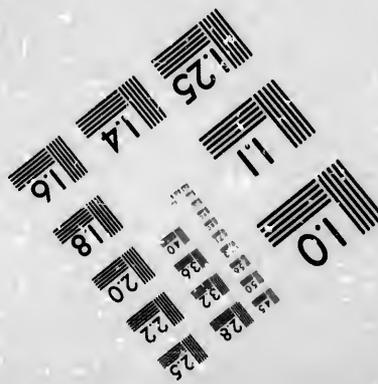
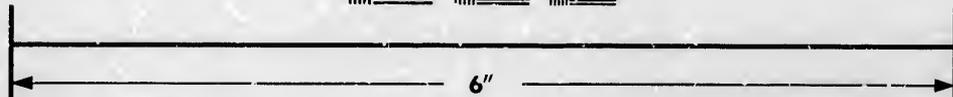
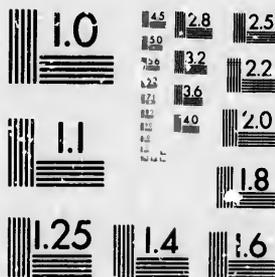


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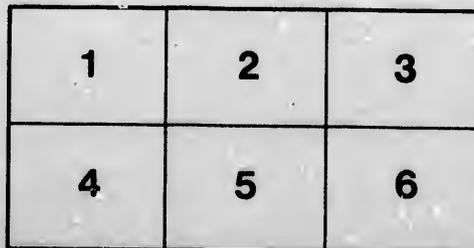
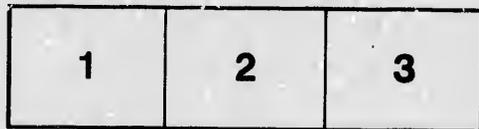
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THE  
MINERAL RESOURCES  
OF THE  
NEW DOMINION  
ESPECIALLY THOSE OF THE OTTAWA VALLEY.

BEING A LECTURE DELIVERED IN OTTAWA, UNDER THE PATRONAGE OF HIS EXCELLENCY  
THE GOVERNOR GENERAL, BY H. BEAUMONT SMALL, S.C.L.,  
MARCH 21st 1868.



OTTAWA:  
PRINTED BY G. E. DESBARATS.  
1868.

# THE HISTORY OF THE

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CHARLES THE FIRST

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THE  
MINERAL RESOURCES  
OF THE  
NEW DOMINION.

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It is a matter of satisfaction to observe that there is an increasing earnestness manifested in the community for a diligent and systematic study of particular branches of science, and that in some of them, geology especially, we are making considerable progress. Mere popular lectures on such subjects, or a superficial attention to them as matters of amusement, are only useful when there is a stronger and fuller current beneath. It is remarkable in general society how comparatively rare it is to meet with people who have really made themselves masters of any particular subject ; but when they have, and can give reliable and valuable information, they become then in that department, an important authority, and worth listening to in society. And so in public life, in Parliament,—if instead of talking superficially and often foolishly on any or every question, a member is known to have made some one important question his particular study, he will be listened to with respect and attention, because he can then really give some reliable and useful information. And so in every case, if besides general gossip, and passing remarks, people can bring into society on any subject, accurate and sensible information, whether of literature, science, or trade, it is adding to the general stock, and advancing the intelligence of all. Sometimes however, people get up facts or information in a dry mechanical way, and thus become tedious and disagreeable. In appearing before you to-night, my endeavours will be to avoid the example of such, and in dwelling upon the mineral resources of the Dominion, not to thrust upon you a lecture on geology, with its stereotyped and hackneyed phrases, but to direct your attention

to the sources of boundless wealth, in our hills and mountains, calling from their native fastnesses for science to unearth them ; though, to grasp which, it is necessary that some acquaintance with geological facts be acquired, and kept prominently in view.

In an industrial country like this, the practical ability of any study is invariably thrown into the scale, and geology at first sight seems to the multitude, unpractical. What money will it earn for me in life ? is the question which first presents itself ; for if the answer be, none, a man has a right to rejoin, then let me take up some study, which will equally train and refresh my mind and yet be of pecuniary benefit to me. But to him who comes in contact with rude nature teeming with unsuspected wealth, of what incalculable advantage is it, to have a knowledge, if it be but of the rudiments of a science which will tell him the properties and therefore the value of the rocks and hills, and formation of country he meets with, or resides in. Let us take an example. Two individuals possessed of equal capital set out, let us suppose, to settle in a new region. The one ignorant of geology, fixes upon a locality characterised by the beauty of its scenery, and the fertility of its soil ; the other skilled in the science decides upon some rejected lot of bleak and barren aspect, but rich beneath in minerals, which his geological knowledge at once enabled him to detect. The former pays a high price for his land, and yearly toils over it, to reap, therefrom a remunerative, harvest ; the latter obtains the despised territory for a trifling sum ;—in the course of a few years by tapping its mineral wealth he secures a fortune, and eventually resells his purchase for a princely amount. Such an instance, is by no means rare. Again the capitalist, the agent who effects sales, the statistician, the traveller, the explorer, may all reap advantage from an acquaintance with this branch of study. Nature beckons alike the peer and the peasant to the perusal of her book spread out before them.

Various theories have been propounded to account for the formation of mineral veins, but it has become now an established idea, that all such with perhaps the exception of bog iron, are traceable to an igneous origin, many of them probably owing their existence to some process of sublimation, arising from the fiery mass below. Vast periods of eruptions could not have

passed without effusions of hot water and steam, and copious hot springs. The heated waters and vapours of these, rising through the crystalline rocks below, may have exerted an active agency in bringing up the ores, that are distributed in the various formations of our earth. Some geologists have asserted that the whole of our globe was at one time in a state of incandescence, and many ridiculous theories in this connection have prevailed at different times ; one being that the matter of which all the planets are composed, at one time constituted a portion of the sun, which by coming into collision with a comet, had some of its particules driven off like a stream of sparks from red hot iron on the anvil, and that each of these jets of melted matter formed itself into a planet, which being launched far out into the colder regions or space, cooled down, solidified, and became a globe. In such a theory as that, there are ample grounds for the idea of sublimation.—The various speculations however were not without their beneficial results, opening as they did a field of controversy and research, and leading to the examination of facts which science is now revealing ; the child must often fall, before it can walk with the well-balanced step of manhood, and the theoretical failures of the past, were but the first struggles of the infant intellect of our race, to attain that perfection which the Almighty has willed can only be secured as the fruit of labour.

