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REPORTS AND TESTIMONIALS

RELATING TO THE

*Iron Mines of Nova Scotia.*

WITH

THE CHARTER

OF

“THE ACADIAN IRON AND STEEL COMPANY.”

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1855.



# IRON MINES OF NOVA SCOTIA.

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## ACADIAN IRON MINES.

THE province of Nova Scotia has long been famed for its valuable mineral deposits, and there is good reason to believe that the early French settlers carried on extensive mining operations. The nomenclature of the country, which has been handed down to our times, proves at least that they were aware of the existence of mines, which were unknown to the present inhabitants a few years since; and it is upon the shores of the "Basin des Mines," and on the slope of a range of hills, whose western extremity to seaward is still called Cape d'Or, that the remarkable deposits, known as the ACADIAN IRON MINES, occur.

The General Mining Association, under a royal charter granted to the late Duke of York, have been for upwards of twenty-five years engaged in working the extensive mines of coal which occupy a large area of Nova Scotia and Cape Breton. By virtue of this charter that association claims, for a term of years, all mines and minerals existing in or upon all the ungranted lands of the Crown, and upon all granted lands where the mines and minerals were reserved to the Crown in the original grants. It happens, however, that certain extensive districts were granted to the early settlers, without any reservation of mines or minerals, or with reservation only of the precious metals; and it is not a little remarkable that the most valuable deposits of iron ores, hitherto discovered, exist in localities to which the Duke's charter does not apply.

The township of LONDONDERRY, which is situate upon the northern shore of the Basin of Mines, is what is called a *free grant*, and 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 seven 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 shew 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.*—Of this Mr. Mushet says :—

“This ore consists of soft unctuous masses of micaceous oxyde 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 inju-

rious 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. The ore was subjected to several trials and experiments, in order to obtain from it the various kinds of manufactured iron and steel.

“A considerable quantity of the ore, in lumps, was deprived of its oxygen and moisture, by a gentle cementation in powdered charcoal. After the cementation had been completed, there remained of soft pure malleable iron, 68.29 per cent. of the weight of the ore operated upon, and the loss in oxygen and moisture during cementation amounted to 31.71 upon that weight.”

Mr. Dawson 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. In reference to this and the foregoing ores, Mr. Mushet says:—

“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 ores, of which there are several varieties. The kind designated by Mr. Mushet as red ore, A 1, he says:—

“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, of Pictou, the eminent geologist, 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

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100·

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

Peroxide of iron	-	-	-	-	84·4
Silica	-	-	-	-	8·
Moisture	-	-	-	-	7·6

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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. Mushet thus sums up the results of a series of experiments made by him with the specular and micaceous ores:—

“On reviewing the preceding nine experiments I may remark, that I have never before met with an ore of iron which has produced results of such even and uniform excellence, excepting only the Indian Wootz ore, and with this latter, the results obtained were no way superior to those now under consideration, from the specular iron or micaceous ore.

“The yields of iron obtained from the ore as raised from the mines, are from the foregoing experiments, as follows:—

Per centage of pure iron obtained from the ore	-	68·29
Ditto of refined metal	ditto	69·47
Ditto of white cast iron	ditto	70·76
Ditto of grey cast iron	ditto	71·87

so that so far as productiveness is concerned, the quality of this ore cannot be materially surpassed.

“The ore in cementation readily parts with its oxygen, and is completely metalized in the cementing furnace, when stratified with about one-sixth of its weight of wood charcoal, and the subsequent processes, in converting the cemented ore into bar iron and steel are all attended with a facility and certainty, which speak volumes to my mind in favour of the purity and excellence of this ore, as applied to iron and steel making in all their branches.

“I have no hesitation in affirming, that the smelting of these ores, which are said to be inexhaustible, and the manufacture from them of pig iron, bar iron, and especially steel, must prove, under even the most mediocre management, a lucrative undertaking; and one, indeed, as respects the manufacture of steel, of the greatest national importance.

Mr. Dawson mentions *specular ore with ankerite*.—“Mixtures of this kind occur in considerable quantity in some parts of the vein. The proportions are very variable, verging, on the one hand, to the pure peroxide of iron; and on the other, to ankerite, with disseminated scales of specular ore. One variety, very abundant, contains in 100 parts:—

Peroxide of iron	-	-	-	-	33·
Carbonate of iron	-	-	-	-	19·5
”    of lime	-	-	-	-	46·
”    of magnesia	-	-	-	-	·8
Silica	-	-	-	-	·4
					99·7

“This variety contains 31·4 per cent. of iron; and, though far inferior to the pure specular ore, would in connection with it be valuable.

“*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 red, brown, and black 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 supposed 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 20 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 :—

"A small excavation, less than half a mile from the river, has exposed a portion of the vein, shewing a width of two feet of specular ore, and about four feet of ankerite; and on the continuation of the vein, a little further eastward, a mass of specular iron, several yards in width, has been disclosed. Further eastward, and nearly on the highest part of the mountain, where the out crop of the vein is covered only by two feet of soil and gravel, larger excavations were made. One of these, a north and south trench, 17 yards in length, exposed a mass of ochery, red iron ore, with streaks of micaceous iron ore, and ankerite—and did not at either extremity reach the wall of the vein. Northward of the extremity of this trench, a space of 28 yards in width, not excavated, shewed a little quartzite projecting above the surface; and beyond this another excavation, nine yards in width, exposed large masses of red ankerite, with numerous disseminating plates of micaceous iron ore; and many fissures of from six inches to one foot in breadth, filled with red and micaceous specular iron ores. In three other excavations on this lot, one of them a considerable dis-

tance northward of that last mentioned, ankerite and iron ores, arranged as above described, and without any mixture of quartz rock, were disclosed.

“From the facts above stated, it is apparent, that the deposit at Londonderry Mountain is a vein of ankerite, including many, and often large masses and minor veins of red ochery, and micaceous specular iron ore; that in the hilly country, eastward of the Folly River, it attains a very great development, and is capable of affording large quantities of ores of iron. It is also evident, that the portions of the vein yet uncovered, are relatively very small, and probably give very inadequate ideas of the real magnitude of the deposit.

“The out cropping of the vein at those points where it attains its greatest magnitude, being at an elevation estimated at 300 feet above the level of the Folly River, and being traversed by several deep ravines, it could be drained and work, to a great depth, by open excavations or levels, driven in the course of the vein itself; and at many points, large quantities of ore may be obtained without extracting a larger quantity of the ankerite than would be required in its reduction.

“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 a 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.

“*Pictou, September 10th, 1846.*”

It is to be observed that since the foregoing reports of Dr. Gesner and Mr. Dawson were made, the deposits have been proved to extend several miles farther than was then ascertained. Mr. Dawson made a second survey, in company with Mr. Hayes, in September, 1849, and the following are extracts from his Report:—

“Since 1846 excavations have been made at a place about a mile eastward of the most eastern point noticed at that time. Here the vein seems to be largely developed, and 18 feet of its width, consisting of

red iron ore and red ankerite, have been exposed without reaching either wall. At the most eastern point of my former examination new openings have been made, shewing a great thickness of ankerite with veins of specular ore.

“Westward of the Folly River, large blocks of hematite, mixed with quartz, mark the continuation of the vein, and two small excavations have exposed red and specular ores. Between the east and west branches of the Great Village River the colour of the soil, and the presence of fragments of ore on the surface, indicate the continuation of the deposits.

