushed into powder. An average specimen was found to contain 97 per cent. of peroxide of iron. As an ore of iron, this substance is little, if at all, inferior to the specular ore.”

Dr. Ure examined a variety of this ore, which he says is—

“Analogous to the fine kidney ore of Cumberland—specific gravity 3·93— 100 parts of it consist of—

Peroxide of iron.....	85·8
Silica	8·2
Moisture.....	6
	<hr/>
	100·0”

Another, which he calls,—

“An ochery friable iron ore—specific gravity 2·95. This is a scumby red brown mineral: 100 parts of it consist of—

Peroxide of iron.....	84·4
Silica	8·
Moisture.....	7·6
	<hr/>
	100·0”

Dr. Ure says of these ores that—

“They are excellent, being pure, rich in metal, and easily smelted, and that charcoal iron made from them will rival the best marks of Swedish iron.”

Mr. Dawson says—

“*Ankerite.*—This substance is a ferruginous variety of limestone, which is present in great abundance in nearly all parts of the deposit. It has a large-grained crystalline structure, and reddish and yellowish colours, and usually

contains crystals and nests of specular ore. The red variety is coloured by peroxide of iron, and usually contains more of that substance in the state of specular ore, than the yellow.

"In the iron mines of Styria, where ankerite is found in considerable quantity, it is highly prized, both as an ore and as a flux, and there can be no doubt that in smelting the iron, it will be found a very valuable auxiliary.

"The white ankerite contains in some parts a large proportion of *sparry-iron*, containing 73.2 per cent. of carbonate of iron. This is nearly as good as the red ore, and very much increases the value of the ankerite in the parts which contain it."

Besides the foregoing, which may all be classed as primary ores, there are large deposits and veins of hematites, besides carbonates and hydrates. Extensive beds of red and yellow ochre, of excellent quality, are also found in many places along the line.

With respect to the *extent* of these remarkable deposits and the *quantity* of ore, Dr. Gesner, the author of a work upon the "Geology" and "The Industrial Resources of Nova Scotia," says:—

"I caused a deep trench to be dug at right angles to the deposit or vein, and to a depth sufficient to reach the compact and undecomposed masses of the ore. The section thus made across the bed or vein was twenty feet in length, but the trench did not reach either of the sides of the ore, and therefore its thickness still remains unknown. I am of opinion that the depth is far too great ever to be ascertained. I followed the ore to the distance of three-quarters of a mile, but the length of the ore bed, like its depth, is unknown. From these facts it may be observed that the ore itself is perfectly inexhaustible, and its situation most favourable for mining."

Mr. Dawson, in his Report, observes as follows:—

"In conclusion, I may remark, in reference to the deposit above shortly described, that from consideration of the abundance and purity of the ores contained in it, their association with the mineral so valuable in their reduction as ankerite, their accessible situation, the facility with which they can be extracted, and the abundance of fuel procurable in their vicinity, as well as the circumstance that carboniferous deposits exist both to the north and south of the range of hills in which they are contained, it is impossible to entertain a doubt that the iron ores of Londonderry are of very great economical and commercial value."

Mr. Cunard, the chief agent and representative in Nova Scotia of the General Mining Association, whose opinion is entitled to great weight, at a public meeting, held at Halifax in 1847, said,—

"That he had visited the mineral deposits with scientific men, and had no doubt himself that they were highly valuable. All that was wanted was capital to turn these resources to profitable account. With regard to the shipping place, it could be seen from the site of the mines. There was a singular combination of coal, iron, and lime. If he had these mines in his possession, he was satisfied he could do something with them which would be

beneficial to himself and to the country. The ore was indeed very rich, and the quantity, he believed, illimitable."

He also stated,—

"That if this valuable deposit of minerals had been reserved in the original grants of the Crown, and conveyed to the General Mining Association, they would have had an establishment at Londonderry by this time worth £100,000."

A quantity of the ores from the Acadian Mines, having been imported into England, was smelted with charcoal at the furnace belonging to Messrs. Harrison, Ainslie, and Co., at Backbarrow, in North Lancashire. They are the only parties in the United Kingdom who reduce iron from the ores by means of charcoal fuel; and Mr. Thomas Roper, the intelligent and experienced managing partner of that establishment, thus expresses himself:—

"I am now so satisfied of the perfectly easy fusibility of your ores, and the excellent quality of the pig iron produced therefrom, that I feel every confidence in your complete success. The great strength of your iron, accompanied as it is by the most perfect ductibility, will not fail to place it high in the iron market."

Again, in a subsequent letter, he says:—

"I feel fully convinced of the immense value of your property, and perfectly certain that with ordinary good management it is capable of making princely returns for judicious outlay. The ores are so easily managed, fuse and work so kindly in the furnace, and the produced metal is so universal in its applicability for superior purposes, that you are now in a position, by commencing the manufacture of pig iron and refining with charcoal, to step at once to a high place in the iron market of the world. I mention these two processes only, because these you can carry on cheaper than they can be done anywhere else under the sun, or I am much mistaken; and because they do not involve either expensive outlay in plant or machinery, nor any great amount of skilled labour."

W. Fairbairn, Esq., F.R.S., the eminent engineer, instituted a number of experiments upon the iron and steel produced from the Acadian ores, and expressed the highest opinion of their quality and value, and thus concludes an able and extensive report, read before the Philosophical Society of Manchester.

"The iron made from these (Acadian) ores has already been tried for almost every purpose for which charcoal iron is used, and the results have been uniformly successful; for tin plate, wire, hore-nails, gun-barrels, and so forth, it is highly prized; whilst the steel has been acknowledged to compare favourably with the best Swedish. The immense deposits of ores, and the unbounded supply of wood for charcoal, seem to justify the expectation that in future years Great Britain will derive her principal supply of steel and charcoal iron from this quarter."

REPORT OF CHARLES T. JACKSON, M.D.

State Assayer's Office, 32, Somerset-street,
Boston, 10th Oct., 1855.

During the past month, in company with my friend, John L. Hayes, Esq., of Washington, D.C., I made an examination of the iron mines situated in LONDONDERRY, on the southern slope of the COBEQUID MOUNTAINS, in NOVA SCOTIA, about five miles north of the tide waters of the BASIN of MINES at the head of the Bay of Fundy.

The great fact to be exhibited is the abundance of iron ores, and I think the developments which have been made since this district was originally explored by Messrs. Hayes and Dawson, have demonstrated the opinions of those gentlemen to be correct, "that this region contains an adequate supply of excellent ores of iron, fully sufficient to support many smelting furnaces, and enough to require extensive tracts of woodland for the supply of charcoal fuel."

The ores consist of red oxide of iron, carbonates of the oxide of iron, ankerite (or a mixture of carbonates of iron, lime, magnesia, and peroxide of iron), amorphous or compact hematites, and geodes of botryoidal hematites, known to the miners as kidney iron ores. There is also a considerable proportion of micaceous specular iron ore mixed most curiously with the ankerite, and appears to have been sublimed into all the cracks and crevices of the veins.

According to the surveys made by Mr. James Carswell, the *trend* of the iron ore deposits, as shown by numerous pits sunk upon it, is nearly N.E. and S.W., the principal vein being a singular mixture of fine red oxide of iron and ankerite with specular iron ore. A level, six feet wide, has been driven in on this vein, and is wholly in the iron ore, no wall rocks being anywhere exposed. By other pits the width of the vein is ascertained to be at least 26 feet. Botryoidal and reniform masses of hematite are frequently met with in these pits; and small streaks and bunches of black oxide of manganese were observed in the compact hematite. A shaft has been sunk on this lode to the depth of 28 feet, and the

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ore has been found to be richer and more compact as it descends. The hill is 470 feet high, and it is, therefore, easy to drive levels on the vein from the hill side, which will effect ready drainage of the mines.