The oldest formation of rocks on this continent, is the Laurentian. The northern iceberg drift, scattered boulders over the surface of a certain portion of the continent of America, at a time of which history can give no record ; but the Laurentian rocks, although bearing evidence of having been submitted to igneous action, proclaim the existence of seas still more remote in time. They consist of hard rocks, which for the most part have been partly melted and reconsolidated—they are stratified, but much bent and twisted together, and their surface presents unmistakable evidences of their having been greatly denuded or worn down by the long continued action of atmospheric and other causes, before any other system was deposited on them. In Canada they occupy the surface of nearly all the country lying on the North shores of the St. Lawrence and Ottawa Rivers, crossing the latter at the mouth of the Madawaska, near Amprior—extend-

ing into the back territory between the Ottawa and Lake Huron, from which district they are prolonged southwards into the United States, crossing the St. Lawrence, between Brockville and Kingston. They constitute an irregular belt from one to three or four hundred miles in width, extending from Labrador to the country lying north of Lake Superior, a distance of more than 1,000 miles. It is in this formation of rocks, and those immediately overlying them, the Lower Silurian, that our mineral treasures are secreted, and there is not the slightest doubt, that as the Rocky Mountains and the Alleghanies have produced valuable minerals in great abundance, and gained a name for metalliferous productions, so our Northern Laurentides when properly explored and known, will afford a revenue that will become one of the brightest jewels in the diadem of Canada, to shine with brighter lustre, long after the lumber trade and its accompaniments has become one of the memories of the past. The discoveries made in them so far, have been in the first instance mostly accidental; from following up which discoveries, the results have been most extraordinary. The shining particles found in sinking a hole in Madoc, led to the discoveries since made in Tudor, Lake and Elzevir—the existence of galena or lead in Buckingham was brought to light by an ox sleigh from a cedar swamp fracturing a projecting piece of rock—and the deposits of plumbago or graphite in Lochaber, worked and then abandoned 14 years ago by some Germans, but now in a most flourishing condition, were pointed out, so tradition asserts, by the Indians, who used that mineral as a pigment.

And here I would state that to the N. E. and N. W. of this goodly city of Ottawa, within a few hours drive of the Parliament Buildings, lies a portion of that Laurentian formation, in which many minerals of economic value abound—and it is to this section of the country, after a few remarks on the Madoc region, that I wish most especially to dwell this evening.

There is a legend, though probably it may be put down as a fable, that certain Spanish adventurers visited Canada at an early period, in search of gold, and that finding none, they named the country *Il Capa di Nada*—the cape with nothing—that they were in search of—in it. Time however rolled steadily onwards; and three centuries and a quarter after the discovery of Canada passed

away, before the gold for which the early colonizers of some parts of Canada showed so great a thirst, was discovered. In the meantime, however, many other metals had been found and worked to a greater or less extent. The forges of St. Maurice probably afford the first instance of the successful working of any metal in Canada. They were established by the French in 1737; at the conquest of the Province, the rights of the French King devolved on His Britannic Majesty, and these forges have been let to private parties, who have worked them very successfully. The copper deposits of the Lake Superior region have long been known, but on the North or Canadian side, they have not been much worked. The Copper mines of the Eastern Townships have yielded of late years a vast amount of wealth to their proprietors. Silver deposits of surpassing richness are reported to have been recently discovered near Lake Superior, at more than one point, and probably before the present year passes away, they will have been thoroughly tested. Iron works have been started in several different places, and at one point on the Lower St. Lawrence, the iron sand is manufactured by means of peat—another economic material, of which as our forests begin to give out in the older settlements, we are just beginning to discover the uses and value, and which will probably in the course of time exercise as great an influence in our manufacturing centres, as coal has done in England. From Marmora large quantities of iron ore are exported, and the new iron works recently established in Hull, in our own immediate vicinity, are but the pioneer movements in developing a source of wealth which has been slumbering for centuries in the bowels of the land, and which only awaited the enterprise of labour and capital to yield a rich return. A new process of separating copper ore from the rock, has recently been put into operation in England, and it will not be long before it is applied in Canada. By the old method of extraction, it was necessary to have ten per cent. of copper in the rock before it could be worked, and if there was only half that quantity, the difference had to be added. By the new method, rock bearing only two per cent., or perhaps less, can be worked without any addition of other copper.

Activity in gold mining as all persons know, is at present chiefly directed to the Madoc region. Our Ontario gold fields differ in character from those of many other countries, in the absence of alluvial washings. The gold has to be obtained by actual mining. In every gold producing country it must come to this at last, but in Madoc the work had to be commenced in that manner at the first. An individual miner with his shovel and his pan could do nothing. Associated capital is necessary for the development of our gold fields. Blasting and crushing the rock form the only permanent basis of mining in any country. The washings of soil and the deposits in river beds soon give out everywhere. In all countries celebrated for their production of gold, quartz mining is now the main and almost the only reliance.

