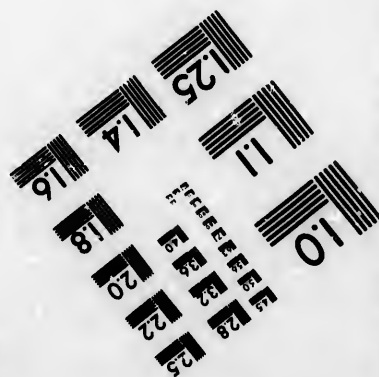
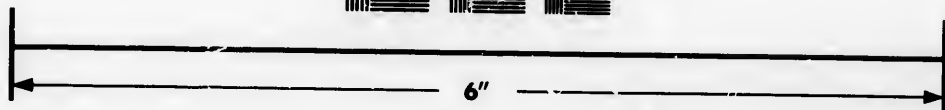
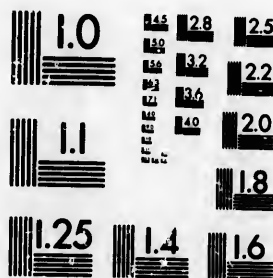


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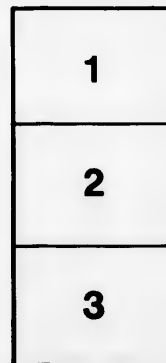
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REPORT
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MINES AND MINERALS
OF

New Brunswick,

WITH
AN ACCOUNT OF THE PRESENT CONDITION
OF

MINING OPERATIONS IN THE PROVINCE,

BY

L. W. BAILEY, A. M.

PROFESSOR OF CHEMISTRY AND NATURAL HISTORY IN THE UNIVERSITY
OF NEW BRUNSWICK.

PRESENTED TO THE LEGISLATURE BY HIS EXCELLENCY THE LIEUTENANT GOVERNOR.



FREDERICTON.

G. E. FENETY, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY.

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REPORT

ON THE

MINES AND MINERALS OF NEW BRUNSWICK.

TO HIS EXCELLENCY THE HONORABLE ARTHUR HAMILTON GORDON, C. M. G.
Lieutenant Governor and Commander in Chief of the Province of New Brunswick,
&c. &c. &c.

MAY IT PLEASE YOUR EXCELLENCY,

In accordance with an appointment which I had the honor to receive from Your Excellency, and instructions given at Government House, June 1st, 1863, to spend a portion of the summer in a scientific tour through the Province, I have the honor to submit the following Report.

Your Excellency having desired that the main object of this exploration should be the collecting of such facts and materials as would best advance the knowledge and development of the mineral resources of New Brunswick, the question at once arose as to which route through the Province would be most likely to yield tangible and profitable results. Two courses presented themselves: first, to follow in the beaten tracks of those who have already devoted much time to the exploration of the Province, and endeavor to collect such facts as may have come to light since the termination of their labors; or secondly to try the exploration of new and comparatively unsettled districts, which though more difficult of examination might lead to more important results.

Having from six to eight weeks at my disposal for the purpose, I determined to try the latter plan first, choosing a route before unexamined, and yet leaving sufficient time to visit the better-known mineral districts, in case the exploration of the wild lands should be found too difficult.

In the choice of my route I was influenced by a number of considerations. Being entirely unacquainted with more than a very limited portion of the Province, I was obliged to be guided by the general geological features of the country, and by the reports of those who have given its study their special consideration. The numerous recent discoveries of ores, in various parts of the Province, also naturally suggested the localities most likely to be of interest. A glance at the geological map of the Province (see Map accompanying Johnson's Report) with reference to the localities where successful operations have been so far undertaken, will at once show that these localities have a very definite and similar geological relation, no matter what may be the part of the Province in which they occur. So far as metaliferous rocks are concerned, they are confined, as a rule, to what is known as the Cambrian series of rocks, which cross the Province above and below

the great coal field, and to the metamorphic and trap rocks of the lower Counties. Considering the present state of mining operations, and the numerous valuable discoveries made in the neighboring Province of Nova Scotia, in Canada, and Maine, I determined to avoid for the present the carboniferous area, and by skirting its borders, above and below, to pass over those geological formations above mentioned which would be most likely to yield good results.

Woodstock and Bathurst have long been known as among the most productive and interesting localities of which this country can boast. Connecting the two, traversing districts represented by all travellers as among the most remarkable in the Province, and passing successively over a series of six different formations, are the Rivers Tobique and Nepisiquit. The former of these had already been examined to a considerable distance from its mouth by Dr. Gesner; but that portion nearest to its source was still unexplored, while so far as I could learn, no scientific examination whatever had been made of the Nepisiquit, with the exception of the immediate vicinity of Bathurst. In consideration therefore of the fact that by a passage of these rivers I should pass through comparatively unknown districts, and that I should thus reach a point, Bathurst, which I thought an important one to visit, I determined to adopt this course.

I regret to say, that so far as discoveries of useful metalliferous deposits are concerned, this portion of my tour was unattended with practical results. The peculiar mode of travelling, the ignorance of Indian guides, the state of almost unbroken wilderness prevailing in this part of the Province, and the fact that these rivers are in almost all parts skirted by wide belts of uncleared intervals, will at once explain how impossible it is, in the present state of that section, to make anything like a careful exploration. It is only where the river directly intersects rocks *in situ* that any examinations could be made, and even these were often attended with danger as well as difficulty, from the fact that the cross sections of the strata thus exposed are also the sites of the most dangerous and violent rapids. I would not, however, have it supposed that the exploration of these streams was wholly without results. So far as examinations *could* be made in my limited time, they were invariably made with the greatest care. The relations of the successive geological formations, so far as they are exposed by the course of the rivers, were carefully noted, and were they only of scientific interest, their value would be considerable. It must, however, be remembered that even those observations which do not of themselves suggest practical results, while they serve to increase our general knowledge, give also a surer foundation for a determination of those laws, which it is for the interest of all practical men to ascertain and follow. The distribution of mineral ores is as much controlled by principles of *order* as the distribution of animals or plants, and therefore every observation which tends to increase our knowledge of the position and relations of the rocks which bear them, tends also to their direct development.

The relations here referred to, and a variety of other facts, collected during this portion of my tour, being somewhat foreign to the more immediate object of this Report, I have, at Your Excellency's suggestion, embodied them in the form of a scientific paper to be presented for publication to the New Brunswick Society of Natural History. This Report, as soon as completed, will, with the specimens collected, be laid before Your Excellency.