After examining the extent of the ores on this hill, which appears to be filled with them, we went to Cook's Brook, and there saw some very large masses of pure specular iron ore, one of which would weigh more than 500 pounds; and from appearances of ore in so many places, we have no doubt of the existence of a vein of the specular iron ore in the rocks of this brook.

We next examined Totten Hill, where an enormous bed of red oxide of iron, brown hematite and specular iron ore exists, and is exposed by a trench for the distance of twenty yards in a course S. 20 deg. W.

We were entirely satisfied of the existence of an abundance of iron ores, and next turned our attention to the *forests*, to ascertain how far they could be depended on for a supply of wood for making charcoal. We estimated that the forests would yield from fifty to sixty cords of wood per acre, and as the reserves are very extensive, the supply of fuel is very ample. The forest trees are mostly of hard wood, such as yellow birch, maple, beech, ash, &c. Charcoal can be made at a cost of not more than five dollars per 100 bushels, and possibly in well managed kilns for four dollars.

There are so many and such extensive deposits of iron ores in these hills, as to justify the erection of furnaces at several points. The ores make the very best kinds of iron for the manufacture of the finest cast steel, there being about two per cent. of oxide of manganese in the average ores.

The cast iron is grey or white, according to the burthen of the furnace, and the grey iron is remarkable for its great strength, softness, and toughness. It is very suitable for the casting of ordnance, and will be found of unrivalled strength. The steel-makers have already discovered the great value of this iron for making steel, and pay for it the highest prices.

The American models will be the best to copy in erecting furnaces in which charcoal is to be used for fuel, since the

furnace masters in the United States have had much experience in smelting iron by means of charcoal.

CHARLES T. JACKSON, M.D.,

Assayer to the State of Massachusetts, &c.

LONDONDERY IRON ORES.

DR. JACKSON'S ASSAY.

*State Assayer's Office, 32, Somerset-street,
Boston, 6th Oct., 1855.*

Average sample from all the veins now worked.

This sample was made up with care by mixing equal quantities of each of the ores and pulverizing the whole, and then quartering the mass of powder in the usual way of sampling. This ore thus drawn represents the whole produce of the mines which supply the Acadian furnaces.

It yielded:—

Peroxide of iron	74.8
Oxide of manganese	2.2
Silica	2.2
Insoluble specular titanif ore.....	1.8
Calcareous matter and water of comp	19.0
	100.0

This mixture contains $52 \frac{8}{100}$ per cent. of metallic iron, and $1 \frac{5}{100}$ per cent. of manganese, the exact proportion required to convert the iron into the finest kind of steel, while it is not enough to render the cast-iron brittle and crystalline.

It is quite interesting to find that thorough scientific investigations justify the high reputation which the Acadian iron has won among the steel-manufacturers of England.

CHARLES T. JACKSON, M.D.,

*Assayer to the State of Massachusetts,
Geologist and Chemist.*

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REPORT OF JOHN L. HAYES, ESQ.

1 In the year 1849 I first explored the iron mines of Londonderry, in the province of Nova Scotia, in company with Mr. Dawson; and I have within a few weeks revisited them, along with Dr. Jackson, of Massachusetts.

2 During the period of my first visit the whole district was covered with a dense forest, and no regular mining operations had then been undertaken; but the nature of the formation and the appearances of ore along the whole line, satisfied me that the mineral was very abundant. In the mean time the wood has been cleared away in various places, and the veins and deposits of ore have been opened up to an extent to prove beyond all doubt that they are practically inexhaustible.

3 The *matrix* or bed of the ore is an extensive band or dyke of ferruginous limestone, to which Mr. Dawson has given the name of *ankerite*. This formation extends in length from eight to ten miles in a nearly straight line through the property, and in some places the ore-bearing rocks are said to be nearly a mile in width. In this calcareous band occur numerous beds and deposits of rich specular, magnetic, and red ores; and the ankerite itself may be regarded as an *ore*, since it contains from twenty to fifty per cent. of iron. In the Styrian and Corinthian mines this mineral is used both as an ore and as a flux; and it is from it that the celebrated steel of those districts is mainly produced.

4 The most eastern point to which I extended my exploration on this, as on the former occasion, was what is called the "Peter Totten Lot," where a trench was dug across a bed of compact red ore, to a width of eighteen feet without reaching the walls. This deposit we traced to a distance of a quarter of a mile through the forest; and as it lies along a sloping hill it can be very easily mined and drained.

5 Pursuing the same course westwardly to the "Barnhill Lot," we saw exposed an extensive bed of ankerite, with numerous veins and strings of specular ore. The ankerite

here contains much *sparry iron*, and appears sufficiently rich for the blast-furnace by itself.

6 Further west, on the "David Totten Lot," we found the ore very largely developed. The deposit was laid bare by a trench which I measured to the width of fifty-three feet, and the whole mass was a red oxide with a large intermixture of specular ore. The ankerite is here of great extent; and at a distance of 350 feet from the trench south-easterly, the red ore is again exposed. North-westwardly from the main digging, 100 feet, another bed of the red ore, ten feet in width, is found in contact with the ankerite. This hill, having a considerable elevation above the bed of the Pine Brook, which divides it from the Barn Hill Lot, can be easily mined, and will furnish an immense supply of ore.

7 Continuing the same course westwardly, the ore shows itself in large beds and deposits throughout the whole of that part of the property which formerly belonged to John Ross, Esq. Several openings have been made along the line, and the ore extracted has proved to be very rich and pure. In consequence of the great denudation of the hills in this locality, the ore beds are exposed in many places, and furnish abundant evidence of the vast quantities of mineral they contain. The Folly River cuts through the *strata* in this neighbourhood; and in the valley which it forms there are convenient sites for works.

8 West of the Folly River the same formation extends, and various trial pits have been sunk to prove the continuity of the ore, which everywhere presents the same appearances.

9 In the neighbourhood of the great Village River, regular mining operations have been commenced by the Acadian Iron Company, and the results have more than verified the predictions which I made during my first explorations. To use the language of the miner who accompanied us, "it was a mountain of ore."

10 The charcoal which I saw in use at the Acadian Iron Works was of excellent quality; but I adhere to the opinion formerly expressed, that great advantages would be gained by carbonizing the wood in kilns or ovens. The wood is admi-

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richly adapted for charcoal, and I think that two cords, on the average, will yield 100 bushels. The forest-lands attached to the mines will furnish from fifty to seventy cords to the acre, and with proper care the wood will be reproduced every twenty years. Viewing all the advantages of the Londonderry district, I am bound to say that I know of no locality where charcoal iron can be anything like so cheaply produced.

I have no doubt that iron of the first quality for purity and strength, and which will demand the highest prices in the market, can be made from these ores. If Mr. Mushet's opinion, based upon his own experiments, that these ores will furnish steel-iron equal to the best Swedish marks, should prove correct, these ores possess a rare value; for of the many charcoal iron establishments in the United States, I know but one which furnishes iron suitable for making the first quality of steel.

Notwithstanding the vast extent of the forests in the rear of the mineral deposits, I am of opinion that it will be more difficult to provide *fuel* than *mineral*. The distribution of the ore along a line of several miles will allow of furnaces being erected at different places commanding the mines and the forests; but even so the difficulty of transportation beyond certain distances will limit the production of iron *in the immediate district*. It is, however, only five or six miles to the shore of the bay; and here almost any number of furnaces might be supplied with wood and charcoal from the well-wooded regions surrounding the basin of mines. The transportation of ore would now be but a trifling expense in winter; and the cost of constructing a railway would be no great affair. The great rise of tide would furnish water-power for all purposes, except driving the furnaces, for which I strongly recommend the employment of *steam* power.