And now for a few words as to the geological features of Madoc, which I will endeavour as much as possible to divest of dryness. The village of Eldorado lies on the contorted and upturned edges of rocks of the Lower Silurian age,—in fact in a much disturbed, metamorphic insular silurian basin, almost circumscribed, if not wholly surrounded by the rocky strata of the Laurentides. It is asserted by Mr. White who has spent much time and research in that section of country, that these Lower Silurian strata, tilted upon edge by volcanic agency, highly crystalline in texture, and very much changed in character by metamorphic action, extend 1000 square miles or over. To ascertain the locality where the most reliable and unquestionable mineral bearing character of such changed strata is to be found, it will be necessary to trace out the anticlinal axis of its winding mineral bearing upheavals, i. e., the lines of force which brought up the basal rocky strata from original to present condition, and to determine by investigation to which or to how many of these variable strata, do the metallic minerals occurring in that basin belong. That they will be found following and closely identifying themselves with certain characteristic strata, there can be no doubt, and it would be contrary to all precedent, if such were not found to be the case. It is therefore of the utmost importance in a labour saving and monetary point of view, to have that question satisfactorily determined, as well as to have the correct position of the anticlinals that brought up the lower auriferous and other

metallie bearing strata, defined and laid down on a reliable geological chart of that district. (I believe the name under which an anticlinal is known among miners, is "a saddle back.")

I cannot forbear in this place drawing the attention of the Government to an early settlement of these important matters, as their determination must sooner or later take place, and it is hardly fair to throw the whole onus on the miner by actual mechanical and manual labour, to say nothing of the hazardous expenditure of large sums of money by private individuals, while we have an efficient geological staff in the employ of Government. Were a few of their officers to be ordered on the ground in early spring, they could by simultaneous action in a short time procure data enough for the compilation of such a map as is now needed, and delineate thereon such information as would be of incalculable benefit to the miner, as well as to those seeking investment there, and thus save from disappointment, many who ventured to embark in mining enterprise without experience or the best available scientific direction and advice.

When we recollect that it is not more than a year and a half ago, since the Eldorado mines were discovered, and that a year ago scarcely any buildings existed there, the present aspect of the place shows what a change the development of mineral resources brings in its train. There amidst the everlasting hills, the wild woods, an expanse of boulders and stones, have flocked hundreds from various quarters of the globe. Men who have travelled over Australia, men from California, Mexico, Cariboo, Nevada. The beaver has started from his lair; the moose hears them afar off—the wolf slinks into denser swamps, and the old wilderness stands aghast. Everything is new—the roads new—the houses new—the scene itself is new. The houses are more like a military camp, some two, more one story high, some rough, unplanned—all devoid of paint. The village consists of an equal complement of taverns, boarding houses, stores, and smithies, the chief business of which last consists in sharpening the miners picks. The air resounds with words about gold, lodes, assays, quartz—quartz—quartz.

In this locality the familiar words of Hood :

"Stitch, stitch, stitch, in poverty hunger and dirt

"And still with a voice of dolorous pitch,

"She sung the song of the shirt,"

have been ably parodied into the following,

" Pick, Pick, blast and pick, from morn till night,

" With eager eyes, for golden ore, craving more,

" The miner goes pick, pick, with all his might."

The only reliable test of the richness of a vein is to crush enough rock to establish by assays its richness per ton; this has been done by the crushing or stamping mills now in operation, and the rock from the well known Richardson mine has yielded an average of \$138 to the ton. This is a prodigious yield—there is probably no mine in Australia now yielding at this rate. The Eldorado mine which joins the Richardson yielded an assay of \$53.88 per ton. From such results as this at a commencement, the mind can scarcely realize the immense wealth to be obtained when the works go into full operation, for when a prolific lode such as that of the Richardson mine is struck, it is surprising, judging from the experience of other countries, to what an extent it is capable of being developed. From the Annual report of the State Mineralogist of Nevada for 1866, we find that one of the mines in that State named the Gould and Curry mine, yielded during six years, an average of over \$2,000,000 a year, obtained from a rock yielding for the year an average of \$59.02 to the ton. The Savage mine from \$44.14 yielded \$1,805,800. The Crown Point from \$38.15 yielded \$1,313,357. The Empire, from \$24.69 yielded \$486,778. These averages show that from a rock as rich as the Eldorado, to say nothing of the Richardson mine, immense results may be obtained. It would be impossible to estimate the effects on the prosperity of the Dominion, if our gold fields should realize the favourable prognostications of those who best understand the matter from their long acquaintance with gold mining elsewhere. There is no doubt that the early development and exceptional wealth of California are due to her gold mines, and that the rich products of agriculture which she now sends forth, are but a natural sequence to that development. But for her mines, that fine State would have been little better than a wilderness to-day. Her gold enabled her to maintain alone among the States, unless it be Nevada, a gold basis for the currency. The wonderful prosperity and attractiveness of Australia, are traceable to the same source. There a population equal to one third that of Ontario and Quebec have been able to raise nearly five times as much revenue as we

have. Australia has for years robbed us of the best class of English emigrants, men of means, energy, and education. No doubt the milder climate had something to do with it, but the chances of making a considerable fortune in a reasonable time, has been the strongest motive. To turn the tide of emigration hitherwards, by circulating in the Mother Country reliable statements of our gold fields, is the duty of our Government; no such state of lawlessness as prevailed at one time in the Australian diggings is to be encountered here, and when facts and figures are fully brought home to the overstocked cities of England, a flow of emigration to our shores may be looked for, that will far surpass any thing that our agricultural inducements could ever offer. Labour, wood, wages and provisions are all far cheaper at Madoc than at the California mines, or in Nevada or even in Cariboo.

The crushing mill erected by the owners of the Richardson mine is a structure of stone three stories high, situated at the bottom of the hill on which the mine is sunk. It is said to be able at its utmost capacity to crush 50 tons of stone ore in a day. Suppose each ton to yield \$50 of gold, we see a profit of \$2500 per day,—if the product were but half that, the profits would even then be enormous. As soon as the rock has been crushed into dust a flow or rush of water washes it through a sluice into a receiving vat in which lime has been placed for the purpose of absorbing the dirt and earthy particles, thence it goes into another vat for further cleaning, after which it is elevated by machinery into revolving cylindrical troughs containing quicksilver and water. From these the dirt and refuse with the water escape into a sluice and run off. The great bulk of the particles of gold are retained by the quicksilver, and thus preserved. Crushing mills of this description are now used in California and Nova Scotia, and are a necessary adjunct to the mining business. According to a report of Mr. Keefer's there are only two mills as yet in operation. These can take out at least 60 per cent. of the assay, and any person having quartz to test can easily ascertain whether it will pay, by getting a ton or more crushed at the custom-mills. The price of crushing a single ton is \$20, with a sliding scale to ten tons—which quantity can be crushed for \$10 per ton, and easier terms can be contracted for, for larger quan-

titles. The Anglo-Saxon, the Bay State, Madoc, Toronto and Whitby, Merchants Union and other Companies, are erecting mills to go into operation this year. The cost of raising, crushing, and separating on an average does not exceed \$7 per ton ; some persons say much less.