While, however, the greater number of the observations made on the Tobique and Nepisquit are of the general character above described, some of them, from the importance of the subjects to which they relate, deserve brief mention at the present time. A few of these I shall proceed to notice, dwelling only so far upon their details as may be necessary to explain the circumstances to which I have reference.

Accompanied by three volunteer friends, I left Fredericton on the 26th of June, and arrived at the mouth of the Tobique on the evening of the 27th. At this point I met with a very intelligent person, who showed and lent me a very fair specimen of gold, which was said to have been found on the shore of the Wapskahegan, a tributary of the Tobique, entering the latter some twenty (?) miles above its mouth. The specimen, which accompanies this Report, was said to have been picked up on the beach of the Wapskahegan, about three miles from its junction with the Tobique, by a man named Essington, at present, I believe, living in Fredericton. The original was a single piece of auriferous quartz, about the size of half a cannon ball. From this the present specimen was broken. The formations where the lump occurred were, as I afterwards ascertained, of red gypsiferous sandstone. The nearest formation of a different character is about twelve miles above, where some slate appears, while still farther up, according to the statements made to me, slate rock and granite boulders occur in the bed of the stream. It is now some years since the date of the alleged discovery, and nothing definite could be ascertained as to its probable truth. Of course, the specimen, if actually found as stated, must have been washed down from auriferous rocks nearer the sources of the stream. The locality has since been examined by the person to whom I am indebted for the present specimen, but without results. The same person also informed me that on the Serpentine, a part of the right branch of the Tobique, there are hills of white quartz, containing much pyrites, and occasional minute quantities of gold. Near these are beds of brownish slates and sandstones, described as glistening in the sun (probably from the mica or pyrites which they contain.) It was my strong desire to visit and examine both the above localities; but upon our arrival at the Wapskahegan, we found the water of that stream too low for navigation, while the limited time which I felt justified in devoting to the examination of these wild lands, prevented me from ascending to the Serpentine, situated as it was nearly fifty miles aside from our direct route across the Province. I cannot help thinking, however, that the occurrence of auriferous rocks among the primary slates near the head-waters of these and other neighboring streams, is highly probable. I am led to this belief by the

very candid information of intelligent and practical men who have visited the district, and also by the fact of the occurrence of numerous washed boulders of quartz-bearing talcose and chloritic slates at different points in the bed of the Tobique. I was also informed at this place of the occurrence of crystallized oxide of iron, at the mouth of the Aroostook, but no specimens were shown me.

Four Indians, with canoes, having joined us at the mouth of the Tobique, we left the village on the morning of the 29th of June, and reached its source in Nictor Lake on the 5th of July.

I have already alluded to the belts of intervalle, which for a large portion of its length form the banks of the Tobique River. These intervalle lands, while they forbade any attempt at geological exploration, could scarcely fail to attract attention for their evident fertility, and for the very remarkable luxuriance of their vegetation. Elms and mountain ash, attaining an enormous height, arbor vitae, spruce, fir, birch, thorn and poplar, were very numerous, while the shrubs, herbs and ferns, some of the latter attaining a height of four or five feet, were generally of a kind to indicate great fertility of the soil supporting them. When travelling up the lower portion of the stream, sitting in a canoe with the temperature somewhat above 90°, one can scarcely conceive that such a place should be visited by the extreme degrees of cold which render the lands of New Brunswick so dreaded by the settler. It seems strange, too, that settlers should prefer the thin strips of intervalle, and even the sides of rocky hills, nearer the sea-coast, rather than these luxuriant lands, where ample water facilities for saw mills and abundant mineral manures seem to offer so many attractions.

Having been told at the Tobique village of the occurrence of lead ore upon the bank of the river, I landed and examined the spot pointed out by my guide as the locality spoken of, but failed to discover any metal or even a rock which would probably contain one. My guide, however, was evidently mistaken in the position of the locality, as I have heard the fact of the occurrence of lead here repeated in various quarters. This spot is said to be in the vicinity of the "Narrows," on the south side of the river.

Although well known, I cannot refrain in my allusions to the Tobique from referring to the immense beds of gypsiferous sandstone, which form so wild and striking a portion of this river's scenery. Both below and above, as well as at the mouth of the Wapskahegan, high cliffs of this rock appear, and the beds of which they form abutments must be of great extent. They pursue a uniform direction N. 62° E., dipping about 5° to the South-east, and consist of white, red and variegated gypsum, gypsiferous sandstone, and red conglomerate. The gypsum occurs in great purity at the mouth of the Wapskahegan, and is of both the compact and fibrous varieties. Specimens were selected which accompany this Report. At Plaster Island, the cliffs of gypsiferous sandstone have, according to Gesner, an elevation of 135 feet. The strata are but little distorted, although marked by many joints, and the whole is soft and crumbling. The cliffs are almost perpendicular and must

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be exceedingly dangerous, covered densely as they are with forest, to all who approach the stream from above. The gypsum is excellent, but it would require adventurous hands to remove it from those shelving precipices.

The fertile portions of the Tobique lands may be considered as included between its junction with the St. John and the locality known as the Forks, where the right and left branches and the River Marmozekel combine to form the main stream. Above this point, pursuing the *left* branch (so called, although geographically the right,) the country is comparatively sterile, supporting a more alpine vegetation than that below. After pursuing for many miles a very tortuous course, the stream at last opens out into the broad expanse of Niotor Lake,* a beautiful sheet of water, completely locked in by high granitic mountains. The geology of this section and of the Upper Tobique will be elsewhere referred to. It is sufficient to say here that I found nothing either at the head waters of this river or of the Nepisiquit, indicating the occurrence of metallic ores or other valuable deposits.

Crossing the Portage, between the Tobique and Nepisiquit, on the 6th of July, we continued our course and reached Bathurst on the 10th. The descent of the latter river was too rapid to admit of such careful observations as were made upon the former, yet wherever an examination of the shores seemed to promise results of interest, I invariably stopped for that purpose. The upper portion of the river is confined to a geological section similar to that at the head of the Tobique, and the vicinity of the Niotor and Nepisiquit Lakes, being composed of high and often mountainous ridges of igneous rocks, such as granite, syenite and porphyry. Among these I may mention one as especially remarkable. The locality referred to is, perhaps, some fifteen or twenty miles above the Forks of the Nepisiquit, and probably ten or fifteen above the Portage stream, which connects with the waters of the Upsalquitch and Restigouche. I am unable to define the position more exactly, having no basis of comparison, and being entirely at a loss to know the rate at which our canoes were travelling with the current.