“In tracing the vein further westward the colour of the soil indicates its continuity, and in Cook’s Brook, distant about a mile from the Great Village River, very large boulders of specular ore have been found.\* At this place a shaft sunk in the bed of the brook has penetrated to the depth of 40 feet through a mass of yellow ochre, with occasional irregular bands of ankerite. This is probably the south side of the vein, covered by an unusual thickness of decomposed ankerite and carbonate of iron, and by driving to the northward, it is likely the more compact and productive parts of the vein will be found. The whole appearance at this point impresses me with the belief that it will be found to be one of the richest and least disturbed parts of the deposit. Still farther westward, in Martin Brook a narrow vein of specular ore has been found in the course of the vein.

“This deposit has now been traced continuously for about seven miles, and there is good evidence that these are not its extreme limits. In that distance it presents several points at which it can be conveniently and cheaply worked, and its whole produce may, if necessary, be concentrated at any one point on its line or bearing.

“On the whole, the facts obtained in the present year fully confirm the opinion expressed in my Report of 1846, that the deposit is a true vein, very irregular in its dimensions and in the development of its valuable contents, but capable of affording very large supplies of very pure and valuable ores of iron, and there can be no doubt that the more recently explored localities near the Great Village River are equally valuable with the parts of the deposit previously known, and superior to any of them in facilities for extracting the ores.

“J. W. DAWSON.

“P. S.—Additional facts relating to the specimens procured on the above examination.

\* Since Mr. Dawson’s visit several veins of specular and compact magnetic ore have been traced from the River across Cook’s Brook, and farther to the westward.

“My specimen of the *Yellow Ochre* from Cook’s Brook has the following composition:

Peroxide of iron	-	-	-	-	74.52
Alumina	-	-	-	-	4.48
Carbonate of lime and magnesia	-	-	-	-	4.0
Silica and Sillicates	-	-	-	-	6.20
Water, mostly combined, and loss	-	-	-	-	14.50

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100.000

“This substance is therefore of considerable value as an ore of iron, its *per centage* of pure metal being 47.6. It is also an excellent yellow pigment, and when calcined affords a fine red. Its fine state of division and freedom from mechanical impurities admirably fit it for use as a pigment.

“Some specimens of ankerite from Great Village River, contain an intimate mixture of chrySTALLINE *spathose iron ore*, of a yellowish colour. This mineral contains, according to a hasty trial which I have made 73.2 per cent of carbonate of iron, with carbonate of lime and magnesia. This I consider a fact of some importance, as this mixture of the spathose iron and ankerite is much more valuable than the pure ankerite.

“The specular ore from the Acadian Mines and Cook’s Brook is equally pure with that of the Folly Mountain. The red ore varies in quality. Since leaving the ground I have received fine specimens of magnetic and specular ores of iron, which have been found in large quantities to the west of the Great Village River.”

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(Extract from the Report of WILLIAM CAIRNS, Esq., of Glasgow, who visited these mines in 1848.)

“The *iron ores* are very abundant—the extent of the vein not yet ascertained, but enough has been exposed to shew that the deposit, as regards mining operations, is inexhaustible; can be worked with great facility and economy, and the quality of the ores suits them for the manufacture of iron of every description.

“*Flux* can be had plentifully with the ores.

“*Fuel*.—There can be no scarcity of timber in this vicinity for a long period of years. The description of wood is suited to the smelting of Iron as well as to the manufacture of charcoal for iron purposes. Coal develops itself in various places, and from specimens obtained, it promises to be of fair quality.

“*Fire Clay* can be procured in large quantities with comparatively

little labour. A quantity which I saw dug out, appeared to be of a superior quality, and well adapted to the manufacture of fire-bricks and steel melting pots.

“Material for *red brick* is plentiful on the ground.

“*Water power* for general operations, is to be had in various localities near the ore.

“*Labour*.—That class of workmen more immediately connected with the production of iron would have to be imported from England, but nearly the whole of the outside labour, such as raising the ore, preparing the fuel, conveying to the work, and thence to the place of shipment, together with a certain portion of the inside labour, could readily be supplied by the country, and at a rate of wages not exceeding that usually paid in England for the same description of work.

“The iron produced ought to be equal in quality to Swedish iron, and there is nothing to prevent its being made at the cost price of English iron. In conclusion I may state, that from what I have seen of the Londonderry Mines, I am persuaded that to any company commencing operations in a proper way, they cannot fail of proving a source of immense wealth, as there appears to be nothing wanting to carry on successfully the iron trade in all its branches.”

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 exceedingly 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 there, which was wanted at Anapolis. 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, & 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 in a letter addressed to Mr. Archibald, under date of 8th February, 1850:—

“ 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. I have now little hesitation in prophesying your complete success; and I trust you will reap a rich reward for all your labour, and your indomitable perseverance, in bringing this valuable mineral deposit into its present promising *status*.”

Again in the following year 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, fuses and works 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 any where 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.”

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(Extract from the Report of Dr. Percival of Connecticut, U. S.)

“ From the examination I have made, there appears to me satisfactory evidence of a very great supply of ore, not only at the present place of working, but also at Cook's brook. Besides the better qualities of the ore, suitable for the Catalan works, there is a very great quantity of ore blended with the ankerite and with the rock, which might be worked to great advantage in a blast furnace. I have observed in the heaps of rubbish thrown out, that the rock, including the masses or nodules of ore which might be so employed, is quite subject

to decomposition, so that by exposing it awhile to the weather, the process of detaching the ore might be facilitated. The yellow ochre, aside from its value as a paint, might be very usefully employed in a blast furnace. Such ochres, or ochrey earths, have been much employed in the Stafford (Conn.) furnaces, which have been otherwise supplied with bog ores, and are said to yield more and better iron than the latter. The more ferruginous varieties, at least, of the ankerite (those verging towards the spathic ore) might also be employed in the blast furnace. The ankerite, besides its value as a flux, might be used, I believe, with advantage as an hydraulic lime, either alone or with a due proportion of prepared clay, so that a very large portion of the entire contents of the mineral or 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. Although my opportunities of examination were limited, and did not extend to nearly the entire length of the whole range, yet from what I did observe, 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.

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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, horse nails, gun-barrels, and so forth, it is highly prized; whilst the steel has been acknowledged to compare favorably 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.”

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 manufacture, have not been overstated.

The able reports of J. L. Hayes Esq., the eminent American Mineralogist and Iron master, of Mr. Carswell the experienced Manager of the Acadian Iron Works, and other practical men having already been published, it is considered unnecessary to introduce them here. Such of them as were made anterior to the erection of the Works contained predictions which have been more than verified by the actual results of operations.

A number of letters and testimonials having a common applicability to the produce, as well of the Acadian as the Victoria or Nictau Mines, will follow the reports upon the latter Mines.



## ESTIMATE of the cost of making PIG IRON at Londonderry, Nova Scotia.

The data furnished by Mr. Cairns and others, shew that the cost of making pig iron at Londonderry may be estimated as follows:—

	£	s.	d.
2 Tons of ore at 5s. per ton, . . . . .	0	10	0
Limestone and flux, . . . . .	0	2	0
2½ Tons of Wood fuel at 5s. . . . .	0	12	6
Blast and Labour, . . . . .	0	14	8
Conveyance to shipping port, . . . . .	0	4	0
Interest on Capital for 10,000 tons annual yield, . . . . .	0	5	0
Incidentals, . . . . .	0	2	10
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Cost of Pig Iron per ton, free on board	£2	10	0
Freight, Commission and Insurance, to England	}	0	15
or to New York, 15s. per ton			
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Pig Iron, per ton, delivered in England at	£3	5	0

In practice the iron has cost from 2 to 3 dollars per ton more, but with the improved arrangements contemplated, it is believed that the above will be very near the mark.