The gold fields of Madoc will require the erection of many more mills than those now in operation, and what has retarded the true development of the country back of Madoc has been the want of more mills. There is also a great deal of silver associated with the gold in the ore. The region containing these precious metals is supposed, by practical men, to extend from Brockville to the northern shores of Huron, comprising the highlands in rear of Kingston, Cobourg, Lindsay, Lake Simcoe and the Georgian Bay. Time only can unfold its hidden wealth.

The mineral which will next engross our attention, and which must soon assume its rank next to gold amongst our economic minerals, from the constantly increasing demand for it, is plumbago, black lead or graphite, by which last name we will call it. The general ideas associated with the use of this article in the public mind, are its powers of imparting a lustre to our stoves and fire places, and its being used as the material which furnishes the writing property of our pencils: hence the name graphite, from the Greek word *grapho*, I write. But it is applied to numerous other purposes, and the manufacture of pencils has now become almost the least important of its various applications. It is used largely to counteract friction in the movement of the heaviest as well as the most delicate machinery. Experience has proved that where the ordinary oils and unguents have been insufficient to prevent heating from the motion of shafting or other machinery, the addition of powdered graphite will infallibly accomplish the object. Few musicians are aware now much they are indebted to plumbago for the smooth elasticity of touch of their piano-fortes, the friction in an important part of the action being overcome by its use. Mixed with oil as a black paint, it exerts an extraordinary preservative influence on both woods and metals. Iron vessels in the United States navy, after being covered with this paint, have sailed round the world without any corrosion of the iron by the salt water, while wood covered with it becomes nearly as durable as iron.

In foundries graphite dust is now used in very large quantities, for facing the inside of the moulds before casting, and as a consequence the work comes out beautifully smooth and bright, instead of requiring the former chipping and scraping. One manufacturer of car wheels estimates his saving from this use of graphite at *fifty cents* per wheel.

But the most important of all its uses is the manufacture of crucibles and melting pots, and small furnaces for assayers and chemists. The Royal arsenals and dockyards where very large steel castings have to be made,—the great railway and other workshops, brass and copper foundries, all must use crucibles, and of the largest size. For their manufacture the graphite is ground to a fine powder, and mixed with a portion of clay, which gives plasticity to the mass, and allows it to be moulded. A remarkable property of these crucibles is, that they may be taken at a white heat plunged into cold water, and immediately heated again, without cracking or undergoing any change; and although the blow of a hammer in the hand of a child would break them to pieces, they yet withstand a degree of heat so fierce that gold and silver can be melted in them like snow. The Battersea Crucible Company, of London, the largest manufactory of the kind in the world, whose consumption of graphite last year reached the enormous amount of 8,000 tons, have just completed additional works, doubling their productive power. In the United States, in addition to the large establishments of the kind previously at work, several new ones have been opened during the last twelve months.

Hitherto the material for these uses has been obtained from Bavaria and other parts of Germany, and from Ceylon, while the finer varieties for pencils are in great part procured from Russia, and from the Borrowdale mine in Cumberland, England, which last has been worked for more than 100 years, and is now nearly exhausted. The graphite from that mine owes its value rather to its peculiar state of aggregation than to its purity, since it often contains more foreign matter than some of the crystalline Ceylon ore, of much less price. From Ceylon, in the year, 1864 (since which date I am unable to get the statistics) no less than 26,000 tons were exported to Europe and the United States. The mines

of that island however are in the hands of a few wealthy extensive landholders or nabobs, who for the purpose of maintaining its price would never allow more to be shipped than the exigencies of trade actually required in each year, and the supply moreover could only be obtained through resident agents maintained there for its purchase by the firms consuming it: added to this, in most cases the masses of ore have to be brought in bags on the backs of bullocks from the mountain sides in the interior of the island to the port of shipment. Competition, however, induced by the use of Canadian graphite, equal if not superior to that from Ceylon, will probably create a revolution in the mining matters of that island, which will have to furnish larger supplies for shipment, by the extension of their works, or else to withdraw from the market altogether.

The graphite from Passau in Bavaria, which is used extensively in the manufacture of crucibles, contains only from 35 to 42 per cent of pure carbon (a poor contrast with that obtained in Canada as will be shewn presently) the residue being of the composition of clay. Argillaceous matters, though they reduce its value, are not prejudicial; but the presence of carbonate of lime is very objectionable, inasmuch as the lime forms a fusible compound with the intermixed clay, when the crucibles are exposed to a strong heat. The United States have during the last few years taken fair rank in the production of this mineral, but here, in the very heart of our own Dominion, within a few miles of this the capital of our country, and close to the waters of the Ottawa River, have been discovered unlimited veins of graphite, pronounced by the most competent judges to be equal if not superior to any yet offered for sale. The large dealers in New York, Boston and Jersey city, where the largest crucible works on the continent are situated, all unite in pronouncing it equal in all points to the best that passes through their hands. From assays made in England 95 per cent of pure carbon has been obtained and pronounced fully equal to the best Ceylon ore.

Before entering however on a description of the localities where it is obtained, and the modes of working it, some account of the mineral itself is necessary.