J. L. HAYES,

*Representative of the Iron Manufacturers
of New England.*

WASHINGTON, D. C.

Nov. 9, 1855.

Iron
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REPORT OF E. WADHAM, ESQ., C.E.,

Mining Agent to his Grace the Duke of Buccleugh.

1 / HAVING in the Report, which I have handed in to the Directors of the Acadian Iron Company, stated the result of my survey of that part of the mineral property in the township of LONDONDERRY purchased by that Company, I propose now to refer to the remaining portion of that district, which is estimated to contain from 10,000 to 12,000 acres.

2 I may here observe that in all my explorations I was accompanied by Mr. Donald Urquhart, who has assisted at all former surveys, and whose intimate acquaintance with the property greatly facilitated my operations.

3 I visited in his company all the places mentioned by Mr. Hayes, Dr. Jackson, Mr. Dawson, Dr. Gesner, and others in their reports, and verified their statements by actual measurements and surface diggings.

4 So much has already been published in regard to the *ores*, and their position, that it may be sufficient for me to say that, from all I saw and all I know of analogous formations, I am quite satisfied that the ores are, at least, as abundant along the whole line of deposit as they are in the particular locality in which they are now being worked; and that equal areas will produce equal quantities, although in some places the difficulty and expense of mining may be increased.

5 Over a very considerable extent of the district now under consideration, there has been great denudation of the hills, and in many places veins and deposits are largely exposed on the surface. This is particularly the case at what are called the Totter and "Barnhill" lots, and also throughout the greater part of the extensive tract which formerly belonged to Mr. Ross. At these localities, therefore, mining operations will be comparatively inexpensive, and there can be no doubt that the ores are very abundant.

The mineral range, as it is called, occupies the rear division of the township of Londonderry, and extends from the Cumberland road to the line of Onslow township, a distance

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6 of from 8 to 10 miles. This tract, for practical operations, may be conveniently divided into *three* sections, each of which, in my opinion, is capable of supplying an establishment sufficient for the production of from 10,000 to 12,000 tons of iron annually. Of an ample supply of ore I have no doubt whatever, and the only difficulty will be in providing adequate fuel. The forest, however, marches along the whole extent with the line of mineral deposits, and is equally extensive in the Eastern as in the Western district.

7 Of the three divisions into which I propose to divide the property, the Western, called the Acadian Mines, and embracing about 4,000 acres, is the field of the operations of the Acadian Iron Company, and forms the principal subject of my previous report.

8 The next, or Central division, which embraces what is called the Ross property, contains, with the adjoining forest land, about 6,000 acres by estimation, and is watered by the two branches of the Folly River, which, after forming a junction, are precipitated over a perpendicular fall of 60 or 70 feet. On a level tract of interval land below this "fall," there is a convenient site for works, and the ores and fuel would be brought to the furnaces from both sides of the river.

9 The Ross property, which constitutes about one-half of the Central division, is the part in which the mineral was first discovered, and has generally been considered as the choicest portion of the mineral field. I understand that the value fixed upon this part by the first explorers was £60,000 Nova Scotia currency, equal to £48,000 sterling.

10 The Eastern division embraces all the remaining part of the property up to the line of Onslow township, and contains, with the annexed forest lands, about 5,000 acres. This tract is watered by the Deburt River and the Pine Brook, but the latter, which is most central, presents the best site for the works, and the greatest facilities for the supply of ore and fuel.

Although I indicate these situations for sites for works, I do not wish it to be understood that I recommend the

11 employment of the "water-power" of these streams to drive the "furnaces." On the contrary, I have seen no "water-power" in Nova Scotia that could with safety be relied on for such a purpose; and as I mentioned in my report to the Directors of the Acadian Iron Company, "steam" must be the motive power for all essential operations. Great advantage will, nevertheless, result from placing the works in the valleys formed by these streams, and for many subordinate purposes, such as driving the smith's and other shops, cleaning ores, sawing timber, &c. &c., the "water-power" will be found both useful and valuable.

12 The advantages of distributing the establishments along the line of the mineral deposits, instead of concentrating them at any one point, are too obvious to require mention. The sites which I have indicated appear to me to be the most favourable with reference to the supplies both of mineral and fuel, as well the transportation of the iron when manufactured. There are two good lines of road from the mines which bring the Central and Eastern Divisions within six or seven miles of ship navigation on the Bay of Fundy. The gradual slope towards the shore renders the land carriage very easy, and when the traffic shall justify the expense tramways and railways may be constructed at a very moderate cost.

13 Assuming that six or eight blast furnaces should be put in operation at each of the above places, I believe that an annual production of from 30,000 to 40,000 tons might be relied on; but to continue this for a long period of years will require a degree of care and management of the woodlands not usually practised in Nova Scotia; and some of the methods mentioned in my report to the Acadian Company must be adopted to render the forest reproductive.

There is a vast extent of fine forest in the rear of the mineral range, but beyond a certain distance the cost of carriage would be a bar; and I cannot see that for a permanency, the quantity of iron above mentioned could be materially exceeded by furnaces dependent upon fuel from the rear country. But as I believe the supply of ore will be

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14 found to be greatly in excess of the fuel wherewith to reduce it, the make of iron might be extended *ad libitum* by erecting furnaces on the shore, for the supply of which wood and charcoal could be waterborne from the country on both sides of the bay. Bituminous coal, too, might be obtained from the provinces, and it is not improbable that, owing to the purity and richness of the ore, a sale might be found for them in the "United States;" and a counter-traffic of anthracite coal would render the township of Londonderry the seat of a great iron manufacture at no distant period.

15 The value of these properties depend so much upon the scale of working, that it is difficult to form any estimate without knowing beforehand the amount of capital intended to be employed. In the district in which I am now engaged (Furness, North Lancashire), and which greatly resembles the Londonderry mineral field, although by no means of so great an extent, the annual shipment of ore has increased within the last five years from 100,000 tons to 400,000 tons, and is still increasing rapidly; and should an export trade be hereafter established for the Londonderry ore, I could not name for ore of such purity and richness a less sum (as royalty) than 1s. 6d. per ton; and if the mines were worked to the extent of their capabilities, the value of this mineral range would far exceed anything that has as yet been contemplated.

16 Confining the calculation, however, merely to the prospective make of iron by furnaces on the spot, I will assume the make of each district at 10,000 tons of pig iron yearly.

17 This will require 25,000 tons of ore, which, at 1s. 6d. per ton, will give £1,875, equal at twenty years' purchase to £37,500; and as I believe each district to possess equal capabilities, this will give a total value of £112,500 for the whole property, so far as ore is concerned; but to this has to be added the not inconsiderable item of wood, as well as the actual surface, much of which is very superior soil.

18 In order to work these mines to the extent above suggested, I think a working capital of £100,000 will be required. This would probably be sufficient to produce 30,000 tons of

pig iron yearly, and as it can be delivered at market under £5 per ton, and sold for more than £7 per ton, the profits will be certain and large; and I have therefore no hesitation in saying, as I have already asserted to the Directors of the Acadian Charcoal Iron Company, that, under skilful and prudent management, this property is capable of yielding very great returns, upon the capital to be invested in its development.

(Signed) EDWARD WADHAM, C. & M.E.

ULVERSTONE, LANCASHIRE,
January, 1857.

NOTE.—The extraordinary rise of tide in the Bay of Fundy (from forty to sixty feet), will give unlimited water power for works to be established on the shore. For hammering, driving rolls, and all operations that can be intermitted, this species of motive power may be advantageously used; but for blowing the furnaces steam will be indispensable.