### VICTORIA (Or NICTAU) IRON MINES.

These mines are situate in the Townships of ANNAPOLIS and Wilmot, in the County of Annapolis, on the south side of the Bay of Fundy, and nearly opposite the city of St. John, New Brunswick; and are embraced in an area of country six miles in length by from two to four miles in breadth. The mineral field is intersected by the Nictau river and the Little river, which afford the best water privileges in the Province; and the whole rear country is covered with a fine growth of hardwood. The principal deposits are within eight miles of ship navigation on the Bay of Fundy, and within three miles of navigable waters of the Annapolis river; and the western Railway, when completed, will traverse the mineral district throughout its whole length.

(Extract from Mr. HAYES Report.)

“The Nictau iron ores are situated in the townships of Annapolis and Wilmot, on the northerly side of the South Mountains, and near the Nictau River, by which they are intersected.

“A remarkable aspect is given to these ores, from their containing immense numbers of shells of the silurian mollusca, the forms of the shells being exhibited with remarkable precision and beauty. Portions of the calcareous matter of the shells have been preserved. Nature has thus provided a flux for the iron, and mixed it more perfectly and intimately with the ferruginous matter than could be done by the most careful artificial process.

“Fortunately, the excellent qualities of this ore, and the facility with which it is worked in the blast furnace, have been practically demonstrated. Bar iron was made from this ore in a small Catalan forge some fifty years since. Although I was unable to find any of the iron, I was able to obtain some information with respect to its quality from an aged, though very intelligent man, who worked in the forge. According to his account, the iron was tough and easily worked. It could be easily worked while hot; and when cold, and placed in a vice, it could be bent backwards and forwards many times without breaking.

“Several hundred tons of this ore were smelted in the blast furnace which was formerly in operation upon Moose River, below the town

of Annapolis. Although a most abundant supply of ore existed in the vicinity of this furnace, it was found advantageous to transport the Nictau ore a distance of forty miles, as it was smelted with so much more facility than any other which could be found.

There are very few localities where the question of an inexhaustible supply of ore can be absolutely determined without expensive explorations, or until the mines are actually wrought, and all the expenditures of constructing establishments for working the ores are incurred. But this important question is here placed beyond doubt, and the quantity may be considered perfectly inexhaustible.

The out-crop of the ore between Abel and Joseph Wheelock's, is on a hill elevated over three hundred feet, by estimation above the valleys in which the Nictau and Little Rivers flow. If the beds are mined at these points drainage can be effected without expense. A deep valley lies east of Wheelock's, from which an adit could be opened to the ore-bed. The water power of the Nictau, and Little River, could be made available for clearing the water from the mine by pumps.

"The expense of mining and delivering the ore at Nictau Falls, or any point as near, would not, I think, exceed one dollar per ton.

"In case it should be desirable to vary the bed of fusion, either to facilitate the working of the ores, or to change the quality of the iron, large supplies of other varieties of ore may be obtained in the vicinity. Very extensive deposits of Bog iron, abound within a distance of three miles. There are also very extensive deposits of magnetic ores of extraordinary purity and richness.

"The combustible for smelting the Nictau Ore will be charcoal and wood. North of the ore-bed the wood has been, to a considerable extent, cut away; but towards the south the hills are covered with a noble forest of hard wood, consisting of birches, maple and beech. Fortunately the settlements have extended but a little distance south of the ore-bed. A vast supply of wood can be furnished by the Nictau River which flows for a distance of over twenty miles through an unbroken forest. The wood can be cut upon the banks of the river and floated or "run" in the stream, which, during several months in the year, furnishes sufficient water for that purpose. Considerable supplies of wood are now obtained in that way. The lands in the vicinity of the river belong to the Crown, and may be secured at a moderate price if they should not be granted for the use of the mines, which there is reason to hope may be done.

"As in other parts of Nova Scotia, the prices of labour at this locality are comparatively moderate. The rich lands and large agricultural population on the Annapolis River and in the immediate vicinity, will furnish supplies and labour at moderate rates. Who:

ever erects works at this place will be saved the enormous expenses which invariably attend the construction of works in a new country. A consideration which those only can fully appreciate who have had experience in undertakings of the latter class.

“Having been personally engaged in the manufacture of charcoal iron, and having visited nearly all the charcoal iron establishments east of the Alleghany Mountains, I know no locality in the United States which presents advantages for the manufacture of charcoal iron equal to those of Nictau.

“There is one point in relation to the manufacture of iron in Nova Scotia, upon which I must speak with less confidence,—that is the most advantageous market for the iron. The American duty on foreign iron is of course an objection to the sale in the United States. The duty on Nova Scotia iron may be removed by the adoption of the proposed system of reciprocity.

But as England produces almost no charcoal iron, and there are so many purposes for which this iron is superior to that made with coke,—such as for the first qualities of iron wire for suspension-bridges, for the driving-wheels of locomotive-engines, for tin-plate, gun-barrels and iron ordnance,\*—it seems to me that the mother country must present the best market for Nova Scotia Iron. This question can be readily determined by those who have better means of information than I have.

JOHN L. HAYES.

P. S. Since writing the above, I have conversed, in relation to the Nictau Ore, with Mr. Alger, at present the largest iron founder in New England. Mr. Alger erected the furnace at Moose River, in which large quantities of the Nictau Ore were smelted. He had thoroughly examined the ore bed at Nictau, and believes that the supply of ore is inexhaustible. He informed me that he had caused the pig made from the Nictau ore, to be refined, and that the iron was of a superior quality. He confirmed the statements which I have made that the Nictau ore was worked in the furnace with more facility

\* The following statements illustrating the superiority of charcoal iron for the purposes above mentioned may not be uninteresting. It appears by statistics reported in an article in the “ANNALS DES MINES,” vol. iv., 4th Series, that while Great Britain exports for consumption on the Continent large quantities of iron wire of the common sorts, the first qualities, selling at much higher prices, are furnished by the French charcoal forges. A commission appointed by the Sardinian Government in 1842 to report upon the fabrication of iron wire, particularly with reference to the construction of suspension bridges, state that the first qualities of iron wire made in France, Germany, or Sardinia, are manufactured from charcoal pig-iron.

All the gun-barrels constructed at the armories of the United States are made of charcoal iron. The Salisbury charcoal pig is sold for making bar-iron for gun-barrels and wheels for locomotive engines, at from 35 to 40 dollars a ton in the casting house. The Greenwood charcoal iron is sold for casting cannon at the West Point Foundry for 35 dollars a ton, while Scotch foundry iron brings only from 20 to 23 dollars.

than any other ore which could be found. To repeat his remark, "No ore could work more beautifully." I have also conversed with Dr. Charles T. Jackson, who stands at the head of the American practical geologists, and who has had most extensive experience. He has thoroughly examined the Nictau Ore, and he fully agrees with me as to the immense supply of excellent ore, and the great advantages of the locality for making iron.

J. L. H.

Mr. Hayes estimates the expense of making pig iron at Nictau at thirteen dollars per ton.

Mr. Hayes' estimate is considered by competent authorities to be too high. Mr. Mushet says:—

"The expenses of smelting this ore are very much over-rated, and the probable make of iron is even more under-rated. Of a very large variety of iron ores, from various parts of the United States, which have passed under my examination during my father's latter years of investigation, I can only refer to one class or set that were not decidedly refractory though generally rich. The set I except, I have since learned, were from the upper part of the Mississippi, far enough out of the way for a hundred years to come. Mr. Hayes, judging from the nature of the ore in the United States, has fallen into an error in estimating what your ores will require.

"I think the remark which Mr. Hayes makes upon the flux contained in the shell ore, is a very just one, for, in fact, it is *chemically* combined, and in all other instances with which I am acquainted, the flux has to be *mechanically* combined. More than this, the basic matters counteract each other, and none of them, therefore, are set free to contaminate the iron."

Again he says—"The shell ore is quite a novelty, and the magnetic character of some of the pieces contrast strongly with the inert state of others to all appearance of similar conformation. It contains protoxide, and though it is mixed with earthy matter and probably phosphate of *lime* (a great toughener of iron,) I reckon it will yield seventy per cent. of iron nearly."