While descending the river in this vicinity, my attention was attracted, even in the distance, by the intensely reddish color of the mountains. Destitute for the most part of vegetation, and showing to their very summits only bare and rugged precipices of the same red tint, they form a very striking feature in the landscape. Near the base of one of these we were carried by the stream, and so remarkable were its features that I determined at once to examine it more closely. To accomplish this was a matter of some difficulty, but my trouble was well repaid. Approaching by a lumberer's path, obstructed with fallen trees and twining runners, what we supposed to be the natural slope of the mountain, just below the cliffs, we were suddenly stopped in our course by a tremendous chasm, from fifty to seventy feet deep, opening in our path. I have seldom seen a spot of a more singular description. The side by which we had approached was steep and broken, but covered with vegetation, while the opposite bank, which was

* For remarks on the impropriety of this name, see Pages 8 and 9.

almost perpendicular at its base, and which reached high up the mountain side, was one dense mass of huge detached blocks of red felspar rock, or felspathic granite, without a sign of vegetation on its rough and broken face; indeed there was scarcely a shrub to be seen on the whole mountain side, while this strange abyss, apparently formed by some sudden upheaval, produced a picture of singular wildness.

The locality is as remarkable in its geological conditions as in the curious landscape which it now presents. The two sides of the chasm are in the most marked contrast, and have evidently been produced at very different geological periods. The first or lower side (the one upon which we first approached) is composed of a fine, compact, and grayish granite, (or more properly syenite,) much weathered on the surface, and covered with vegetation. The opposite bank, on the contrary, is of a deep red color, being composed of a fine grained felspathic granite, or *granulite*, (there being little mica or hornblende present,) and from the bottom as far as I could see up the mountain side, bears scarcely a shrub on its rugged cliffs. The rock is but little weathered in comparison with the other, and has probably been raised by an upheaval of much more recent date. I was unable to make as thorough an examination of the surrounding hills and the relations of these rocks as I should like to have done, but I cannot help thinking that this locality will yet be studied with much interest, when the geology of this section of the Province shall have been more carefully examined.

I am unaware that this locality has ever received a name, this portion of the Province being so little known, even to the lumbermen. I would therefore venture to propose, for convenience of reference, that it henceforth be known as the "Felspar Mountain," a name eminently descriptive of its peculiar character, and one free from the objections which so often characterize the names of natural objects. It is highly desirable that some more systematic rule should be adopted in the nomenclature of our natural scenery, than that which is now employed in the Province. Few probably are aware of how much importance this subject is, or to what an extent all rules of propriety and elegance are at present disregarded in its application. A few remarks upon this subject may not be deemed amiss.

I have already alluded to the confusion of names connected with the branches of the Tobique River, arising from the difference in the popular and the geographical methods of describing rivers. Another mistake has arisen in the same locality from an improper understanding of the Indian name. What is generally known as the Left Hand Branch, and also the lakes from which it takes its rise, are known by the name of Nictau, or Nictor. Now the proper significance of this word is "a place where two or more streams meet," or "a confluence of waters," and is therefore entirely inappropriate to either of the above named places. The Nictor is really the "Forks," but has been extended to the river and lake, through a misapprehension of the meaning of the term. Such mistakes should be carefully guarded against. A more fruitful source of difficulty, and one which seems

to be steadily on the increase, is the habit of repetition, giving the same name to numberless different places, without the slightest prefix to distinguish them. Thus we have in the Province as many as two Grand Lakes, two or more Moose Mountains, two Bald Mountains, two Eel Rivers, two Black Rivers, three Pokiocks, and *five* Salmon Rivers. Of the latter there is one in Albert County, one in Saint John County, and another in King's County, all three within less than thirty miles of each other. This is a constant source of confusion, and one which, though difficult to remedy as regards localities already named, should be carefully avoided in the naming of those which are new. The names, moreover, should be chosen with some special reference to the character of the object named, whether river, lake, or mountain. The mineralogical character of the latter, its outline, or its vegetation, will afford a familiar and a characteristic name; while for the two former, the shape or size, or the character of their fauna, would readily suggest a fitting title. Indian names, when readily pronounceable, are greatly to be preferred to *any* others, being as a rule suggestive of some characteristic feature, as well as pleasing to the ear. Some of *these* are objectionable on account of their length, or the uncertainty as to their meaning or the proper mode of spelling. Of the former I may mention Quatawamkedgwick, or Guadamagouchoni, and Augéanquapsoiegan Rivers, and Petteiguagguamak Lake, while of the latter a river in the vicinity of Bathurst will afford a good example. It is ordinarily spelt "Tattagouche," but one map has it "Tetea Gauche," and another "Tête a gouche." It is impossible to decide whether the name is of French or Indian origin, and even those living on its banks were unable to inform me of the meaning or true spelling of the name. Even this, however, is preferable to such uncouth English names as "Grog Brook" and others of a like description, which though much less frequent than in the neighboring State of Maine, are yet not wholly wanting in the Province.

The igneous rocks, above referred to, extend for a considerable distance below the sources of the river, and are succeeded by slates and schists of Lower Silurian, Cambrian, or Taconic age. The precise geological relations and relative age of the rocks referred to I was unable to work out, my time being exceedingly limited, and no opportunity being afforded to search for fossils, by which alone such facts could be determined. Probably all three of the formations named are intersected by the Nepisiquit, but it was chiefly in the two latter and more particularly in the clay slate and mica schist formations, that I was enabled to observe any facts of interest.

While descending the main river, at a point about 18 or 20 miles above the Grand Falls, I noticed upon the left side of the stream, a bold cliff of bright red slaty-looking mineral, of so deep a color as to induce me to land for the purpose of examining it. At first sight I supposed it to be a bed of earthy haematite, a valuable ore of iron, but on further examination found it to be too slaty in character to belong to that mineral. It has, however, associated with it, a quantity of impure red oxide of iron, of a fine red color, and

approaching in softness to mineral paint. The locality is one of interest as indicating the probable presence of other ores. The slate in some respects resembles that of the manganese-bearing rocks on the Tattagouche, and may like them be found productive. I would advise those whose business may lead them to the vicinity, to give an extended examination to the spot. There are also some fine looking slates in the same neighborhood. The slates are in many places calciferous and apparently manganesian, like those at Woodstock, and I have little doubt that valuable beds of haematite may be found in this vicinity. From this point, about sixteen miles above the Falls, to the immediate vicinity of Bathurst, the geology of the country is so interesting, and has so direct a bearing on the study of the metalliferous rocks of the Tattagouche and other neighboring streams, that it may be well to mention here its leading features.