The cost of making pig iron at the Acadian Iron Works, Londonderry, according to the manager's report, does not exceed £3. 5s. per ton; and as the timber ships from the Bay of Fundy take it as *ballast*, or at a *nominal* freight, the whole cost of transportation to England, including insurance and commission, is under 20s. per ton. This iron is now selling readily at £8. 15s. per ton.

Mr. G. G. Palmer, the Managing Partner of extensive Iron Works in Pennsylvania, speaking of these mines, says:—

“From the examination I made of these mines some few years since, I came to the conclusion that they possess all the elements for making *charcoal iron* cheaper than any other place I have met with; and of the quality of the iron there needs no surmise, since its superiority has been so fully proved.”

Dr. J. G. Percival, of Connecticut, U. S., the eminent Geologist, says,—

“From the examination I have made, there appears to me satisfactory evidence of a very great supply of ore. Besides the richer qualities of ores, suitable for the Catalan works, there is a very great quantity of ore blended with the ankerite, which might be worked to great advantage in a blast furnace. The yellow ochre, aside from its value as a paint, might also be used as an ore. The more ferruginous varieties of the ankerite (those verging towards the *spathic* ore) may also be employed in the blast furnace; and besides its value as a flux, might be used, I believe, with advantage as an hydraulic lime, so that a very large portion of the entire contents of the ore-bearing ranges may be turned to profit; and when it is considered that the mineral ranges may average 250 yards wide, on an extent of at least eight or ten miles, it is difficult

to conceive the resources which, by proper management, they may furnish. From all I observed I could not but form a very high estimate of the value of this property, considered in itself, without reference to the inexhaustible supply of the best and most appropriate fuel in its vicinity; and to the great facilities of conveyance by its nearness and easy access to navigation, and the expected passage of the railroad across the centre of the range. I need not further observe that all these circumstances will add very much to its value."

The manager of the Acadian Company in Nova Scotia, under date of the 20th February, 1857, writes:—

"We have everything well organized and working most satisfactorily at the Acadian Works. We have made iron there at not exceeding \$16, say £3. 3s. 9d. sterling; and on a long blast I am sure we should not exceed that—say £3. 5s. per ton."*

Speaking of mining operations, he says:—

"We have now on the hill 22 men and boys under Williams as head miner. Instead of the old system of surface-working, he has sunk deeper and struck regular veins, yielding pure and splendid ore. There are now three regular workings just on the brow of the hill. The uppermost, when first opened, showed a bunch about 12 feet wide, and sinking on this, a regular vein was discovered between clearly defined walls. This vein has been opened to an extent of 60 feet, and is worked in stopes. Precisely 28 feet north of this vein a parallel and exactly similar vein has been struck and opened to an extent of 52 feet, with exactly the same results. Out of a small space, little, if anything, more than 20 x 11 yards, Williams informs me that 450 to 500 tons have been extracted. Further down the hill Smith and M'Kenzie have two separate pits, from which they are supplying ore by contract at 7s. currency (equal 5s. 7d. sterling) per ton, they sinking their own pits, and are making capital wages. Further down again Eagles has sunk and reached just such a vein as one of Williams's, from which he is putting out splendid ore. My opinion is, that within the band of ores, when regular workings are carried on, numerous veins will be found in juxtaposition, giving in a small compass any required amount of ore. Below Eagles' pit, again, we come to the main level which has now struck into ore, and from which, by cross cuttings, we can catch the veins running east and west. With reference, therefore, to the supply of ore, we have arrived at proofs vastly superior to any we have ever had before of the existence of *quantity*; and, shortly, we shall be able to extract it at more reasonable rates."

Since the greater part of the foregoing reports were written, the Acadian Iron Works have been erected, and the result of actual working has proved that the abundance and purity of the ores, quality of the iron and steel, and facilities for manufacturing, have not been overstated.

The strength of the Acadian iron was found to exceed any

* In a memorial presented to the congress of the United States in 1850 by the iron manufacturers of New England praying for increased protection, it is stated, that the cost of making charcoal iron in that country, on the average of 18 furnaces, was \$34.49 per ton, more than twice the cost of the Acadian iron.

results obtained by Mr. Fairbairn and Mr. Eaton Hodgkinson, in their experiments undertaken at the instance of Government to test the relative strength of a great variety of irons.

Messrs. Salt and Co., the well-known surgical instrument makers, of Birmingham, write :—

“Our foreman says the steel works admirably, and we are of opinion that it is of very superior quality, from the finish and polish of the instruments.”

Messrs. Rodgers and Sons, of Sheffield, cutlers to her Majesty, say, “We have now tried your steel for a great variety of purposes, and find it uniformly good.”

Large quantities of cutlery and specimens of various articles manufactured from Nova Scotia iron and steel were exhibited at the Great Industrial Exhibition of 1851, and were highly recommended by the jury in their report, and a first class medal awarded.

Messrs. W. Jessop and Sons, Hutchinson, Wilkinson, Butcher, and Turton and Sons, of Sheffield, who have used considerable quantities of the Acadian iron for steel purposes, and almost all the principal steel-makers in Great Britain, concur in giving it a high character. In no one instance has there been an unfavourable opinion expressed.

Coleford, 29th July, 1854.

As I have, from first to last, manufactured some hundred tons of cast steel from Acadian bar iron, pig iron, and some of the iron ore, I am able to speak decidedly as to its merits. The steel has invariably been pronounced *first rate*, and the Acadian iron is for this purpose quite equal to the best marks of Swedish iron. For shear steel the Acadian iron is not equal to the Swedish; but this is only in consequence of insufficient care having been bestowed upon the manipulations of the bar iron department. A little care and experience will remedy all this.

R. F. MUSHET.

The following is the result of experiments made for the purpose of testing the strength of the Acadian iron, and its fitness for casting heavy guns :—

Tensile strain in lbs. :—

38,000	} per square inch.
40,400	
41,600	

The greatest strength obtained in any other iron hitherto used by Government, as stated by the Secretary for the

War Department in the debate on the Ordnance estimates, did not exceed 27,000 lbs. per square inch, and only averaged 22,000 lbs.

Recent trials made at Woolwich, have demonstrated the extraordinary strength of the Acadian bar iron. A bolt was made of the same size as the link of a chain-cable, calculated to bear a strain of *seven* tons. This bore a strain of *forty* tons before breaking. Bolts of the very best iron that was brought in competition broke at *seventeen* tons.

ON THE MANUFACTURE OF STEEL DIRECT FROM
THE ORE AND PIG IRON.

The ores of this district possess in an eminent degree the steely propensity (*propension acieuse*), and large quantities of cast steel of the highest quality have been made *direct* from the ore, as well as from the pig iron. The ores may, in fact, be regarded as *ores of steel*, and peculiarly adapted to the summary processes which are now attracting so much attention. The greater part of the expense of making steel by the ordinary methods is incurred in the conversion of the pig iron into malleable iron, and in rolling and hammering the bars to the requisite dimensions. It is confidently believed that, with these pure ores, all this expense may be avoided; and the following letter from a practical man of great experience explains some of the processes so successfully employed upon the Continent.

SIR,—The manufacture of steel direct from the ore has long been practised in this country, but it is only within these last few years, since the method of puddling it with pit coal has been discovered, that it has been carried to its present extent. The method of making blister and cast-steel in England is too well known to need remark; but the manner in which steel is made here is so very different, and I think not generally known in England, that perhaps a few observations may be acceptable. The quality and magnitude of the samples from Essen and Bochum, exhibited at London

and Paris, is a proof of the soundness of the principle on which steel is here made; the extension and flourishing of the different establishments show that, in a mercantile point, they are highly profitable.