This mineral is occasionally met with in most of the stratified

rocks of the Laurentian system, not only in the limestones, but in gneiss, quartzite, and other formations. It is moreover met with in the iron ore of the series, as in Hull, though not in sufficient quantities to offer any obstacle to the smelting of the latter. It is however in the limestone formation that we find graphite disseminated, sometimes so finely developed as to give a bluish grey tint to certain bands marking the stratification, and at other times appearing in thin detached films or flakes. It is this disseminated form which Sir Wm. Logan says in the Report of the Geological survey of 1866, will be found most available, as the veins hitherto found, though affording a very pure material, appear too limited or irregular to be relied upon. But the greatest thickness of *any* vein alluded to by him is only 12 inches, while most that he speaks of vary from 3 to 7. The Canadian Graphite Company have exported to Glasgow some of the mineral from one of their mines, just as it came from the shaft, and it received the highest encomium there, being pronounced equal to the Ceylon ore, yielding 93 to 95 per cent of pure carbon. It stands to reason therefore that the ore which can be quarried and exported in the state in which it occurs, without going through any process, must yield a larger profit to the miner, than that which has to go through a crushing and cleansing process at the stamping mill before being placed upon the market.

*Crystalline* Graphite is one of the most frequent minerals of the Laurentian veins, in which it occurs under a variety of aspects, sometimes as large hexagonal plates,—in scales between mica crystals, or else forming solid masses in the vein. These masses when pure are generally made of broad thick plates, the edges of which are at right angles to the sides of the vein. Sometimes these veins exhibit on a fractured surface a peculiar finely waved aspect, due to a structure consisting of fine narrow fibres, arranged at right angles to the layers; it is these which present the fibrous or columnar aspect when broken across. This appearance is not unlike certain waved maple woods, and is due to the fact that the fibres of the successive layers are not quite parallel with each other. Portions of specimens of graphite, sent from Canada to the London Exhibition in 1862 were carefully analyzed by a French chemist and physicist Mr. Cloez. These after being calcined to

expel any traces of moisture, where burned in a current of dry oxygen, and yielded a result of 98½ per cent pure carbon.

The presence of graphite in veins, implies its separation from solution at an elevated temperature. Pauli in his experiments, found that when hydrate of soda, mixed with cyanide of sodium was heated with nitrate of soda to incipient redness, the carbon of the cyanide separated from the liquid mass in the form of graphite. Jacqueline, another celebrated chemist, obtained by decomposing sulphuret of carbon in contact with copper, an amorphous graphite, and he suggests that native graphite may have originated from the distillation into the fissures of rocks, of volatile hydrocarbons, which have there, by a decomposition similar to that which takes place in contact with the walls of coal gas-retorts, given rise to a deposit of carbon that has assumed the form of graphite. Brodie again by dissolving graphitic iron in strong acid, obtained a lamellar graphite identical in physical character with that met with in nature.

It is now generally conceded by geologists that it has been formed by the alteration of coal and similar carbonaceous matters at a temperature below redness, while its subsequent translation into the veins, and its deposition in a crystalline form have been effected under conditions which though imperfectly understood, probably included aqueous solution at a high temperature. Dana in his address on American geological history, delivered before the American Association for the Advancement of Science, says that the fires from the Appalachian chain converted by slow degrees, and without any sudden violence, in ages long gone by, the carboniferous strata they came in contact with into a hard siliceous anthracite, and in some localities even into graphite, previous to the deposition of the carboniferous beds of Nova Scotia and the North East.

In the valley of the Ottawa, graphite is found in the townships of Grenville, Lochaber, Buckingham, Templeton, the Seigniorie of Petite Nation, and in the township of Burgess, south of the Ottawa River. It occurs in a disseminated form through the Laurentian limestone in the rear of Kingston, and on Gold Lake, in the township of Loughborough; but the section of country where this mineral is being principally worked is in the townships of Bucking-

ham, Lochaber, and Templeton.—During the past year the attention of explorers has been given for the most part to the ridges of land lying between the river Blanche in Templeton, and the River du Lièvre in Buckingham. It is only three years since the mines in the latter were opened under the present system of working, but there are already two crushing mills in full operation, and several others in the course of preparation. The facility of obtaining water power for the machinery, and the short distance the prepared article has to be conveyed to navigable water, greatly enhances the value of the deposits in these townships. For the benefit of those who have never seen a crushing mill at work, I will endeavour to describe the operation.

A powerful head of water by the construction of a dam being first of all obtained as the motive power, huge square blocks of iron each weighing several hundred weight, called stamp-heads, are allowed to fall alternately upon the crude ore previously broken into pieces, which they by repeated blows crush fine in water. The matter thus obtained is then conveyed into the buddles, which are circular vats or shallow tubs in which four cross bars, each furnished with a strong brush nearly but not quite touching the bottom, rotate, giving a circular motion to the whole of the contents, which are of the consistency of thin mud; by this motion the graphite and the minerals associated with it are separated from one another according to their specific gravity, and deposited in rings around the centre of the buddle. The graphite being the lightest of the minerals gradually reaches the outer ring, while the heavier stony matter remains in the centre. From assays made of the matter collecting in the centre, where the heaviest particles concentrate, gold to the value of \$4.38 per ton has been obtained, and it is not improbable that the greater the depth from which the ore is dug, the larger the yield of gold will prove. When proper steps have been taken to separate and collect this, the precious metal will go a great way towards paying the working expenses of the mill, and thus enhance materially the value of its products. The graphite being thus cleaned, is then dried on a furnace or kiln, and subjected to other processes, one of which is not made public, and the mineral is ultimately collected in fine scales or grains in a condition of great purity. It is then barrelled up and

is ready for shipment. The price obtained for the material in England when manufactured is stated to be about \$130 per ton of 2000lbs, while in the U. S. it is said to sell \$200 and over in American currency. The price of course varies according to quality.