A few miles below the red slate cliffs are ferruginous strata, dipping westward at a high angle on the right bank of the river, and beyond them on the left, good slates. About here a great many granitic boulders appear in the bed of the stream, which is very rapid. The country is rocky and desolate, and, judging from the river banks, incapable of cultivation. Granite ridges appear *in situ* and seem to have displaced and been thrust through the other strata. The violent eddies and rapid currents in this portion of the stream make careful observations very difficult.

About five or six miles above the Falls, there is a gorge very similar to that at the mouth of the Tobique, and probably formed by the intersection of the same series of rocks. Like the latter it is called the "Narrows." The stream diminishes in width and passes rapidly through a gorge, half a mile long, of slates and slaty sandstones with some limestone, dipping into the bed of the river at an angle of 60° to the northward, the river here running about north east. The course of the stream is nearly at right angles to the strike of the slates, which form precipitous cliffs from 50 to 75 feet high. To the slates, at some distance below, succeed beds of heavy ferruginous sandstones, these in turn being succeeded by the contorted slates which form the wild scenery of the Nepisiquit Falls. Upon these I need not at present dwell. I may only state that all the rocks in this vicinity are highly ferruginous, the slates being sometimes micaceous, and at others containing cubical crystals of sulphuret of iron.

Pursuing our way from the Falls, we pass over sandstones and slates dipping westward. Still further, at a place called "The Great Chain" is a portage and fall caused by sandstone rocks in the bed of the stream, with a strike about north and south, with which are associated talcose and chloritic slates, conformable with them. A few miles further down are more laminated sandstones, crossing the stream with a strike N. 40° W., being nearly perpendicular and highly filled with crystals of iron pyrites. With these are again associated ferruginous slates, the whole having a reddish appearance on the exterior, from the oxidation of the iron.

About five miles above the Pabineau Falls are beds of impure red oxide

of iron, (limonite) or clay iron stone, tolerably pure, and crumbling to a red powder, which might perhaps be used as a mineral paint. These beds outcrop on both sides of the river, and indeed this whole district is highly ferruginous. The ochreous beds extend for some distance along the shore, and are seen to overlies nearly horizontal beds of ferruginous sandstone, with small conglomerate and pebble beds, these in turn resting upon granite. It is these pinkish granites, which, in nearly flat and water-worn masses, form the curious and beautiful channels of the Pabineau Falls.

The granite here referred to probably forms a great anticlinal axis, along whose northern side repose the metalliferous slates above mentioned, and on the southern and south eastern similar slates or schists, (from which copper nodules to the extent of some tons are said to have been extracted,) which in their turn are followed by the sandstones and conglomerates, which, near the mouth of the river, form the north eastern boundary of the New Brunswick coal measures. Even *these* are at this point highly charged with copper, and ore (a curious mixture of malachite and lignite) has been removed to the extent of 20 or 30 tons, from the red conglomerate strata near the great Nepisiquit Bridge.

Upon my arrival at Bathurst, I visited in company with Mr. Baldwin, formerly Sheriff of Gloucester County, this very interesting spot, and saw the strata and pit from which the ore had originally been removed. This locality has attracted so much attention from all who have visited it, and has such a direct bearing upon the probable copper bearing qualities of the rocks further inland, (having indeed led to the discovery of the Tattagouche mines,) that I may well in this connection say a few words concerning it.

I have already, in describing the geological succession of rocks as exposed in the Nepisiquit River, stated that the great anticlinal granitic axis at the Pabineau is succeeded by metamorphic slates, and these in turn by the conglomerates and shales of the coal measures. These conglomerates, shales and sandstones, in alternate and nearly horizontal strata, are exposed in the immediate vicinity of Bathurst, on both sides of the river, but more particularly on the right bank, forming bluffs of some 30 or 40 feet elevation. The strata consist of light bluish shales, sandstones, and both fine, coarse, and crumbling conglomerates, and extend for about a mile and a half up the stream. In these, at a point about a quarter of a mile from the Nepisiquit Bridge, the copper was originally found and removed to the extent of 20 or 30 tons. It consisted of grey copper and the green carbonate intimately associated with the mineral called lignite, a peculiar variety of coal. The grey copper by analysis in England yielded 52.5 per cent. of copper, a very productive ore. The pit from which this cupriferous lignite was taken was driven into the bank to the distance of about ten feet in a nearly horizontal direction, but the distribution of the ore being found irregular, and the whole deposit uncertain in its character, the enterprise was abandoned, and the pit filled up with the rubbish at first removed from it. At the time of my visit very little of the pure copper-bearing lignite could be found. The

few specimens obtained were removed from a fine bluish clay, interstratified with the sandstones and conglomerates. These latter, like the lignite, are charged with copper, and a general greenish appearance, due to the weathering of that metal, is seen along the bank for a considerable distance.

This locality has always been most remarkable for the curious association of conglomerates, copper ore and lignite, and many theories have been proposed to account for it. The most probable and the most important one from its bearing on the other metalliferous deposits of this neighborhood is, that the rocks containing the ore have resulted from the disintegration of the primary slates further inland, and that these, being highly copper-bearing, have yielded their metallic contents to the disintegrating agent, (probably water holding certain salts in solution), from which by unknown causes it has again been deposited in the present position. As to its association with the lignite, the latter may have been brought there by the same or similar agencies, and, being organic, may have had an influence in the precipitation of the copper. This would account for the greater abundance of the ore in connection with the lignite than with the surrounding rocks. The most important fact in connection with this theory, however, is that the blue shale and clay above referred to, are exactly what would result from the disintegration of the primary slates to the northward, and that these, therefore, must at some points contain extensive copper lodes. This opinion was advanced by English geologists, without their having had more than a written account of the locality, and it was in consequence of their opinion, thus stated, that an examination was made of the slates farther inland, which resulted in the discovery of the present mining districts on the Tattagouche River. Of these I shall now attempt to give a detailed description, with a few words as to their present condition and future prospects.

Having procured the company of Joseph Kent, an old Cornish Miner, living about seven miles from Bathurst, I proceeded with him to examine this interesting locality.