Pig steel is made from the white carbonate of iron ore, either alone, or mixed with brown hematite or clay iron ore, which are smelted with charcoal in a peculiarly formed blast-furnace, the tuyers of which are so arranged that the metal produced is quite white and crystalline, and breaks with large silvery facets, some the whole depth of the pig. This pig steel is then, either alone or mixed with suitable charcoal pig iron, according to the quality of the steel required, puddled in an expressly constructed furnace, with a cast-iron bottom; when it is sufficiently decarbonized, it is formed into balls, and drawn under the hammer and rolls into rough bars, which are again welded and rolled into bars, and sold as puddled steel; this is well suited for all the purposes for which in England blister steel is used.

This puddled steel is treated by the cast-steelmakers as blister steel, who, by using different mixtures, make almost every quality of cast steel. From the statistical tables (just issued) of the production of metals in the Rhenish chief mining districts, it appears that the quantity of pig steel made in blast-furnaces in this district in the year 1856 was 7,500 tons; but what more particularly deserves the attention of my countrymen is *that the make of rough bar steel has increased in one year sixty-five per cent.*, or from 3,800 tons, the make of 1855, to 5,800 tons, the make of 1856. With this fact, is it not time that this new method be introduced into England? Although I fear that the pig steel from here would come too high in England, as the average price last year in Siegen was about £10. 10s. per ton, in consequence of the price of charcoal being £6. 6s. per 100 bushels; yet, if the information I have obtained be correct, either the East-India Iron Company or the Acadian Iron Company could produce steel from their ores at a far cheaper rate than it is made in Prussia, where, in addition to the high price of charcoal, the ore at some furnaces costs nearly 18s. per ton. Some exten-

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sive trials are, I hear, at present being made in England to produce steel direct from pig iron by melting it with a mixture of iron ore, manganese, and bar iron; but whether the steel produced can compete in quality with that made at Essen and Bochum remains to be proved.

J. PLAYER.

BERG. GLADBACH,
RHENISH PRUSSIA, *March 6.*

The ores of Styria and Corinthia, so famous for steel, are analogous to the ankerite and spathic ore, which abound in all the Londonderry district; and, as charcoal is so cheap, the methods used in those countries may be very advantageously employed. The processes of Mr. R. Mushet, and others, which aim at the more economical and speedy conversion of pig iron into steel, have been applied to the Acadian iron with the greatest success. In fact, the native steely propensity of the ores pervades every form of the produce; and, whether the steel has been made from ore, pig iron, or bar iron, the results have been certain, uniform, and satisfactory.

Mr. Hayes, a very competent authority, says, that if these ores are capable of producing steel of first-rate quality they possess a rare value, for of all the charcoal iron establishments in the United States, he knows but one which furnishes iron suitable for making the first qualities of steel. Neither in any other part of North America are any such ores known to exist; and it therefore follows, according to our present knowledge, that Nova Scotia will, from its geographical position, command the whole of that vast continent as a market for her superior iron and steel. The circumstances above mentioned also prove that these essential materials can be furnished to Great Britain from this, the nearest of all her Transatlantic Colonies, on better terms than from any foreign country.

FROM JOHN L. HAYES, ESQ.

Washington, Oct. 15th, 1855.

DEAR SIR,—It will be some considerable time before I shall be able to complete my reports of the survey of your properties in Nova Scotia and New Brunswick, lately made in company with Dr. Jackson. I may tell you, however, in advance, that this second visit has greatly strengthened my previous favourable impressions. It is difficult to estimate the value of properties of such great extent, and capable of being worked on so large a scale; but I feel that I am not above the mark when I name one million five hundred thousand dollars for the value of the three localities explored—viz. the Londonderry Mines, the Victoria Mines, and the Albert Quarries.

The advanced season of the year obliged us to postpone the survey of your other properties in the provinces, which, from all I have learned, must be very valuable.

Truly yours,

JOHN L. HAYES.

To C. D. ARCHIBALD, Esq.

FROM C. T. JACKSON, ESQ.

*State Assayer's Office, Boston, U. S.
Nov. 6th, 1855.*

DEAR SIR,—Having examined the Acadian and Victoria Mines, in Nova Scotia, belonging to you, I concur with my associate, John L. Hayes, Esq., in his estimate of their very great value; and am of opinion that when wrought to the extent of their capabilities, they cannot fail to yield interest on a million dollars; for the extent of your iron ore beds is so great as to render them, in a practical point of view, inexhaustible.

From the improvements which are likely to take place in the means of transportation to tide water, great facilities will be afforded for the exportation of these iron ores, which may be brought to the United States and carried to England,

according to the demand that may arise in the two countries. Lumber ships going to England will be glad to take the ore at small freight, since it will serve for ballast.

Respectfully your obedient servant,

C. T. JACKSON,

State Assayer of Massachusetts, &c.

THE LONDONDERRY MINES, so called, occupy the third and rear division of the township of Londonderry; and, commencing on the east, extend from the line of Onslow Township, westward, a distance of six or seven miles. This tract, which contains upwards of 10,000 acres, may be conveniently divided into two sections, each of which presents favourable sites for works, and commands abundant mineral and forest resources.

The line of the mineral deposits, with the accompanying ore-bearing formation, is shown on the map; and the several streams which cut through the *strata* afford great facilities for mining and draining.

The distance to the shore of the Bay, from the principal mineral deposits, is about six miles, with a downward slope favourable for transport and the construction of railroads or tramways. During the winter months the snow renders transportation easy and inexpensive by the ordinary roads of the country.

The greater part of the mineral district above mentioned is covered with a heavy growth of hard wood; and the whole rear country for many miles is one unbroken forest, reserved for the purposes of iron manufacture. It is estimated that these wood-lands will yield from 50 to 60 cords of wood to the acre; and that two cords will make 100 bushels of charcoal, which is proved to be sufficient to produce one ton of pig iron from these ores. The wood, with proper care and management, will be reproduced every twenty years.

The whole country on both sides of the Basin of mines,

and the headwaters of the Bay of Fundy is, for the most part, occupied by the native forests, which are capable of furnishing abundant supplies of wood and charcoal for furnaces and works to be erected on the shore, where the great rise of tide affords unlimited water-power.

Great numbers of vessels are engaged in carrying timber, gypsum, cord wood, and other bulky materials from the Bay of Fundy to the United States; and, as they now return in ballast, *anthracite coal*, which is free of duty, could be delivered at these works at a very cheap rate.* The timber ships from St. John's, Windsor, Parrsborough, and other parts in the Bay, gladly convey the iron to England as *ballast*, or at *nominal freight*.

* Bituminous coal of excellent quality exists on both sides of the Bay of Fundy, and the mines are extensively worked.