I will now give a slight description of the mines of the Canadian Graphite Company, represented by the Messrs. Pennock of this City, the development of which is due to their indefatigable exertions. Having visited them a number of times during last autumn, and carefully noted everything connected with them at the various stages of the work, I am able to speak from personal observation. This Company in the summer of 1866, selected 1250 acres of land in the 7th, 8th and 9th ranges of the township of Buckingham, on the ridge extending between the Blanche and du Lièvre Rivers. Of course the whole of this is not mineral producing, but regard was paid to the obtaining of timber and a mill privilege on the spot to avoid the increased cost cartage to any distance would entail. Upwards of \$10,000 have been expended in opening out and testing the various veins existing there, and in exposing a large lot of disseminated ore on the side of a steep mountain. One vein of pure graphite in the 7th range, about eight inches in width and traceable 20 feet on the surface, gave after blasting the most astonishing results. It is now exposed 150 feet on the surface, and a shaft sunk 20 feet down, has given an increased width to the vein of 24 inches, and apparently widening as the shaft proceeds. Situated on high ground about 110 feet above the plain-level, it admits of being worked without any inconvenience from water, and affords every facility for drainage of surface water whenever requisite during the wet season. Should the vein continue to widen, a depth of a few more feet will allow taking out the pure graphite, without the displacement of adjacent rock, thus considerably lessening the cost of working. Four other veins of the pure mineral, all in near proximity to the one just mentioned are also opened, and will be worked in the coming spring. From these indications it is impossible to estimate the unbounded wealth contained in the bowels of the mountain in which they occur. Another advantage these veins possess is that they exist in gneiss, and consequently

are free from lime, which has been known to be an ingredient detrimental to the manufacture of a good crucible.

The bed of disseminated ore which the Canadian Graphite Company has opened has a width of 220 feet, and a depth of 50 feet running into the mountain, yielding from twenty to forty per cent, and promising a supply which will withstand the operations of a gang of miners for many years. Buildings for miners, a powder magazine and blacksmith's shop for sharpening the picks are already erected, and every preparation seems to have been made for pushing forward with vigor a work that will tend to create a village in what two years ago was, comparatively speaking, the primitive forests. Splendid water power has been secured within a quarter of a mile of the mines, on a stream issuing from a body of water, known as Devine's Lake, and the timber necessary for erecting a crushing mill is hewn and already drawn on to the spot. In addition to the graphite, gold in paying quantities has lately been discovered in pyrites in the rock adjacent, and decomposed sulphuret of iron or copperas is visible parallel to the graphite, where I am informed by the Messrs. Pennocks, it is expected that the gold elsewhere held in combination will be found set free. As these works proceed, it will probably be found that gold and silver are to be met with in Buckingham and Templeton in nearly as great abundance as in Madoc.

Another company, the Canada Plumbago Company, represented by Mr. S. T. Pearee, have a crushing mill erected at the outlet of Donaldson's Lake, in Buckingham, which when in full operation is capable of turning out 3 tons per day of prepared graphite. Great benefits arising from the money expended on these various mines have accrued to the farmers in their vicinity who are enabled to dispose of all their surplus produce, hay, oats, butter, potatoes, meat, &c., without the loss of time attendant on taking them to market; and the ordinary commodities of life have been greatly enhanced in price in consequence. Labour has risen proportionately, and the lumber firms of the locality who have hitherto dictated their own terms to the men engaged by them, have been compelled in many cases to advance their wages, and offer greater inducements to their employees, than formerly. An influx of miners will proba-

bly set in as fresh mines are opened, and the woodland ranges and barren ridges, where only the sound of the axe has broken the existing solitude, will be alive with the ringing of picks, and the merry voice of the miner, as he unearths the hidden treasures of the hills.

Another Company the Lochaber Plumbago Company, have a crushing mill in operation on the River Blanche, in Lochaber, capable of turning out two tons of the prepared mineral per day.

The Central Canada Mining Company, of which Mr. Currier is the Provisional President, own in Templeton 1,500 acres of land, where they are about commencing extensive operations with every expectation of great success. It is a Joint Stock Company of which Messrs. W. Wade of Ottawa and others are members. Gold-bearing quartz exists in this range, which has yielded an assay at the hands of Professor Hayes of Boston, of \$18.55 per ton.

It is not my intention to dwell upon our iron works and mines, which are so well known, especially those of Hull and Marmora, further than to say that there is no reason why when, properly conducted, the same success should not attend the manufacture of iron as has attended it in other countries where similar conditions exist. In Sweden and in Norway as in Canada, the ores are generally magnetic, the fuel charcoal, the motive power water, the means of transport and communication imperfect; labour is certainly cheaper, but the ores are less rich (33 per cent being the average in Norway, while here it is estimated by Sir Wm. Logan, at 69 per cent.) The same conditions as to ore, fuel, &c., obtain in New York State, where the smelting of iron ores seems to be very successful, and if care be taken to employ the same skill,—with due care and judgment, and the same apparatus and processes which are there applied with perhaps slight modifications, iron could doubtless be as successfully made in Canada as in New York. The protective duty in the latter country is to a great extent balanced by the higher prices paid for labour and fuel. The New York Journal of Commerce in calling attention to the vast number of iron deposits known to exist in Canada, says, under the heading of an article on the Moisie iron, that there is every probability of a heavy rivalry between the two countries in the manufacture of this

metal, not only because of the remarkably excellent quality of the Canadian metal but on account of the low prices of labour and material employed here in its production, and the writer further exemplifies its quality from a test made by the superintendent of the West Point foundry, who reported a square inch of the Moisie iron resisting 20,000 lbs. more pressure than that from the most popular works in the U. S. He considers it worth from 70 to 75 dollars in gold per ton at Quebec, and the duty on importation to the States 1 cent per ton specie. The same iron he says has been manufactured into beautiful specimens of steel, unparalleled there by Messrs. Sweet, Barnes & Co., of Syracuse, and further states it is the *highest grade of iron in the market*.

I will now pass on to one or two other minerals which seem to have been almost neglected, and yet which are met with abundantly in the Laurentian Strata, and might be worked with advantageous results. The first of these is the usually despised iron pyrites, scientifically known as bisulphuret of iron. It is not uncommon to hear the remark passed on a specimen of rock in which may be seen patches or veins of a brassy, yellow coloured mineral, "it is only pyrites—throw it-away." But I hope, by shewing the uses to which it might be applied, to give some idea of its real value. From statistics of the alkali manufacture in Great Britain, we learn that the consumption of pyrites in the several alkali works, reached in 1862, 264,000 tons.