The mines are distant about eight miles from the Harbor of Bathurst, with which they are connected by a tolerably level and well constructed road, amply sufficient for the transportation of the ore from the mines to the point of shipment. The immediate vicinity of the mines is slightly undulating ground, now tolerably well cleared, and apparently abundantly capable of cultivation. At some little distance back the land is wooded, the trees being Maple, Birch, Pine, Spruce, Fir, and Cedar.

The mines are situated in a gorge 100 feet deep, (according to Kent,) cut by the river through the solid beds of slate, which here cross the stream obliquely to its course. These beds of slates are highly colored, in some parts red, in others deep brown or black, and strongly resemble those which I had seen upon the Nepisiquit, near the Falls, and whose geological relations

NOTE—Mr. Kent informed me that he had once found on Armstrong's Brook, a branch of the Tattagouche, a mass of copper ore lying in the bed of the stream, and weighing 12 cwt., and again some 17 miles up the Tattagouche, some excellent specimens of Lead ore. If these accounts are correct, the districts are well worth an exploration.

I have already noticed. They cross the stream with a strike E. 10° S., having a dip of about 50° towards the South. They are highly charged with iron, manganese, and copper. The iron, existing in the form of the sulphuret, is of no value except as an indication of the presence of other ores, and one means of guidance in their search.

The manganese is found in veins of various sizes, imbedded in quartz, and running without much regularity through the slates, which are everywhere stained with it. The manganese, which is the black oxide, is highly crystallized and affords very handsome and brilliant specimens, the crystals being sometimes as much as half an inch long, and grouped in fibrous, radiating, and stellate forms. The mineralogical names of the ores are *manganite* and *pyrolusite*. The lode-stone of the manganese is both heavy spar and quartz, the lode-walls being slates. The veins run without much regularity through the slates, but do not approach the copper lodes, which may perhaps be an important fact, as some authorities hold that manganese associated with copper has a tendency to "crowd" the latter "out," and finally to occupy its place. There seems, however, to be no such tendency here, and as many of the long established Cornish laws are being daily disproved as regards their application in this country, perhaps the objection is of little consequence. A considerable quantity of this manganese has been removed and shipped to England, where, I believe, it yielded about £12 10s. per ton.

I have said that the manganese does not approach the copper lodes. These latter are, like the manganese, imbedded in metamorphic slates, but there is a marked difference of color between them, the manganese rocks being reddish and approaching black, while those bearing copper are of a bluish tint. The two are conformable—i. e. their planes of stratification are parallel—the manganese being superior. Both are inclined at a very high angle. I may here mention that this bluish tint is the same as that of the clay associated with the copper-bearing lignite at the mouth of the Nepisiquit, and it is undoubtedly from a continuation of this bed of slates that those materials were derived. The lodes containing the copper ore are numerous, there being no fewer than seven within sixty feet, according to Mr. Kent, who seemed thoroughly acquainted with the ground. These lodes are composed of quartz, rocks called "flugan" and "gozzan" by the miners, with "mundic" or iron pyrites, and the ore, copper pyrites. The latter is the yellow sulphuret, said to be worth, according to the late Dr. Robb, as much as £35 per ton. Some of the lodes are five or six feet thick, and branch in various directions. I should have been glad to have given a plan of these lodes, and to have examined their relative bearing, but operations having been suspended and the adits all closed, it was impossible for me to make more than the most general observations. According to the reports of those who have examined the mines as agents for the owners of the property, there is a tendency of the lodes to converge at a point some short distance (250 feet) back from the present face of the cliff. If so, the indications being all

favorable, a rich bed of copper ore might be there found. The course of the lode is, according to the accounts given me, pretty uniformly east and west, the dip being nearly vertical, but at a short distance below the surface turning to the northward. This is an important fact, and will be again alluded to in the description of the copper districts in the lower Counties, and in the general conclusions at the close of this Report.

One of the most important considerations in estimating the value of these mines is the extremely favorable situation with reference to water power. The facilities in this respect are unlimited. In the immediate vicinity of the adits, forming indeed a part of the same slates into which the adits are driven, is a ledge crossing the stream nearly east and west, and forming a fall of about thirty feet. The channel just above the Falls is considerably narrowed, but immediately widens out again below it. Through the solid rock forming one side-wall of the Falls, a tunnel has been driven nearly at the level of the water in the upper portion of the stream, which running through this rocky sluice-way, once turned a wheel of thirty feet diameter. All the operations of pumping, raising ore, washing, crushing and dressing, could easily be performed with the aid of machinery by the water power of this single Fall. Besides this, there is also a brook entering the main river above the Falls, across whose mouth, if a dam were erected, a fall of some forty feet would be obtained. The mine is also very favorably situated for *drainage*, the cliffs being over 100 feet high, and the bed of the river furnishing a natural outlet. Operations have, however, for some time been suspended, the working of the mine having been entrusted to the care of some American lessees, who had intended erecting suitable machinery, but were deterred by the opening of the American war. I am informed by the present owners of the property, that operations were not delayed from any lack of ore, (the prospects being very encouraging,) and that they would probably be soon resumed.

The scenery at the Falls is very beautiful. The rocky bed of the river, the fall of thirty feet, the artificial fall of the water which rushes through its rocky tunnel at the side, the heavy precipices one hundred feet or more high, and the gloomy pits or adits at their base, make a picture well worth seeing, and strangers stopping at Bathurst cannot do better than to pay this and the neighboring streams a visit.

A number of these other streams I visited, in company with Mr. Baldwin, and was in each case well repaid. I may here express my thanks to Mr. Baldwin for the courtesy and kindness, with which, at considerable trouble to himself, he took pains to point out localities of interest in the vicinity of Bathurst, and to give me any information in his power. Among the specimens shown to me by him was one of auriferous quartz, which he had found upon Grant's Brook, a branch of the Little Nepisiquit, several years ago. The piece shown to me contained upon its surface numerous branching veins of gold, and promised to yield, by crushing, considerably more. He had since hunted for more in the same locality, but without success. He

had also an interesting piece of lead ore from the same stream, and also some iron ore from different parts of Gloucester County. It is a curious confirmation of the above stated discoveries, that on an old Nova Scotia Map, made before the separation of the Provinces, there is *lead* marked as occurring in this vicinity. Among the streams which I was enabled to examine I may mention the Little Nepisquit, Grant's Brook and the Nickadoo. At all of these the rocks were of a similar character to those on the Tattagouche and Nepisquit, the streams forming a succession of romantic Falls and Rapids as they work their way backward over the slaty strata. These slates cross the Nickadoo at its Falls, running east and west, and are a good deal injected with limestone and quartz, running nearly north and south. In this there is a little copper pyrites, and I detached from one seam in the rocks a few small bits of galena (sulphuret of lead).