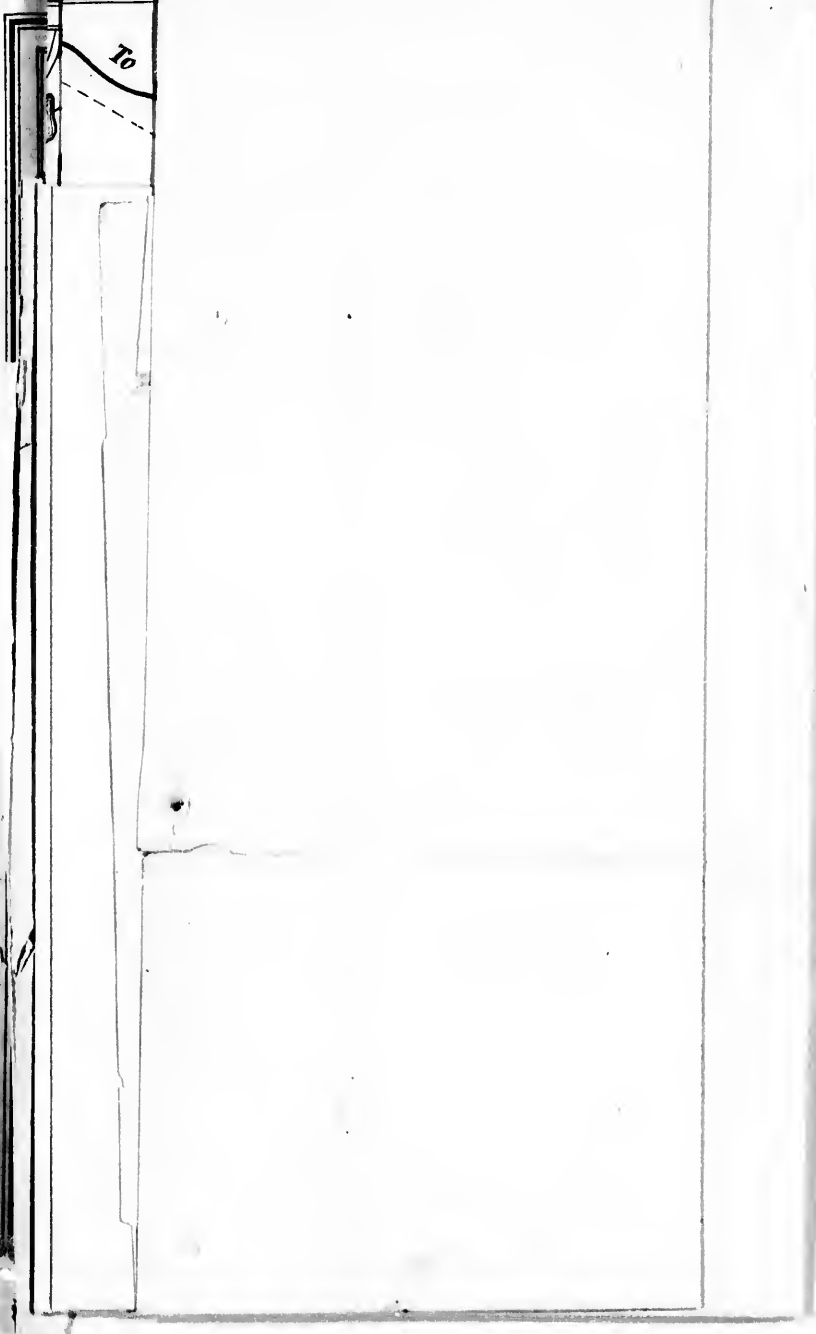
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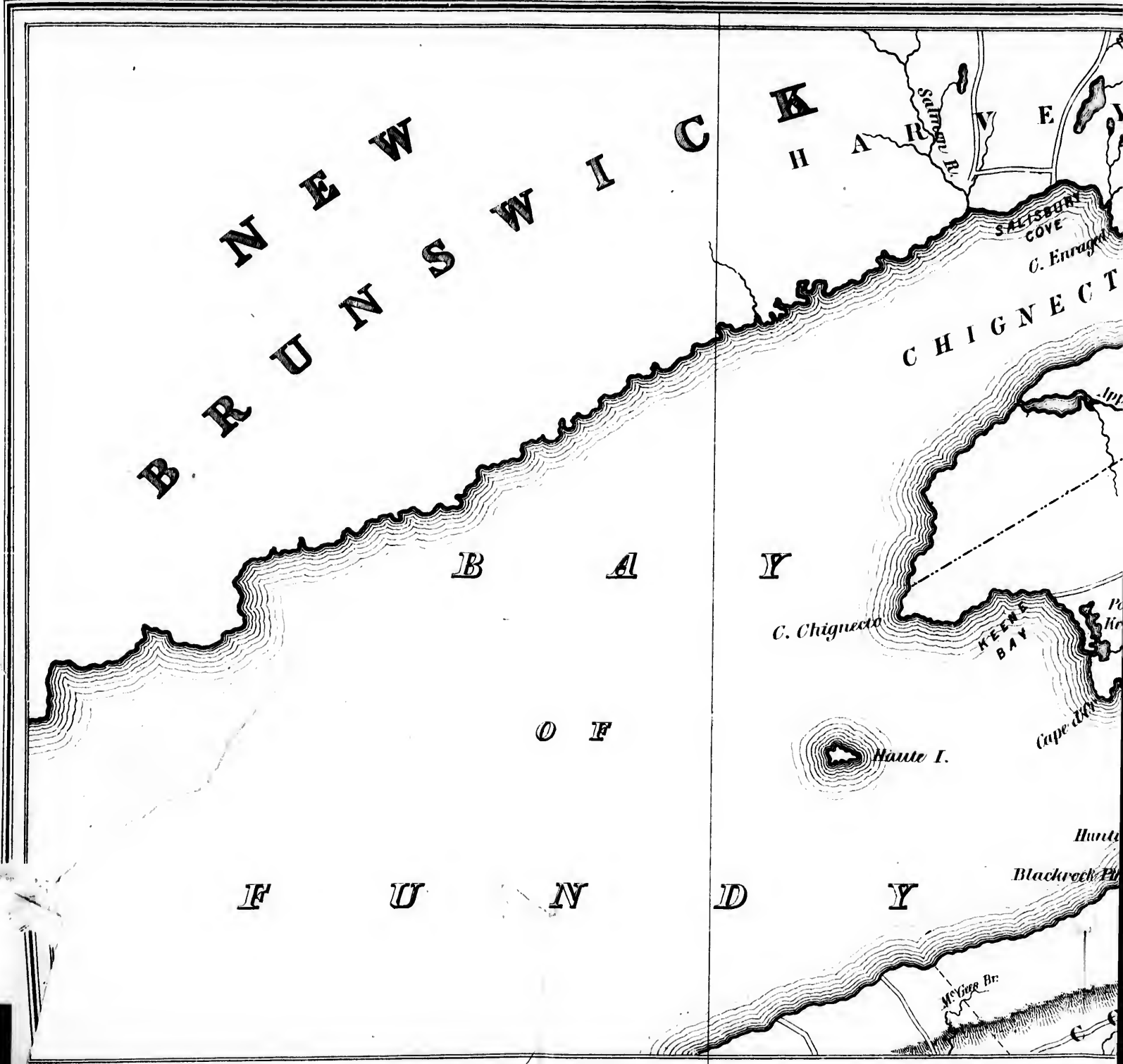
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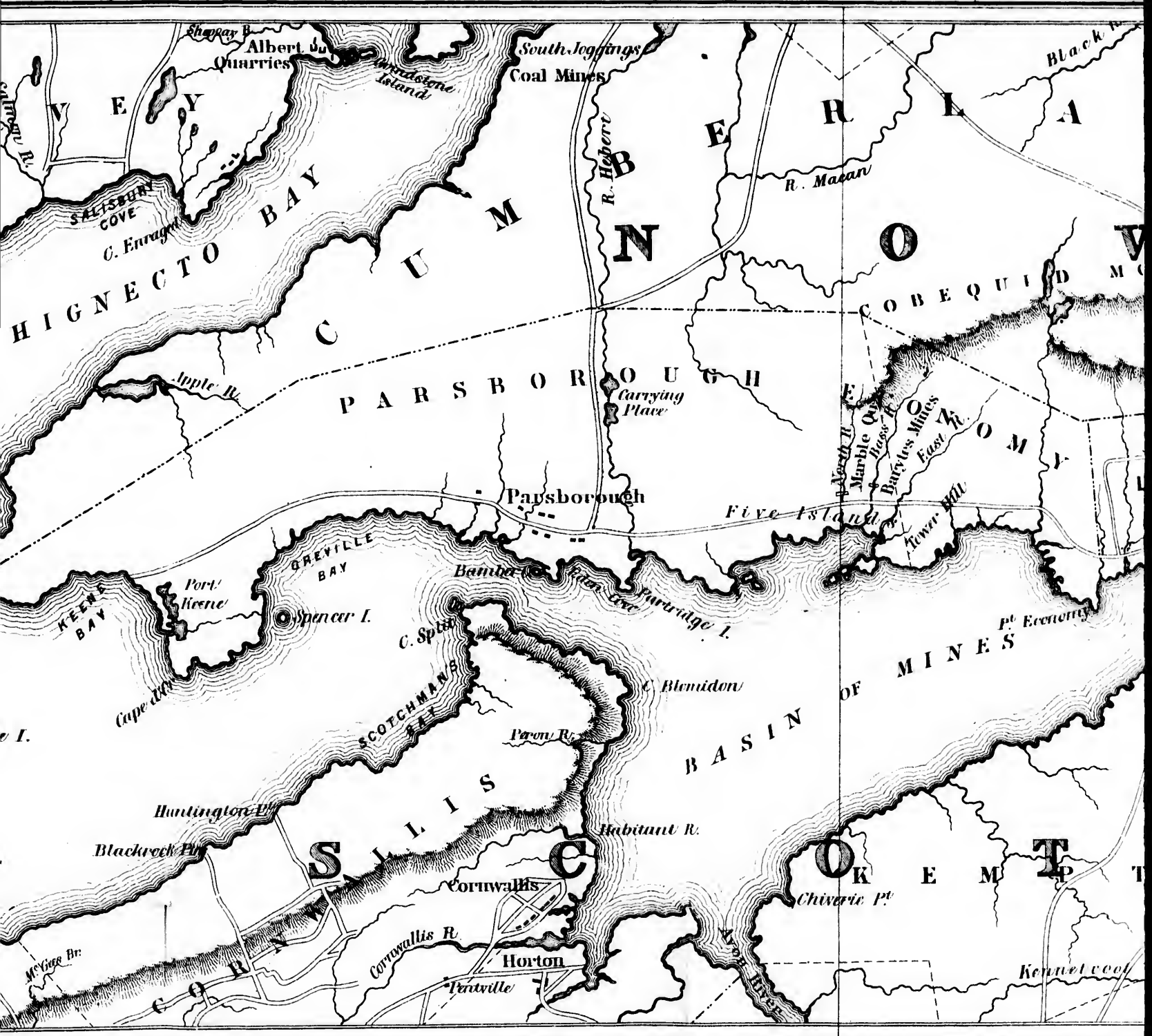
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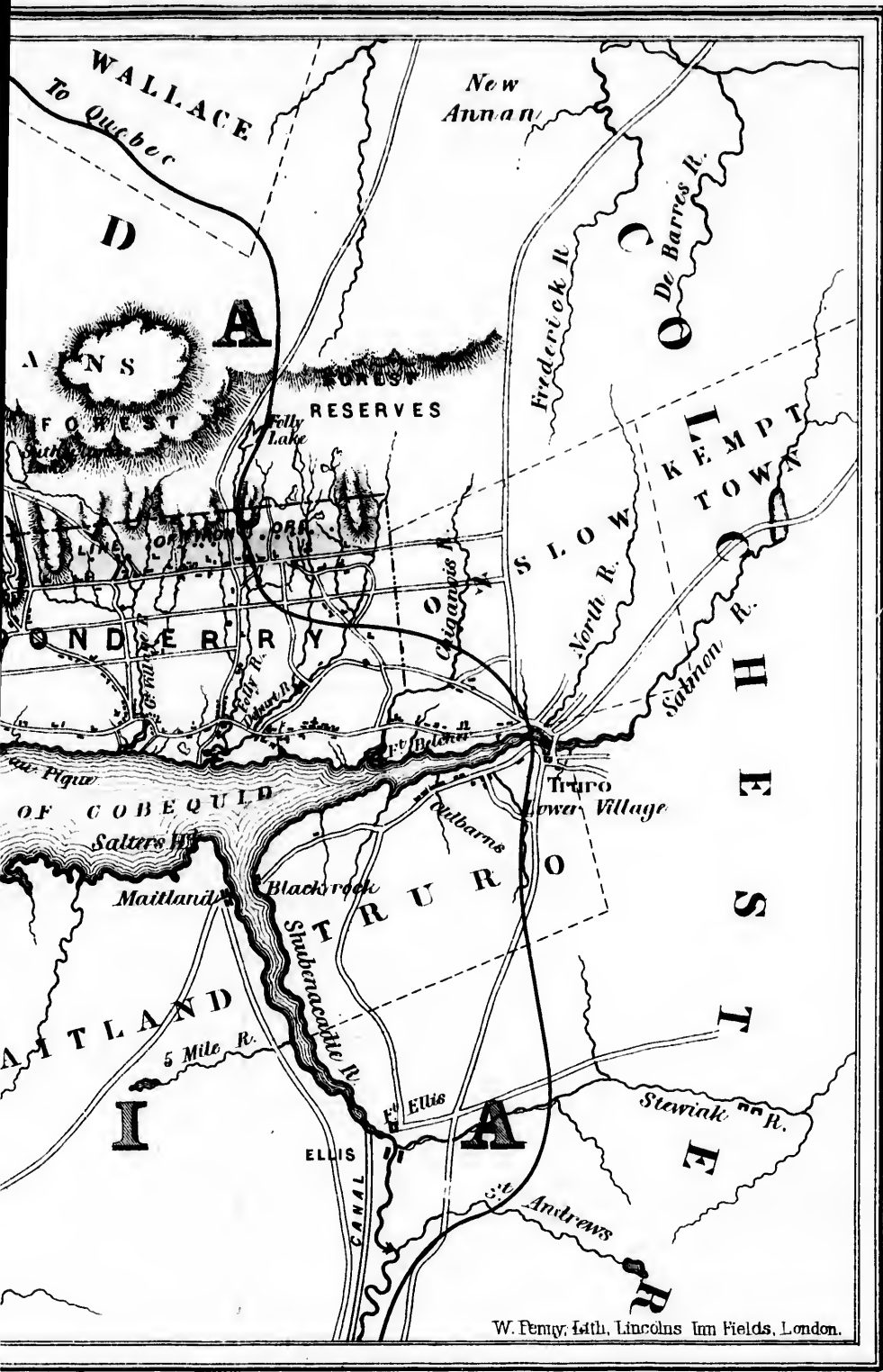
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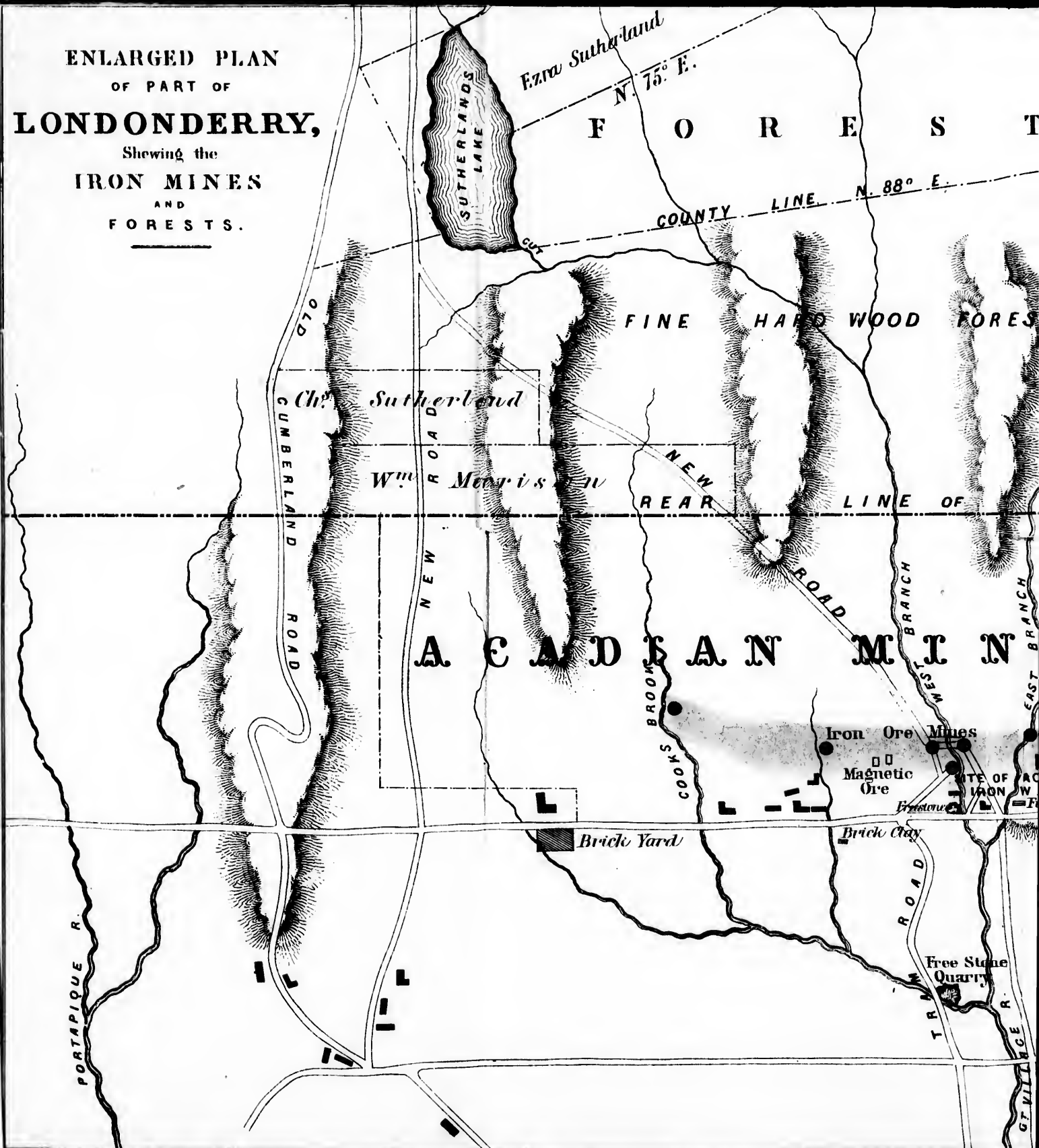