Afterwards he says—"I have examined the shell ore, and find that it is curiously composed of *magnetic* and *non-magnetic* laminæ. The assay of the former gives 67½ per cent. of iron, and the latter 54 per cent.; but as the proportion of the *magnetic* part to that which is *inert* is more than a ratio of equality, the per-centage of the bulk will be higher than the mean of the above yield, I think about 62 per cent. For iron-making this ore is unrivalled."

Again—"The shell-ore, no doubt, will produce steel of excellent quality, but for bar-iron and all descriptions of wrought-iron, it possesses a pre-eminence in quality. It should be smelted in the blast-furnace, without any calcination previously, and without the addition of any flux except a small quantity of pure limestone, about five per cent. of the weight of the ore, introduced."

"The bog-ore is nearly as reducible as the shell-ore; it affords 47½ per cent. of iron, but requires a larger addition of lime to revive the metal in the shape of grey iron. This is a very great yield for a bog-ore. I hardly know where to place a limit to the quantity of iron which a well-appointed blast-furnace would turn out weekly, if burdened with either of these ores, or with them jointly; 300 tons of pig-iron per week would not in any way surprise me: this bog-ore will yield good charcoal iron. It is not the same in character as the bog-ore of Ireland or Holland, which latter is very rich, but much impregnated with sulphur. I should class it as a hydrated oxide of iron, of the variety called 'pitchy hydrate,' a mineral not met with hitherto in more than one or two localities."

"Of the other ores from this District, four varieties are exceedingly rich, and eminently suited for steel."

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(DR. PERCIVAL'S Report on the Victoria Mines, Township of Annapolis and Wilmot, Nova Scotia.)

"THERE is here a range of iron ore extending four to five miles, in which, though the ore has not been traced throughout the whole extent, yet there is good reason to conclude, from the uniform direction of the different localities on the same line, and the great extent to which, in some parts, it may be traced continuously, that it is continued through the whole extent. The ore, wherever it is observed, forms a bed, included in a conformable position in the rocks (slate); and from this circumstance I should suppose it less liable to interruption than if a vein. This ore (peroxide of iron) is characterised by the great quantity of silurian shells which it contains, and of which it is sometimes almost entirely composed; and forms, as just observed, a regular bed, included between the *strata* of slate of that formation. Commencing on the east at Little River, it shews there one large bed in the bank of the stream, and two distinct smaller beds in the stream itself, south of that in the bank. The ore is here softer, and of a lighter red than farther west, and is included in a soft, light, red slate. At A. Wheelock's and R. Banks's, two or three miles farther west, are two openings in apparently the same bed, each about six feet wide. The

ore is there of a darker red, and less soft, than before, and is included in a harder greenish slate. About a mile farther west, the bed may be traced a considerable distance on the surface, of about the same width, through a wood; and still farther west is an old working, in two parallel beds, in the same range, together, of at least equal width, as before-mentioned. The ore and rock in these latter localities are similar to the same at Wheelock's and Banks's. On the north side of the ridge, next south, satisfactory indications are observed of a similar bed of shell ore, probably of nearly equal width, but here a much harder, nearly black, magnetic ore, and, in part, with only indistinct traces of shells, though in other parts the shells are very distinct. This is connected with a hard dark-brown clay slate or argillite. In the fields north of A. Wheelock's, fragments are frequently found of a harder darker red ore, than that in the principal bed first noticed, in which few or no traces of shells are observed; but still, like the ore of the principal bed, a peroxide. The frequency of the fragments, and the different quality of the ore, seem to indicate another parallel bed, north of the principal one.\*

"I have already observed that the ores of Nictau form conformable beds in the slate or beds of deposit, which is also indicated by the shells, which enter into their composition; but they have been thrown up from their original horizontal to a nearly, or quite, vertical position, probably by the action of the hornblende rocks which have altered them. It is thus necessary to work them in the manner of a vein; but the situation of the western and more important part of the principal bed on high ground, falling off abruptly on the west at the Nictau, enables you to drive a level at a very considerable depth (almost 300 feet!), by which it may be worked and drained to much advantage. The northern bed of red ore would possess a similar advantage. The bed of magnetic ore, where observed, is on a lower level, but, in its continuation farther east, passes through ground much more elevated. I may here give a conjecture as to the original formation of such beds of shell ore. They may have been formed in the bottom of a marsh or lagoon, favourable to the breeding of shells, and into which there was also conveyed a deposit of ferruginous matter, in a manner similar to the formation of deposits of bog-ore in our present marshes. There might have been successive periods of such lacustrine formation, separated by intervals, in which a different state of things existed, and thus the different beds might have been formed. The conversion of the shells into iron is similar to their conversion into silicious matter, so common, but something of the original calcareous matter remains, at least in the less altered ore of the principal bed,

\* This has since been discovered.

and will serve as a flux to facilitate its reduction. It is satisfactorily ascertained that the principal bed may be traced from Little River nearly or quite to the Nictau (five miles), with an average width of six to eight feet. The amount of ore in this extent, even when worked to a very moderate depth, is practically inexhaustible. Besides this, there is undoubtedly a parallel bed at the locality of magnetic ore, and of nearly equal width. The fragments of harder red ore, found north of the principal bed, indicate a distinct bed in that direction. It is thus, I think, evident that the supply of ore at Victoria must be very great, and, I may add, for a long period very easily accessible. The quality of the ores has been sufficiently tested. My opinion of the value of this property is thus similar to that of the value of the Acadian deposits. Among the observations which I made in the vicinity, the following may be useful:—The hornblende range, on the summit of the south ridge, is bordered by a band of white quartz rock, which may be valuable as a firestone. A similar bed of grey quartz rock occurs, interposed in the north hornblende range at the Little Falls, which may answer a similar purpose. Near it is a bed of light grey altered clay slate, which, if pulverized, may answer the purposes of a fire clay. These may perhaps supply you with the necessary refractory materials for your iron works.”

(Signed)

J. G. PERCIVAL,  
*New Haven, Conn.*

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(Report of Mr. BLANCHARD, of New Jersey, United States.)

“ Agreeably to your request, I have visited your mineral property in the county of Annapolis, and spent several days in exploring the Victoria Mines. Commencing at the Nictau River, I ascended the hill on the east side of the river to the height of several hundred feet, and there found the vein exposed at the place which was worked many years ago. There appear to be two parallel veins at this place, each about six feet wide, and I discovered evidences of the existence of several others. I confined my first explorations to the principal vein which has been uncovered at various places up to the Little River, an extent of five miles or thereabouts. At this latter place the vein is exposed in the bank to the depth of forty feet, and the facilities for mining are very great; indeed I have never seen any locality where ore was so abundant or so easily procured. For many years the expense of mining will not exceed half a dollar per ton.

“ I was much struck with the great variety of ores in this district :



besides the *shell-ore*, which exists in enormous quantity, there are several kinds of magnetic ores of great purity, and which have been proved to yield steel of excellent quality. With respect to fuel, an abundant supply can be obtained at a very cheap rate from the surrounding forests. In the immediate neighbourhood the whole country is covered with splendid forests of hard-wood, and from my experience at these mines, I could undertake to furnish any quantity of *charcoal* at a rate not exceeding four dollars per 100 bushels. Building-stone, lime, brick-clay, and timber, are to be found in great plenty close at hand. Labouring men, oxen, and horses, are abundant and cheap, and the facilities for transport are very great.