I cannot conclude this portion of my Report without expressing the hope that this section of the Province will soon receive a more attentive examination than has yet been given to it. Although my own very limited experience in mining districts has scarcely been sufficient to make me a competent judge, I may yet say that in no part of the Province have I been so much pleased with the prospects of mineral wealth and the probability of valuable discoveries as in the eastern portion of Gloucester County. Wherever the rivers in the vicinity of Bathurst have cut through and exposed the strata, indications of the metals may be found, and in many cases give to the rocks their characteristic color. I have no doubt that the discovery of extensive and valuable metalliferous lodes would be the reward of a thorough and intelligent exploration of this district. Such an exploration, however, must be of a peculiar character, and occupy considerable time. The country in this portion of the Province is so wild and rugged, the rivers are so difficult of exploration, and the land is so little cleared, that it can only be by the roughest and most laborious toil that satisfactory results can be obtained. No professional naturalist, unless one of unusual vigor, and accustomed to all the hardships of life in the woods, could undertake the task with any prospect of success, and even then a very considerable space of time would be necessary to thoroughly search the field. The examination must be made, in part at least, by *thorough woodsmen*, by men living in the vicinity and acquainted with every hill and every brook. Should a party of these be formed, with reasonable compensation for their labors, and a professed naturalist be added, who, while not himself performing the laborious work of exploration, can yet direct and draw rational conclusions from the labors of his subordinates, I think that results of much interest might be obtained, and which would much more than repay any expenditure incurred in the exploration. I trust that this promising field, although at present for the most part an unknown wilderness, may receive the attention it deserves and soon become the seat of active and prosperous manufacturing communities. Should private individuals feel unable to incur the expense and risk of such a survey, I think that the Government of the Province itself would find it to be their interest to undertake the task.

PRINCE WILLIAM ANTIMONY MINES.

Immediately upon my return to Fredericton, I determined to make a visit to the very remarkable Antimony mine, discovered recently in the Parish of Prince William, in York County. For this purpose I drove out to the vicinity of the Antimony mine, and examined the locality with much interest.

The mines are situated, as above stated, in the Parish of Prince William, York County, about twenty miles from Fredericton, in a depression near the highest part of the ridge separating the St. John and Pokiok Rivers. They are about three miles distant from the St. John River, and about the same from the Post Road between Woodstock and Fredericton. The land rises gradually from the river bank to an elevation of some 300 or 400 feet in the vicinity of the mine, then sinking into a shallow though extensive basin, in which the shafts are sunk. This conformation of the land is somewhat unfortunate for the mining operations, as at present conducted, this ridge forming a barrier to the water-shed, and retaining the water in the basin above alluded to. If, however, the mines should ever be extensively worked, this objection would be of little weight, as drainage might then be easily effected towards the northward, the land falling in the direction of Prince William Lake. At present this portion of the country is not held by the Mining Company.

The difficulties of drainage were, at the time of my arrival, the principal obstacles to active operations, which had, in consequence, been temporarily suspended. It was only with difficulty, therefore, that any observations could be made or facts determined. Indeed my observations were restricted wholly to surface indications, the shaft being at the time filled with water. I was informed, upon the ground, that a greater number of hands was required for keeping out the water than for mining and raising the ore. The bailing apparatus was, however, of the rudest description, not even horse or ox power have been employed for the purpose. I believe it is the intention of the company to procure a steam-pump, and at an early day to resume operations; should this be done, I shall visit the Mine again, and make further observations.

The land in the immediate vicinity of the works is now under cultivation, but has until within a comparatively recent period been uncleared. It is for that reason mainly that the discovery was not sooner made. Near the summit of the hill above alluded to, is a belt of primary rocks, and associated with these are the Antimony lodes. The rocks are mostly covered with soil, rendering their relations doubtful, and over the surface are strewed a number of loose boulder rocks. Some of these are of finely crystalized white and colored quartz, sometimes stained red with oxide of iron, and containing imbedded crystals of specular iron and chlorite.

The shaft of the mine is now protected by a substantial wooden building, and in this are piled considerable quantities of ore, taken at different depths, and giving a fair idea of the richness of the deposit. The shaft itself is about 8 x 10 feet in dimensions, and is sunk on the line of the lode, the latter having

a dip of about 45° to the northward. This would be an inclination of about twenty-five feet in every fifty. The strike of the vein is N. 70° W.— Another lode has been found near the first, but is not sufficiently explored to ascertain its precise direction, which is probably nearly parallel to the above. About half a mile from this, in a direction westward by north, three other veins appear, but had not been thoroughly explored.

The rocks composing the hill itself in the vicinity of the mines are talcose and common slates, and a little chlorite. The rock above and below the lode is slate, the "hanging wall" being comparatively soft, the "foot wall" on the contrary exceedingly hard; this is near the surface. At the bottom of the shaft is found a fine, compact, even-grained variety of honestone, (or soapstone,) while the ore itself is imbedded in white crystalline quartz. The ore is the crystallized sulphuret of antimony (stibnite,) and ramifies through its matrix in thin veins and bunches. It is also found entirely free from any gangue, perfectly pure and brilliant, in masses of considerable size. The quartz is of a pearly, sometimes translucent, whiteness, and frequently exhibits a tendency to break into flat parallel layers of half an inch thickness or more. The surfaces thus laid bare are generally "drusy" with minute crystals of antimony, while, at times, the crystals, associated with transparent ones of quartz, attain considerable size, and afford beautiful and very brilliant cabinet specimens.

The crystallization is radiating and divergent. When in mass it is finely granular, and sometimes columnar. On the surfaces of broken quartz, small, flat, deeply striated crystals may be found which are slightly flexible. Some of the minute crystals imbedded in the quartz show indications of lead, being probably sulph-antimonides of that metal, but the quantity is small.

I have felt great interest in the development of this antimony ore, and in all the circumstances connected with it, not only on account of its intrinsic value, and the revenue it may be the means of bringing to the Province, but also because it has hitherto been considered as remarkably rare in America. The only localities before known on this continent are *Carmel, Penobscot County, Maine*; *Cornish and Lyme, N. H.*, and *Soldiers' Delight, Md.* In each of these its quantity is very limited. It has also been recently announced as occurring in quantity in Canada, but I have no authentic information concerning the new discovery. As the metal in its natural state is so little known, it may be worth while to say a few words as to its appearance and uses, and the best modes of distinguishing it from other similar ores.