In order to give some idea of the great importance of this mineral and its products, in a manufacturing point of view, let me first state, that sulphuric acid, which is manufactured mainly from pyrites, is the agent used in the manufacture of soda from common salt; from this is obtained hydrochloric acid, used in the manufacture of bleaching powder, and chloride of lime. Soap, glass, and many other chemical products are dependent on the soda thus obtained. In one manufactory, in Lancashire, 3110 tons of sulphuric acid are used weekly for the decomposition of salt, and 700 tons for other purposes, making a weekly total of 3810 tons, most of which is made out of pyrites. The process of making the acid is very simple;—the pyrites is first calcined in furnaces of a peculiar construction, by which means the whole of the sulphur contained is expelled, and then conducted at once to

leaden chambers employed in the fabrication of the acid. The value of pyrites in England is said to be \$10 per ton, and the supply is obtained chiefly from Belgium, Spain and Ireland.

It is also employed in another important manufactory, viz: Copperas, extensively used in dyeing. For half a century the American market has been supplied by copperas manufactured from a bed of pyrites in Stafford, Vermont. Its production is still more simple than that of sulphuric acid. The pyrites is broken into small pieces, sometimes but not necessarily previously baked, and placed in heaps beneath sheds with water-tight floors. It is then from time to time moistened with water, which favours the oxydation of the mass. After some time it heats, crumbles, and is converted into a soluble sulphate of iron, which is dissolved out by water, and from the floor led into boilers in which it is evaporated to such a point that by cooling, crystals of sulphate of iron, better known as Copperas, are deposited. From its peculiarity of thus spontaneously heating when in heaps, it has obtained its name pyrites, from the greek word *pur* fire. The time will come sooner or later when our increasing industry will warrant the establishment of large chemical works in the Dominion, and then the long neglected and despised pyrites will become available. I would add that large quantities of sulphuric acid are now used in refining coal oil and petroleum.

The pyrites of the Laurentian rocks, *i. e.*, gneiss and limestone, has frequently been found to contain small portions of nickel, and cobalt, which metals might be profitably extracted from the residue left after its calcination in the manufacture of sulphuric acid. Cobalt ore is rare, and much sought after, its price being about \$3 per pound in England. An estimate of the expense of extracting cobalt from pyrites and the marginal profit resulting from it is shown by Sir Wm. Logan to be as follows:—Expense of excavation, calcining, freight, &c., \$14 per ton. That amount, as ascertained by analysis of pyrites taken from near Brockville yielded at the rate of 8 lbs. cobalt—worth \$24—leaving a clear profit of \$10, without taking into consideration the sulphuric acid obtainable during the process.

Within the last eighteen months a rich deposit of another valuable mineral has been discovered within four miles of the village

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of Buckingham, viz., galena or lead, associated with sulphate of barytes. Its discovery was entirely accidental, and though the veins have only been uncovered for a short distance, sufficient idea has been gained of their richness to warrant extensive operations. Sulphate of barytes, familiarly known as white lead, is extensively employed in the arts as a paint, both by itself and for mixing with other pigments as an adulteration, for which purpose it is fitted by its great weight. It enters into the composition of the cheaper kinds of white lead paint, to the extent sometimes of 75 or 80 per cent. For this purpose the native sulphate of barytes is crushed, and if necessary boiled with diluted sulphuric acid to remove any metallic oxide which may discolour it, after which it is ground to a fine powder. A much finer article than that obtained by simply grinding the mineral, is prepared from the sulphate by igniting it with charcoal, and then obtaining a precipitate by the use of sulphuric acid. This is called permanent white, and is used as a water colour, and in the manufacture of paper hangings, for giving a peculiar glossy surface. The consumption of the ground sulphate of barytes is very considerable, as much as two tons per week being used in South Lancashire; about 4,000 tons are sold annually in the U. S., partly imported from Europe, and partly obtained from parts of their own territory. The appearance it presents in its native state is an opaque white, which can be easily cut or scraped, not unlike hard putty. The veins discovered at Buckingham are from 6 to 14 inches wide, several of them containing strings or bands of galena, or lead ore. The locality in which the discovery has been made is very favourable for working, being on the summit of a bluff or steep bank surmounting a small creek, thus affording natural facilities for draining off the water from the workings. The property on which the discovery has been made has passed into the hands of a Quebec firm, but the works are temporarily suspended; it is to be hoped however that operations will be resumed in the Spring, as there is every indication of rich returns, and it has been ascertained in addition that the lead is argentiferous, or impregnated with silver. I have been unable to obtain any statistics relative to the assays made from this locality, the company maintaining a remarkable reticence on the subject.

A company has been formed in Peterborough to develop the galena veins of the township of Galway, distant twelve miles from Bobeaygeon. On the west half of lot 20, Concession A. there are several veins of galena and sulphate of barytes, with a cross vein of iron running N. E. and S. W. and at a distance of 30 feet from that a vein of zinc. The excavations made so far have been through slate. At the extremity of one of the tunnels there is, in miner's parlance, a blow up or chimney containing molten lead, incrustated with what is supposed to be antimony. The galena is believed to hold a large amount of silver.

Amongst the other economic minerals of the Ottawa valley, may be cursorily mentioned Steatite or Soapstone, used for lining furnaces, and when ground to a powder and mixed with oil, constituting the so-called fire-proof paint. Kaolin, or porcelain clay, is met with in a few localities, and feldspar which enters largely into the composition of porcelain, is found in considerable quantities in granitic veins among the Laurentian rocks, and in some places of sufficient purity to be available for the use of potters. Specimens of sandstone from Vaudreuil at the London Exhibition, attracted the attention of English glass manufacturers, who import a similar material from the United States, and who made enquiries as to the price at which the sandstone could be furnished in England, though without as yet leading to any direct results. To establish a trade in our minerals with England—and there is no reason why it should not be extended to other manufacturing countries of Europe,—it is necessary that their adaptability, cost, and above all the richness of the deposits of most of them, should be prominently brought before those countries, and every information circulated respecting them. I would respectfully call the attention of the Emigration Department to the circulation abroad of works on the resources of our Dominion, especially in mining and manufacturing districts—for attention is now being given to items of interests from Canada, and the apathy which heretofore existed in regard to Canadian affairs, has now in England given way to a desire for accurate data. Time was (and not so many years ago either) when about as little was known in the midland counties of England respecting Canada, as there was about Walrussia or Kamschatka. But the opening of the Grand Trunk

Railway, and the visit of the Prince of Wales, initiated a new order of things ; and the surplus money of England always floating about for investment, began to find its way into our midst. Once get English or European capitalists interested in our mineral products ; let them see that labour and everything else is reasonable, and that the deposits of some at least of our minerals are of almost boundless extent ; let them see a prospect of fair open dealing, as of man to man, and I have no hesitation in saying that a connection could and would be secured with Britain, that would rivet still closer our ties to the mother country, and bind in still closer union the British race of the two continents.