“The Nictau, or Victoria River affords the finest water privileges in the province. At one place, near the great vein of ore, I observed an excellent situation for blast-furnaces, and at another place there is every requisite for rolling mills, forges, nail factories, and every branch of iron and steel manufacture. Altogether, I feel bound to say, that I have never seen a locality combining so many and so great advantages and facilities for a great iron establishment. In estimating the value of such a property as you possess at Victoria, it should be borne in mind that it is *charcoal-iron*, made from exceedingly pure ores, that you will produce. And I believe such iron can be produced here to almost any extent, at fifty per cent. cheaper than any other country I am acquainted with.

“I believe that capital judiciously invested here will yield extraordinary returns, and in estimating the value of a property of such great capabilities, I cannot begin to think of a less sum than one million of dollars.

Dr. G. G. PALMER, who has been for many years the managing partner of extensive Iron works in the United States, writes as follows :—

It gives me pleasure to hear that you have succeeded so well at Londonderry, and are making satisfactory progress at Nictau. From the examination I made of these places some few years since, in your company, 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 your own experiments have so fully proved its superiority.”

The following is of a later date :—

*Philadelphia*, Sept. 25th, 1854.

C. D. ARCHIBALD, Esq.,

Dear Sir,—In reply to your favor asking my opinion of the localities which you have secured in Nova Scotia and New Brunswick, for the manufacture of Iron, I may remark that when I visited the Nictau or Victoria Mines in 1850, I was forcibly impressed with the advantages this locality possessed in having all the elements for manufacturing Charcoal Iron at a very cheap rate.

These mines I found were in a beautiful country bordering on the Valley of the Annapolis River, and about fifteen miles above the head of navigation, and in the immediate vicinity of great water power, and large quantities of the finest timber for making Charcoal.

The only vein of ore then opened which I saw, was the fossiliferous or shell ore, which was over six feet in thickness, and could be seen at several distinct places, embracing altogether a distance of five miles; evidently lying in regular position between the stratified rocks.

I also saw specimens of a rich magnetic ore, from the same section of country, but did not see the vein.

I was, however, perfectly satisfied that there was an abundant supply of ore, of a very superior quality, and which could certainly be mined very cheaply.

I should say that even at the present high price of labour, &c., iron could be manufactured at this place and put on board vessels at the shipping port at \$14.00 per ton, including interest on Capital invested, and all other charges.

The cost of manufacturing iron at Londonderry, I should think would somewhat exceed that at Nictau, though not very materially.

If the Railroad which is now being constructed from Halifax to Annapolis was completed, or even 30 miles of the western end, it would afford you a ready and quick transit of your iron from Nictau, and with this avenue to the shipping port open, there would probably be a large business established in exporting the rich magnetic ore, which recent explorations have proven to be so abundant in that section of the country.

I have here given you my views in a general way, without entering into any minute calculations and figures to shew how I arrive at the conclusions, but I am very well satisfied of their correctness.

Very sincerely yours,

G. G. PALMER.

## GENERAL REPORTS AND EVIDENCES

RELATIVE TO THE ORES, IRON AND STEEL, PRODUCED FROM THE BEFORE-MENTIONED MINES.

With reference to the importance of an abundant supply of charcoal iron, Mr. Mushet thus expresses himself:—

“To no country in the world is a supply of superior charcoal iron of such vital importance as to Great Britain, and yet for this essential article she is, and ever has been, dependent upon Russia and Sweden, whence the materials are imported which produce the only kinds of steel which are fitted for supplying the various branches of manufacturing industry, with implements and tools, of that degree of excellence and finish, without which our manufactured products would in most instances degenerate into mediocrity, or even inferiority, as compared with the produce of other countries.

“Without first rate steel England would speedily lose her station of pre-eminence amongst the nations, for what art or science can flourish without this essential substance, and if our supply of Swedish and Russian charcoal iron were now cut off, England possesses not within herself the sources from which she could produce a quality of iron to fill up the void, and to furnish steel adapted to meet and satisfy the endless requirements of her operative and manufacturing population.

“If, instead of the enormous monopoly prices at present paid for a scanty supply of this indispensable foreign iron, an equally excellent quality of iron could be furnished at half the present cost, what an impetus would not at once be given to the manufacturing energies of Great Britain! Such iron would supercede the common iron at present in use for many purposes of machinery, for ordnance and fire-arms, for steam boilers, for building iron ships, for tin plate, wire iron, for anchors and cables, suspension-rods and chains for bridges, for tubular bridges, for axles of locomotives, for wheels and wheel tyres, and above all for railway bars, it being an indisputable fact that best charcoal iron rails will endure more traffic without wearing, crushing and laminating than from four to five sets of coke iron rails, so that the former would prove the more economical even at four times the price of the latter.

It is an object of the deepest importance to all principal railway companies to obtain hereafter the means of re-laying in a more permanent and substantial manner their lines of road exposed to a heavy

and increasing traffic. Charcoal iron alone can enable them to effect this most desirable improvement, and the province of Nova Scotia, the nearest of all our transatlantic territories, appear to possess in an eminent degree, all the materials, natural facilities and appliances, necessary to furnish a cheap and inexhaustible supply of this article, equal in quality to the finest varieties of foreign iron. The ores of NOVA SCOTIA form an entirely new class, and there alone are found in the midst of native forests, immense deposits of oxides of iron, existing in a state of absolute purity, instead of being associated, as is usually the case, with refractory and injurious admixtures of foreign substances. The rich but infusible ores of the United States will bear no comparison with the pure varieties of our highly favoured Colony of Nova Scotia, a country destined at no remote period to take a conspicuous lead amongst the iron manufacturing districts of the world."

From W. T. BRANDE, Esq. F. R. S., Master Moneyer of the Mint, and Professor in the Royal Institution :

*Royal Mint, 13th April, 1850.*

MY DEAR SIR,—I have had 12 dies made from the piece of steel you sent me—8 of which have been hardened and are now ready for trial—but when an opportunity of trying them may occur I cannot say, as the Mint is not at present at work, and there appears little probability of its being so for some time to come. As far as I can judge of the quality of the steel from the account of our die forger and die turner, and from the manner in which it has sustained the operations of die *sinking* and hardening, I should pronounce it *good*; but the real test of its merits is its conduct in the coining presses.

Yours faithfully,  
WM. THOS. BRANDE.

C. D. ARCHIBALD, Esq.

The reports subsequently made were highly favourable. The master of the dies reported that "the Acadian steel has performed its duty in the coining presses very satisfactorily." It is to be borne in mind that this and other steel supplied to the Royal Mint was made *direct from the ore*.

*Ardwick Iron Works, Manchester, Feb'y. 9th, 1850.*

C. D. ARCHIBALD Esq.

DEAR SIR,—On the 7th Feby. 1850, we cast 4 bars 5 feet long 1 inch square, from the Iron delivered by your order to me from Messrs.

Roberts, Fothergill & Co. On the 8th we put them into our testing machine 4 feet 6 inches betwixt supports, suspended weights from the middle, and found that one bar carried 649 lbs. Broke with 656 lbs.

Yours most respectfully,  
WALTER MABON

This proves the strength of the iron to exceed by far any 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 & 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.”

Messrs. Hutchinson, Wilkinson, Marshes & Shepherd, Newbould, Mechi, Butcher, Parker, Jackson, Stewart and Smith, and many other manufacturers at Sheffield and elsewhere, concur in giving to the Acadian Steel the highest character.

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. A first class Medal, in addition to several Exhibitors' medals, was awarded to Mr. Archibald on that occasion.

From Messrs. W. Hunt & Sons, Birmingham:—

“ We have converted the two round bars you sent us, and find the Steel equal to that made from the Swedish Marks.”

W. Jessop & Sons, Sheffield:—

“ We are satisfied that the iron of your make is decidedly better for the purposes of Steel than either Cooper's or the Adirondac. We have not been able to make any extensive experiments on the iron, but our first opinion is fully established that there is something valuable in the Iron.