Gray antimony, or *stibnite*, is the principal ore of antimony, the pure metal being rarely found. This stibnite is a chemical combination of antimony (74,) and sulphur (26,) and is found associated with ores of silver, lead, zinc, and iron, the matrix being heavy-spar or quartz. It resembles, when first dug, the common ore of lead, *galena*, but unlike the latter loses its fine lustre on exposure, and tarnishes to a blackish grey, sometimes, as in the case of the Prince William ore, assuming iridescent tints. Antimony ore may be very readily recognized by its color, by its extreme fusibility,

(melting in the flame of a candle,) and by giving, when heated on charcoal, white fumes and an odor of sulphur. If powdered and boiled in a solution of caustic potash, it dissolves, and if to the solution an excess of acid be added, a yellowish-red precipitate is at once thrown down.

None of the American localities of antimony have yet proved of much value. Most of the ore of commerce has been obtained at Schemnitz and Kremnitz in Lower Hungary, "where it is associated with ores of silver, lead, zinc, manganese, and some gold." From this locality about 6000 quintals are annually raised. It has been found in France, and also in Cornwall, in Great Britain; but in the latter locality, from its intimate association with lead, and the difficulties attending the separation of the two metals, its production is not found profitable. Borneo is another celebrated locality where it exists abundantly, and from which it was brought in considerable quantities to Boston, and there reduced. At Borneo, as in Hungary, it is said to be associated with a considerable quantity of gold. It has been stated to me, by parties connected with the Prince William works, that gold has also been found there, and one fair piece of auriferous quartz was shown to me, which the possessor assured me had been picked up on the surface in the immediate vicinity of the mine. If this be true it is an additional incentive to active operations.*

"To obtain the crude antimony of the shops, the ore is placed in crucibles, having a hole at the bottom, and these are inserted in other vessels; heat is applied above, and the ore melts from its gangue and flows into the vessel below, where it becomes solid. It is not altered in composition. It is reduced by carefully roasting the crude antimony in a reverberatory furnace, and thus obtaining a grey oxide. This oxide is then mixed with a tenth of its weight of crude tartar, placed in large melting pots and heated in a wind furnace. The metal antimony, (called *regulus* of antimony,) is thus obtained pure, excepting generally some little iron. By melting it again with one fourth its weight of oxyd of antimony, the impurities separate and form a slag above, leaving the metal beneath. It is a silver-white, brittle metal, coarsely crystalline in texture. It fuses at about 800° F."—*Dana's Mineralogy*.

The applications of antimony in the arts are not numerous, nor is the demand likely to be very rapidly increased. From all I can learn, however, there is, at present, nearly a monopoly of the business in other countries, and if the ore can be found sufficiently abundant, it cannot fail to be remunerative, especially if associated with gold as above stated. The principal uses of antimony at present are for the manufacture of type-metal, (1 of antimony to 4-12 of lead, with a little tin or bismuth,) Britannia metal, (100 of tin, 8 of antimony, 2 of copper and 2 of bismuth,) and for various medicinal purposes, as wine of antimony and tartar emetic. With tin it forms the metal on which music is engraved.

*It is stated in the last Report on the geology of Maine, upon the authority of Prof. C. H. Hitchcock, geologist of the survey, that the antimony of New Brunswick occurs in a mica-shist formation, and that this is the same as that of similar beds in Maine, in which gold has to some extent been found.

The Prince William ore, judging from all the indications yet observed, is very abundant and of excellent quality. The space over which its indications have been already traced, is fully half a mile in extent, while it is probable, the ore having been found abundant at the depth of thirty-five feet, that it will be found still richer as the work descends. I think that the works are at present injudiciously conducted, and that from present indications unjust views of the capacity of the mine might readily be entertained. The ground should first be thoroughly explored at the surface, and the relation of the lodes determined. If there is any tendency to converge, the proper place for the sinking of a shaft would then be found near their point of junction, so that all the lodes which approach that point might readily be tested by drifting from the main shaft. Moreover, the engine shaft, if a permanent one, should be vertical and not inclined as at present. The shaft now opening might do for ventilation, but, in case of a vigorous prosecution of the work, would be found inconvenient for the raising of the ore. There should be a careful examination of the ground by a practical mining engineer, before much outlay is made in the erection of works.

The ores from Prince William have been subjected to analysis in several places and the results are here given.

A sample of ore sent to England yielded—

Sulphuret of Antimony,	...	...	...	50.70
“ “ Iron,	...	...	...	1.87
Silica, (quartz)	...	...	...	47.43
				<hr/>
				100.00

This would be equal to 37 per cent. of metallic antimony.

Samples sent to other parties in England yielded 47 per cent. of good metal, and £9 per ton were offered for the ore delivered in London. Some of the ore was much superior to this, and said to be worth as much as £14 per ton. As before stated, there is nearly a monopoly of the business in England, (there being only three smelters in Great Britain,) and every obstacle and discouragement was thrown in the way of the parties here engaged, upon endeavoring to obtain information. Upon learning that the ore could be shipped to Boston, and there smelted, the English proprietors at once increased their offers from £7 or £8 per ton to as much as £14. The English assays yielded a small amount of silver, (from three or four to twelve oz. per ton.)

Specimens were also sent to Dr. Hayes, of Boston, and the result of his analysis is as follows:—

A mass of rough ore, gave pure ore 82 + rock 18, = 100.

100 parts contain antimony, 59.00.

Sulphur and rock, 41.00, with no silver.

A later analysis of Dr. Hayes, quoted by Mr. Allison, and published in Silliman's Journal, for January, 1863, gives 36 per cent. of ore, *with* silver. Dr. Jackson also returned silver, and, I believe, 73 per cent. of metal.

According to Dr. Hayes, it costs \$60 per ton to import antimony (such as the stamped ore) into the United States, and perhaps about the same into Great Britain. Considering the facilities of obtaining fuel, the low cost of transportation on rafts on the St. John, and the proximity to the American markets, I cannot help thinking that the energetic working of this deposit will lead to favorable and remunerative results. I shall regard its further development with much interest.

The analysis of James R. Chilton & Co., of New York, is as follows:—

Antimony,	...	...	...	...	...	66.00
Iron,	...	...	...	...	...	60
Sulphur,	...	...	...	...	...	23.40
Silica,	...	...	...	...	...	10.00

On the 27th of September, learning that the operations at the Prince William mines had been resumed, I determined to pay this interesting locality a second visit. I was, however, upon arrival at the mines, met with a second disappointment. The work had not been resumed, as stated, and everything was in the same condition as at the time of my first visit. I devoted my attention, therefore, to a re-examination of the ground, and succeeded in determining some points of interest, not noticed in my earlier trip.