The early days of mining in Canada, were blighted by the action of speculators—men whose business it was, not to work a mine, but to form a Company, sink a shaft a few feet, and then transfer the shares at a fictitious value to others, who again disposed of them in their turn as long as purchasers could be found, till the bubble burst. The very name of mining shares, was a terror to bank managers. Lanman who wrote so ably on the Copper regions of Lake Superior in his "Wanderings in the wilds of North America" speaks of the population of that district as consisting of dishonest speculators, and scheming adventurers. But the systematic course of operation now being carried on under the guidance of able mineralogists, with a view to realizing profits not not so much from the sale of shares in the mine, as from the minerals produced, is already yielding in most instances remunerative returns, and a source of wealth is opened which must swell the revenue of the country, and build up settlements in localities where otherwise the sterility of the soil forbade permanent improvements. Take for instance the Graphite mines I have described ; compare the section of county in which they are being worked now, with what it was a few years ago. Then the population were dependent upon the lumbering firms, who took the produce of the farmer at what prices they chose without consulting the producer, who was invariably in debt to them. Money was very little used, and the whole country bore an air of poverty and hardship. Go now through the same section, and a very different prospect is presented. Produce of all descriptions commands a high price in cash ; teams which had to be sent far up the rivers

for lumbering in the winter are now in demand for drawing ore from the mine to the crushing mill; the farmers are rapidly accumulating if not wealth, at least a sufficiency of means to which they have hitherto been strangers; the influx of strangers connected with the various workings is swelling out the population of the villages, and the additional revenue derived in the form of taxes from the increased value of the lands, add to the municipal wealth, and the lands surrounding the district are rapidly rising in value, and now command a price, that a few years ago would have purchased the best lands in the West. When the graphite mines have assumed larger proportions, that mineral next to gold, will be found to be the most valuable of all our Canadian deposits.

Associated capital for the development of all our different minerals, is the only way to ensure success; and when we see the names of some of the leading merchants and capitalists of our Canadian cities at the head of a Company, men of reliable standing in the community, who have a purpose in every undertaking, and the welfare of their country at heart, for with *its* advancement they advance themselves further, no apprehension need be felt for the ultimate results of their undertakings when systematically carried on. The formation and existence of Companies has this further advantage, that it enables those who have the *means*, to assist those who only have the *will* to prosecute these enterprises; and every man who takes stock or becomes a shareholder is in addition to his own personal investment, a benefactor to the country. If the residents of the Dominion disregard the wealth beneath their very feet, we may rest assured that the stranger will not be long before he assumes a title to it; and it is scarcely right that the treasures from the store-houses of our rocks should be removed from the land that yields them, to swell the coffers of another people. The majority of our Companies are in a prosperous state, and if information of an interesting nature respecting this branch of industry was diffused more generally, an interest would come to be taken in mining matters by a class of persons who now have perhaps no idea where the products they see in daily use are procured. Circulate

information freely through the press,—by pamphlet or by lecture,—and it will repay itself a hundredfold and more.

As further investigations are made of the ridges of land lying between the du Lièvre and Gatineau rivers, there is no doubt that more valuable discoveries will be made ; and I am firmly under the conviction, from specimens that have come under my observation, that auriferous quartz, similar to that of Madoc will be found on the du Lièvre at or near the High Falls, or in the vicinity of White-fish lake. It is there that the same formation which occurs in Madoc, crosses the river from the Laurentides. The whole of that section of country is comparatively unknown except to the lumberer and trapper, and offers a fine field for the explorer and the mineralogist. It is easy of access, the river being navigable up to the Falls, and with a short portage there, for many miles above them. Time will be when the whole country around this our capital will be systematically mined, and it is fervently to be desired that the proposed Ottawa Ship Canal from Lake Huron become a matter of fact, and not of theory. Passing as it would through a country whose geological formation is always the cradle of mineral wealth, it is almost impossible to foresee the vast influx of population which would be attracted there. Success to the brawny arms and stout hearts of those who will become the pioneers of that route ; may they reap the profits which must accrue from the treasures of the rocks ; let our Government afford them every facility in its power, and let us one and all bid them in their work—God speed. I would fain allude to and dwell on the gold fields of N. S. and her vast coal fields, so soon to form a stronger link in the chain of our Unionism, than any legislation, but time will not permit.

In conclusion I would say that I have no interest in any mine or land ; nor am I in any way pecuniarily interested in mining matters. I simply speak for the country—for the hard-working miner, and for those whose faith in these hidden resources of our Country has induced them to embark in these enterprises. God in his infinite goodness has filled the bowels of our land with hidden glories and precious things, as he has clothed the ripper fields with beauty and precious food. The material of this universe by which we are surrounded is full of the evidences of the

Creator ; they crowd upon us from every side—wherever we turn our eyes, there we read them. They are inscribed on the blue dome of Heaven, and on the gorgeous cloud turrets of the western sky—on the rocky cliffs which record the memories of long buried ages, and on the green sods which cover the last new made grave. The materials with which the Eternal writes his name, and the style of his handiwork are evermore the same ; whether in the golden characters of the mine, or the metallic lustre of the hills, science recognizes its Author's hand, and admires with reverence his matchless autograph.



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