Messrs. Turton & 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.

Mr. R. F. Mushet, the Manager of the Forest of Dean Steel Works writes :

*Coleford, 6th December, 1852.*

Assuming the rough Bars for smelting to be worth £ 14 per ton, then a fair price for other qualities would be,

Bars for common Blister Steel . . . . .	£16
Do. for Double Shear . . . . .	£18
Do. for best Blister Steel . . . . .	£20
Do. Extra finish and width as for Anvil faces, &c. &c.	£22

For Pig Iron £7 10s. per ton in Liverpool or London. I am speaking here of Bars made from Pig Iron. If made *sound* by the Catalan method they ought to range higher and the extra finished should rank with the highest Swedish Irons, say £30 per ton.

For many purposes, your Acadian Iron affords steel, which surpasses all other steel in excellence: but there are other purposes for which the Swedish is superior. Neither of them, at all equal steel made direct from the Acadian Ore, which unites in itself each and every excellence, which Cast Steel can possess. We are making as much steel as the work admits of our producing, about 4 tons weekly, in finished bars, and I send it off *hot*. We are in a fair way of monopolizing the Cast Steel trade of Europe; but I need scarcely add that the work must get bigger, before we could supply such a monopoly. I am quite certain, that were the West Dean Steel Co. and the Acadian Mining Co., pulling in the same boat, Sheffield would not sell a Bar of Steel on the Continent, in five years' time. England, and America, we have not tried. The following is an extract from a letter received on Saturday, from the Continent. "Our steel, tempered for mill-picks, does more work, without re-setting, than any two of Turtons, Sandersons, and others, of the best Sheffield makers, which have been brought forward, to test against those of our make. A certificate is in preparation, for these facts, proved before a large assemblage, day before yesterday; the dies for printing cylinders, have also as fully succeeded this day." The Sheffield Travellers dropped their prices in alarm, but in vain, for our Steel sells at an *advance* upon their highest price.

I wish you and Mr. Burgess could agree to make one concern, of West Dean and Acadia. We should gain the States just as we have gained the Continent, to say nothing of the home market. Back me with a work big enough, and Capital to keep it going, and I can whack all Sheffield for price and quality.

I am, Dear Sir,

Yours truly,

R. F. MUSHET.

To C. D. Archibald, Esq. F.R.S., London.

From the same : " If you refer to my letter you will see that I only named £18 per ton as a price which would suit *us*. I by no means meant that the bars are *actually worth* no more, for I consider them equal to Danemora at £35 per ton for cast steel; but you cannot get people to believe this at first and they will not give at once a high price."

*Coleford, 29th July, 1854.*

DEAR SIR.—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.

I am glad to hear that your prospects are so promising for the future in America; and I sincerely wish you all the success you could desire.

I am, dear sir, yours truly,

R. F. MUSHET.

C. D. Archibald, Esq., London.

*Paris, 31st January, 1855.*

TO C. D. ARCHIBALD ESQ.

DEAR SIR.—Though I have only had the honor of your acquaintance for a few hours I cannot refrain from adding my mite of Testimony to the high character of your Acadian ores, especially for steel purposes.

Since 1852 I have sold some hundred tons of Cast Steel made by Mr. R. Mushet, much of it made from Acadian ore.

Two qualities of steel marked by Mr. Mushet Nos. 1 & 2, have called forth the greatest encomiums, and these numbers were made from Acadian ore.

No doubt exists in my mind that your iron surpasses all the ordinary Swedish iron. If inferior to Danemora, I am unable to decide; but *this* I can prove, that the *Steel* made from it was found equal to the very best Sheffield steel made from Danemora iron.

I have one or two letters on the subject of the steel made by Mr. Mushet, and I select the following as referring particularly to the steel made from your ore, as they were written in 1852, when Mr. Mushet obtained his supplies from your mines. The first is from Mr.

Marcellis, the well known Iron founder of Liege, whose celebrated work, the roof of the Exchange of Antwerp, cast in his foundry, is a sufficient proof of the "*Industriel*" rank of the writer. He says:—  
 "We have employed your steel for cold chisels, Turner's tools, Screw Taps and planes. The tools are very durable, and replace with superiority the best steel we ever received from Sheffield.

Signed F. MARCELLIS."

The second Letter is from Francois Pauwels, whose name is well known as the largest railroad Carriage and Waggon builder, and a great contractor. The carriages on the Austrian lines, Russian line, the Swiss lines, and Rotterdam lines, are all built by him. He writes me, "We are really obliged to you for the introduction of the West Dean steel into our workshops. We find it sound, easily tempered, and making the best of Engineering tools. We congratulate you on the success of your new undertaking. The introduction of any thing but Sheffield steel into general use is no easy matter:—the steel must be good indeed to succeed—for the future, be assured your steel will be the only quality used in our workshops. FRANCOIS PAUWELS."

Molenbeck, St. Jean Leg. Bruxells, 9th June, 1852.

Now any of your friends may write to Mr. Marcellis, and Mr. Pauwels, and they will find that I have continued to supply them up to this day; they have had above 40 tons in the last year. One circumstance I ought to mention respecting Mr. Marcellis. He had the *No. 1* steel made from your ore. Since that period we sent another mark, your ore being all used, and Mr. Mushet could not obtain a fresh supply. Such was the prejudice of the workmen in favor of *No. 1* that we were positively obliged to take back some really good steel and send them other steel marked *No. 1* made as nearly as possible to resemble the *real No. 1*; but Mr. Mushet was obliged to make use of expensive Swedish iron to arrive at anything like the quality. I may mention a curious experiment made with a pistol barrel made with *No. 1* steel. The barrel was sent for proof to the Liege Proof House, and Mr. Championmont, the Proof House master, gave me a certificate of the extraordinary result of the proof. The barrel was of the ordinary thickness of a duelling pistol barrel. We desired Mr. Championmont to prove the barrel "*a l'outrance*," to extremity, if I may use the term. After continually charging and adding ball to ball, and powder to powder, we finished by half-filling the barrel with powder, and then ramming down 9 balls, which were so tightly rammed that when discharged they adhered one to the other. Mr. Championmont signed a certificate that after this proof the barrel was "intact" uninjured.



I have given you some notes on charcoal Iron, its great value to wire makers, &c. I, therefore, think it unnecessary to repeat them in this long letter, and have the honor to subscribe myself,

Dear Sir, yours faithfully,

JOHN BOX.

It is well worthy of note that several hundred Minie rifles and pistols manufactured from Acadian Steel in Belgium, are in use before Sebastopol.

Acadian Iron Mining Association, 5 Alderman's Walk, London. 15th February, 1855.

C. D. ARCHIEALD, Esq., London.

MY DEAR SIR,—In reply to your application for the particulars of the Acadian and Nictau Works and the lowest price that will be accepted for the same. I beg to say that the price of the two Works, Leases, Plant, &c. is Forty thousand pounds, sterling (£40,000) and the particulars, as far as I have the means of ascertaining, are as follows:

THE ACADIAN WORKS consist of a Blast Furnace 30 feet high and 10 feet diameter at the Boshes, and is capable of producing about 35 tons of Iron per week, Pipes and Heaters, Tools and Implements, Blowing Engine, Air receiver and other connections, Dam and Floom carrying water to the machinery, Water Wheel 16 ft. by 5 ft. 6 in. Large house for stocking Coal and Ore sheds connected therewith, and large house for storing Wood, &c. connected with coal house.

The forge consists of 5 Catalan Fires with Blowing Apparatus and pipes complete. Water Wheel for do. 14 ft. by 5 ft. Two Puddling Furnaces and Stacks. Two tilt hammers and one helve hammer, carriages, anvils and gearing. Water Wheel for same, 12 ft. by 7 ft., tools, &c. Large building for Forge with houses for coal and ore adjoining. There is also a train of Rolls with gearing, housings, &c. but it is not at present in a workable condition. House for Mill. Crushing Rolls for Ore and set of Stammers.