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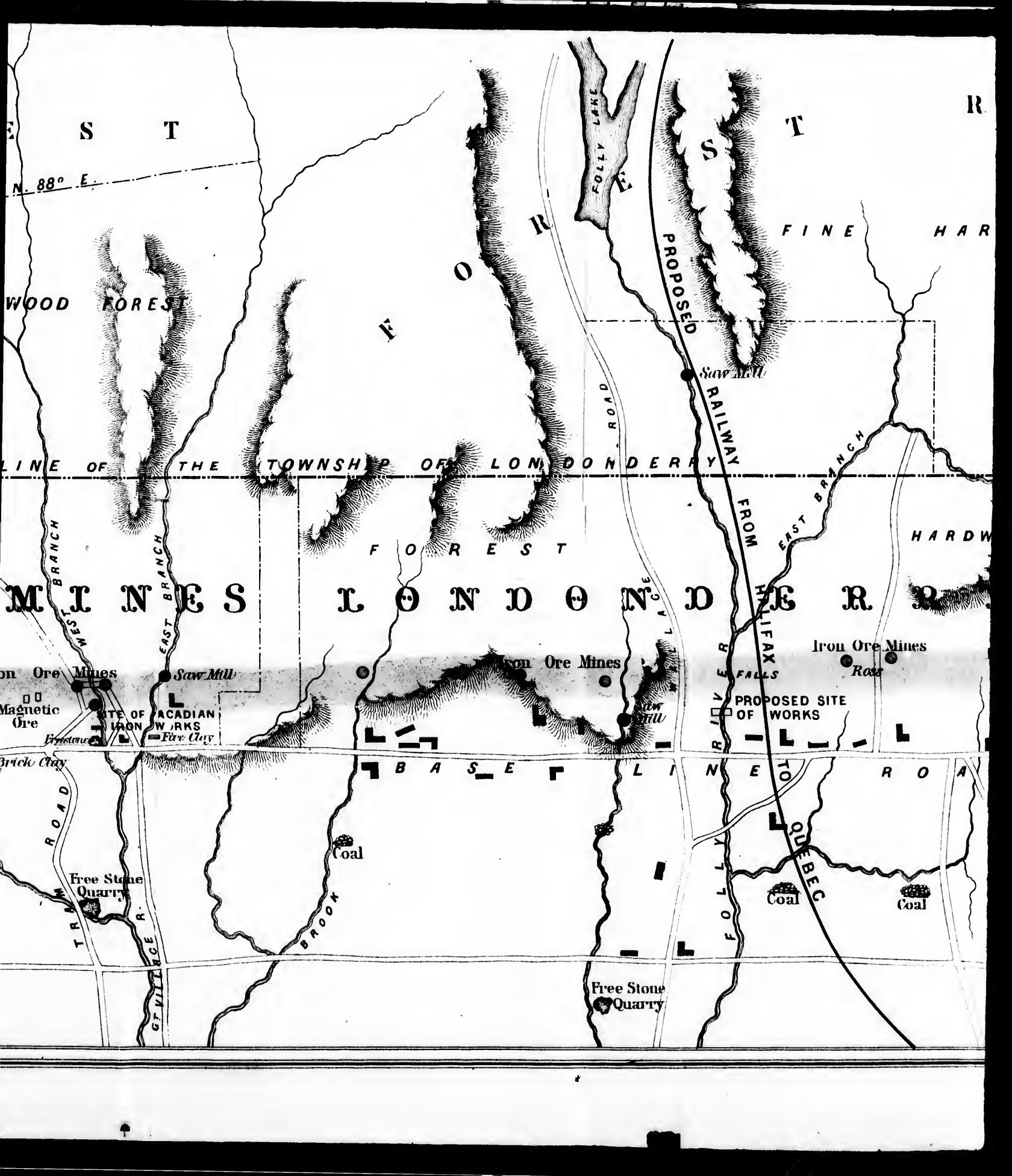


IRON MINES.



ENLARGED PLAN
OF PART OF
LONDONDERRY,
Showing the
IRON MINES
AND
FORESTS.





N. 88° E.

WOOD FOREST

LINE OF THE TOWNSHIP OF LONDONDERRY

M T N E S L O N D O N E R R

Iron Ore Mines
Magnetic Ore
Saw Mill
SITE OF IRON WORKS
Fire Clay

TRUNK ROAD
Free Stone Quarry
G. VILLAGE R.

Iron Ore Mines

B A S E L I N E

Coal

Free Stone Quarry

PROPOSED RAILWAY

FROM HALIFAX TO QUEBEC

Coal

Coal

Iron Ore Mines
Ross

PROPOSED SITE OF WORKS

Coal

Coal

QUEBEC

EAST BRANCH

ROAD

FOLLY LAKE

F O R E S T

F O R E S T

HARDWOOD FOREST

FINE HARDWOOD FOREST

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