Kilns for making charcoal.

Cupola and pipes for Foundry, with tools and appliances. Smiths Hearths, Anvils, Bellows; Miners', Puddlers' and Bloomers' Tools, Blocks, Tackle, Chains, &c. Scotch Pig Iron and Bar Iron in Stock. A set of Boring rods, 40 pins with chisels and wrenches. Turning Lathe with appliances, Vertical Boring Machine. Double and single power Crabs, Stoves for thawing Water wheels, Carts, Barrows, Ploughs, and Implements. Weighbridge and weighing machine. There are 20,000 fire-bricks in Stock. There is a large residence for the manager and eight workmen's houses giving sufficient accommodation for the persons in the employ of the Association. Barns, Stores, Office, &c.

All the necessary roads and bridges are complete, and the works are now in active operation.

THE NICTAU WORKS consist of a Blast Furnace 30 feet high and 10 feet diameter at the boshes. It is capable of producing 40 to 50 tons of Iron per week, Heating Furnace, Pipes and connections, Cast House, &c., Blowing Engine, Water Wheel, Air Chests and Blast Tube. House for Engine, Tools,

Utensils, &c. Flood and Water Gates. Two Coal Houses and Ore House, Blacksmiths' Shop. Sandries, Blocks and Tackle, Bar Iron, Sheet Iron and Steel in Stock, Crab Winch. Carts, Harness, &c. 14,000 Fire-bricks, Fire-clay, Houses, Furniture in Manager's House.

There is a very powerful Rolling Mill by Thos. Perry & Sons of Bilston and a High Pressure Horizontal Engine, of 60 horse power, by Murdoch and Aitken of Glasgow, ready for shipment to the works; both Mill and Engine were made expressly for this Association; they are of the best materials and workmanship; and contain all the latest improvements in Mill Machinery.

The Furnace at the Nictau Works is ready for work and the Manager intends to Blow in, in about a fortnight or three weeks from the present time.

I remain, my dear Sir, yours very truly,

EDW. M. SWEETLAND.

The accompanying Act of Incorporation of THE ACADIAN IRON and STEEL COMPANY evinces such a liberal spirit on the part of the Legislature and Government of the Province, as cannot fail to facilitate this important enterprise; and it is hoped that the preceding reports and statements will suffice to convince the people of Nova Scotia that a company which has for object the developement of these great mineral resources is every way deserving of encouragement and support.

There is no mineral so abundant and so widely distributed on the face of the globe as the *ore of iron*; and yet there is nothing in nature so rare as those richer varieties which contain what the French call the *propension acieuse* or steely propensity, without which the higher qualities of *steel* cannot be produced. Many of the ores in the district above described may indeed be called *ores of steel*: for they may at once be fused and converted into *cast steel*, and that too of the very best quality. A very eminent authority, the late Mr. Phillips, speaking of these ores says: "they may be regarded as so much *bullion* and only require to be properly treated to be converted into a precious, if not a noble metal."

The *iron* made from these rich ores by means of Charcoal fuel may be regarded as an entirely different metal from that manufactured from the secondary ores of Great Britain, reduced with impure mineral coal. *Charcoal iron*, which is indispensable for steel, is also largely used for the more delicate parts of machinery, for fire arms and implements of war, for wire, tin-plate, axles and wheel tyres of locomotives, suspension rods and chains for bridges; and nothing but its *cost* and *scarcity* prevent its

being extensively used for ship building, railways, boiler plate and many other important purposes.

Next to the richness and abundance of ore, a cheap and ample supply of wood for fuel is the most essential condition: and it happens most fortunately that the native forests still exist in the neighbourhood of the mineral fields. The Legislature has already sanctioned the reservation of extensive tracts of the ungranted wilderness lands for the purposes of iron manufacture: and the proprietors of lands in the vicinity of the works will soon find it to their advantage to preserve their wood lands from the waste and destruction of times past.

In several countries of Europe, where iron is made with charcoal fuel, the laws compel the proprietors of land to plant and cultivate wood and to take measures to insure its reproduction. It is true we have in Nova Scotia ample stores of mineral coal; and there can be no doubt that it will eventually be extensively used in the manufacture of iron; but it is the fortunate combination of rich primary ores with abundant forest resources, that will give a pre-eminence to the produce of our mines.

Another great element of success consists in the great advantages and facilities for transportation. The lines of railroad projected in Nova Scotia, have been surveyed to traverse the mineral fields; but without these the mines and works are very conveniently situated within a few miles of ship navigation on the Bay of Fundy.

The present establishments consist of two Blast Furnaces, with Catalan Forges, Dwelling Houses, Coal Houses, Stores and other necessary buildings. There are also Heating Furnaces and a powerful Rolling Mill, with Steam Engine ready to be erected, so it will be perceived that the Company is in a position at once to commence reproductive operations. It is intended gradually to enlarge the existing works as occasion may require: and the operations of the Company will embrace every branch of Iron Manufacture.

*First*—The purer varieties of ore will be reduced entirely with wood charcoal, to produce Iron suited for the highest qualities of steel. In the first instance this will be sent to the English and American markets, where it is highly prized, but the Company contemplate the establishment of Steel works when circumstances will admit.

*Second*—By means of sea coal and coke, Iron will be manufactured on a large scale for all the ordinary purposes and uses of North America.

*Third*—Those manufactures connected with Iron, which require least capital and skill, will be introduced: for example, Factories for Nails and Spikes, Axes, Agricultural implements &c. To these, with the progress and success of the Company, may be added Tin Plate Works, Wire Drawing and Edge Tools, and eventually Steel Works.

*Fourth*—Traffic in ores by direct sale, or by the Company's erecting Furnaces at places in the United States, where pure anthracite coal is cheapest. The Nova Scotia ores will then be conveyed to those furnaces, and the vessels will freight back with coal. By these means, not only will the quantity of Iron of the highest quality, and fit for Steel, be greatly increased, but so much of it as is made within the United States will be free of duty.

In addition to the minerals above described the Londonderry District contains other products of great economical and commercial value. The ankerite, a ferruginous variety of limestone, which is very abundant, is found to possess *hydraulic* properties, and to be admirably suited for the manufacture of *Roman cement*.

The red, brown and yellow *ochres*, which occur in all parts of the mineral range, yield *pigments* of a rare and valuable kind, and can be so cheaply prepared as to make them a source of great profit.

*Fire clay, freestone, and lime* of excellent quality are also abundant, and there are good indications of the existence of *sea coal* in the immediate neighbourhood.



# A BILL

ENTITLED

## AN ACT TO INCORPORATE "THE ACADIAN IRON AND STEEL COMPANY."

*Be it enacted by the Governor, Council, and Assembly, as follows:*

I. Cyrus Alger, Abbott Lawrence, Charles Thompson, George Winslow, Francis Alger, James W. Paige, Donald Mackay, Geo. Greig, and Thos. Lamb, of the State of Massachusetts, in the United States of America, Chas. C. Alger, Horatio Allen, Peter Cooper, Edw. K. Collins, David Henderson, Gouverneur Kemble, R. B. Kimball, G. G. Palmer, Alfred Pell, Taliafero P. Shaffner, Moses Taylor, and Wm. Van Hook, of the State of New York, in the said United States of America, David Bronson, John L. Hayes, A. C. Morton, John A. Poor, and John M. Wood, of the State of Maine, in the United States of America; Thomas Moulson, Master Cutler, and William Fisher, Mayor of the City of Sheffield, William Anthony Matthews, John Jobson Smith, Joseph Turton, John Crowley, and Thomas Jessop of Sheffield, J. Howard Blackwell of Birmingham, George Pemberton and Philip P. Blyth of London, James Platt of Oldham, Robert N. Philips and Richard Johnson of Manchester, in the County of Palatine of Lancaster in England,

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Enos Collins, Mather B. Almon, William A. Henry, Jonathan McCully, James McNab, Edward Kenny, William A. Black, John E. Fairbanks, and Alexander Keith, Benjamin Wier, and John Esson of Halifax, in this Province; Edward B. Chandler, John Robertson, William J. Ritchie, Robert Jardine, and George Botsford, of the Province of New Brunswick; Francis Hincks, John Ross, George Etienne Cartier, James B. Forsyth, A. T. Galt, William Beverly Robinson and Samuel Zimmerman, of the United Province of Canada; or such of them and all other person and persons who shall from time to time be and become shareholders in the Company, their successors and assigns, shall be and they are hereby created a body politic, and corporate in deed and in name, under the style and title of "THE ACADIAN IRON AND STEEL COMPANY." and by that name shall have succession and a common seal, and may sue and be sued, and purchase, acquire, hold, possess, and enjoy, mines, quarries, lands, tenements, and hereditaments, vessels, craft, goods, chattels, and things in action, and may let, sell, assign, mortgage, convey, and dispose of the same, or any part thereof; and may explore, open, and work, any mines, veins or deposits of iron, or other minerals, and reduce, smelt, manufacture, use and export the same, and may make, construct, keep in repair, and operate any railways, tramways, or plank roads, for the purposes of their operations; and may improve the navigation of rivers, lakes and harbours, and construct piers and docks: and may set up and establish factories and machinery, and may engage in and prosecute any lawful business or calling within the scope and in furtherance of the objects contemplated by this Act.

II. The Capital or Joint Stock of the Company, shall be one million five hundred thousand dollars, in shares of one hundred dollars each, which shall be deemed and held to be personal property, and transmissible and assignable as such.

III. The first meeting of the Company shall take place and be held at the Revere House in the city of Boston, in the State of Massachusetts, on the first Wednesday in the month of May now next, between the hours of twelve and two o'clock, at which the above-named Corporators or any three of them, and all such other person and persons as may in the meantime become shareholders in the Company, may attend and vote: and parties then and there may adjourn the meeting to any other time or place, or may then and there or at such adjourned meeting proceed to organise and form the Company: and at the said or any such adjourned meeting elect the Board of Directors of the Company, which shall consist of not less than five nor more than eleven shareholders, qualified as hereinafter mentioned, who shall continue in office until the first Wednesday of June, 1856, and until their successors shall have been elected in manner hereinafter provided: and the said Directors may thereupon or at any subsequent meeting appoint a President, Vice-President, Manager, Secretary and other officers and servants of the Company, and may prescribe their powers and duties, and fix their salaries and emoluments; and the Directors may fill vacancies occurring in the Board of Directors (by death or otherwise) until the next Annual General Meeting, and the Directors of the Company shall also have power to receive subscriptions to the Capital Stock from time to time and require and enforce payment thereof and in default may forfeit shares or otherwise as they shall see fit: and may make Bye Laws not repugnant to the laws of this Province; declare and pay dividends and interest, and generally regulate and manage all the affairs and business of the Company; and any three of the Directors shall form a quorum.

IV. No person shall be eligible to be a Director of the Company who shall not be the *bona fide* holder in his own right of at least ten shares in the Capital Stock of the Company: and every shareholder shall be entitled to give one vote for each



and every share held by him or her in the Company—and the said Directors shall cause a true and correct Register of the shareholders to be kept in a book for that purpose; and no assignment or transfer of any share shall be valid or effectual until all arrears of calls shall be fully paid up, and until the same shall be registered: Provided always that when any shareholder shall transfer in manner aforesaid all his shares or stock in the Company, such shareholder shall cease to be a member of Corporation.

V. The General Annual Meeting of the shareholders of the Company shall be held at such place in the city of New York or the city of Boston, or the city of Halifax in this Province on the first Wednesday of June in each and every year as the Directors may from time to time determine and give notice: at which said meeting the Board of Directors for the past year shall exhibit a full statement and report of the affairs of the Company: and the meeting shall thereupon proceed to examine and audit the accounts, elect a Board of Directors for the ensuing year; amend or annul any bye-law and make any new bye law and transact all other necessary business: and special meetings of the shareholders may be called by the Directors upon a requisition to that effect signed by any ten shareholders, of which meeting and the object thereof at least twenty days notice shall be given in some newspaper published in each of such three cities; and at all meetings of stock or shareholders each shareholder may vote in person or by proxy, on production of sufficient written authority.

VI. The Directors of the Company may from time to time purchase or acquire any lands, mines, quarries, tenements, or hereditaments, in fee simple, not to exceed the value of £150,000 in the whole, or by lease, grant or otherwise, and in payment or part payment therefor, the said Directors are

hereby authorized to issue preferential Bonds of the Company, the payment of which and the interest thereon shall be specially charged upon the property and effects of the Company, as may be therein expressed. Provided that such bonds shall not bear a higher rate of interest than six per centum per annum, nor have more than twenty years to run, nor amount to more in the aggregate than one half the Capital of the Company for the time being: and provided also that such Bonds shall contain a clause entitling the holders thereof to convert the same into stock of the Company *at par*, at any time within ten years from the date of the issue thereof; provided, also, that it shall not be necessary for the holders of the said Bonds to register or record the same: and the Directors may also issue paid up shares of the Company in payment or part payment for any lands or property purchased or acquired for the Corporation.

VII. A copy of the Bye-Laws of the Company, and also of the Register of Shareholders, shall be deposited in the office of the Provincial Secretary of this Province: and also a list of the number and amounts of the Bonds from time to time issued by the Company.

VIII. No member of the Corporation shall be liable in his person or separate estate for the debts of the Company, for a greater amount in the whole than the amount of the stock held by him. But this section shall not have effect to relieve the Company from liability until shares to the number of 4,000 shall have been subscribed and £50,000, including paid up shares, actually paid into the funds of the Company.

IX. The conveyances and transfers of property to the Company may be in some of the customary forms of Indentures or Deeds Poll used in this Province, and where the title shall be of a Freehold nature the said Indentures or Deeds Poll

shall enure to convey directly and absolutely to the Company all the estate, right, title, interest, equity, claim, property and demand of all and singular the parties who may execute the same, whether tenants in fee or in tail, mortgagees, trustees, lessees, for life or years, occupiers, remainders, men or reversioners, and in like manner where the estate or title shall be less than freehold; and the Company may from time to time, by such or the like deeds or instruments, grant, convey, lease or demise any part or parts of their lands, tenements, and hereditaments.

X. In order to encourage and facilitate an enterprise which, with its attendant industries, is likely to be productive of great benefits to this Province, there shall be set apart and appropriated for the uses and purposes of the Company, so much of the ungranted wilderness lands in such localities as may be indicated on the part of the Company, in the vicinity of their works, as in the opinion of the Governor in Council, shall be reasonably sufficient for the operations contemplated under this Act, with the option to the Company to purchase the same from time to time, within twenty-one years from the passing of this Act, at the price of one shilling and nine pence, sterling, per acre, and in the meantime the Company shall be at liberty to take and use the building materials, wood and timber on such lands on such terms and conditions as the Governor and Council may deem expedient. Provided always that in case works shall not be erected and in efficient operation within five years after the passing of this Act at any mine in respect of which such reservation is made, the Governor in Council may on proof thereof annul such reservation by an order; and thereafter the land reserved in respect of such mine shall be again at the disposal of the Crown in the same manner as if this Act had not passed.