The most important, and at the same time the most difficult question to settle, was the geological position of the antimony lodes, and the relations to each other of the beds which bear them. I therefore devoted a considerable portion of my time to the searching out of exposed rocks, the determination of their strike and dip, and their relations to each other. This was, however, no easy task, the rocks *in situ* being everywhere covered with a deep layer of alluvial soil, and strewn with igneous boulders derived from deposits situated farther north.

The geological features of this portion of New Brunswick are rather peculiar. If reference be made to the geological map drawn up by the late Dr. Robb, and accompanying Johnson's Report, (this being considered at present as the most reliable authority,) it will be seen that the formations which cross the valley of the St. John, between Fredericton and the mouth of the Pokiok River, are considerably disturbed. Starting from Fredericton, by the post road, we pass over at first a portion of the coal field with its shales and sandstones. To this succeeds a belt of red sandstone skirting the coal measures, and forming the intensely red soil in the vicinity of the Indian village. It will be seen by the map that this belt of red sandstone, stretching from Bathurst, on the Bay Chaleur, around the coal measures to the Petitcodiac, is interrupted at two points, where it is crossed by the River St. John. One of these points is that just referred to, as being near the Indian village, about ten miles above Fredericton. The disturbing cause is evident in the long and picturesque semi-circular walls of trap, which have

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here been thrust up through the Cambrian rocks by igneous action from below. The red sandstone re-appears on the left bank a little further up the stream, and is then succeeded, on both sides of the St. John, by what are termed on Dr. Robb's Map the Cambrian rocks, consisting principally of non-fossiliferous slates. At this point these slates are very generally injected by dykes of trap. To these Cambrian slates succeeds, with an exception to be presently noticed, the great granitic chain which stretches across the Province from Cheputneticook Lakes to the vicinity of Bathurst. In almost all parts of the Province, it is these Cambrian slates, in the vicinity of trap dykes, which yield the only productive deposits of useful ores. It is in these rocks that we find the copper and manganese of the Tattagouche, the iron and copper of Woodstock, the antimony of Prince William, the iron and copper of Charlotte, St. John, and Albert. It will also be noticed in the case of Prince William, that there is a deposit assigned to the coal measures, although separated from the great coal field by the red sandstone and Cambrian series. This circular bed may have formed a distinct basin at the period of the coal formation, or may, possibly, have been connected with the main carboniferous area. It has produced small quantities of coal, found principally in the northern portion, which has been locally used as fuel, but the quantity is too limited to be of any commercial importance. Upon my first visit to Prince William, I had been under the impression that the site of the antimony lodes was included within this carboniferous area, and such would be the natural conclusion from the rather indefinite coloring of the geological map. A more careful examination of the vicinity, however, convinced me that this spot really lay somewhat to the south-westward of the carboniferous island (so to speak,) and that it is in reality a part of the great series of Cambrian rocks before referred to.

These rocks are clay slates, and may be distinctly seen, with injected dykes of trap, crossing the road leading from the Post road to the vicinity of the mines. They outcrop on a number of parallel ridges and are separated by depressions of inconsiderable depth, the whole forming the gradual slope from the bed of the St. John to the ridge separating the latter stream from Lake George and the Pokiok. At the first of the above mentioned ridges, these slates have a strike of about N. 26° E., but at the second ridge have slightly changed in general direction, bearing nearly due north and south. In both cases they are filled with dykes of trap, and are succeeded, in the vicinity of the mines, by other beds considerably filled with veins of pearly quartz, which intersect and ramify in all directions through the rock, without regularity. The land still continues to rise until, after passing the lodes just opened, and midway between these and the two new lodes, but recently discovered, we have a high circular hill, rising conically to a rounded or truncated top, and falling on all sides to the St. John, Lake George, and the Pokiok. This is the highest point of land in the Parish, and affords an extensive view in every direction. Its peculiar position and conical shape, taken in connexion with its proximity to the antimony lodes, which occur

on *opposite* sides of it, is rather remarkable. Wherever examinations have been made upon its flanks, and the rocks laid bare, they are found to be similar to those in the immediate vicinity of the antimony lodes, viz: slates and trap, and they are sometimes stained in a manner to indicate the possible presence of antimony near them. I was unable, however, to find any of this metal in the rocks laid bare, although I was assured by interested parties that it had been found there.

During this portion of my trip I visited the two newly-opened lodes above referred to, which I had not seen at the time of my first examination. These are situated about half a mile south-westward from the lode first opened, and fully equal the latter in purity and richness. They have only been laid bare by the removal of the soil, being found at the depth of about two feet below the surface. As at the lodes first opened, the rocks are slates and trap, the latter forming the lode-walls, while as before the ore is found imbedded in strings and bunches in white crystalline quartz. The mining privileges at this point are owned by a different company from those before referred to, and nothing has as yet been done to develop this deposit. The land is scarcely cleared and is very boggy, requiring much preliminary preparation before active operations can be entered upon. It is to be regretted that these two antimony outcrops are not under the control of a single company, as a concentration of capital and power is of the most material importance in their development, which must, for some time at least, be regarded in the light of a mere experiment. I do not myself doubt that the experiment will be a successful one, but I think it is much more likely to prove so, if all who are interested would heartily combine, and, by a concentration of effort, make their work effective.

MINING OPERATIONS IN CHARLOTTE COUNTY.

Returning from Prince William to Fredericton, I started immediately to pursue my examination in the lower Counties. Being attracted by the many favorable reports I had heard from Charlotte County, and by the many specimens which had been sent to me from various parts of that district, I determined to visit that county first, and, should sufficient time be left, to pass over Albert and King's Counties afterwards.

In my examination of Charlotte County, I was greatly assisted in my labors by the kindness of several gentlemen, to whom I now return my thanks. In company with Mr. Reynolds, of St. John, I drove over the stage route to Lepreau, stopping a few hours at the latter place to await the stage for Magaguadavic. During this time I walked down with Mr. Reynolds to examine the rocks in the vicinity of his mill, which is situated on a very pretty bend of the River Lepreau, where the latter falls over the red sandstone strata into the Bay.

These sandstones are beautifully exposed in the sides of the stream, and, at the mills, form a series of natural steps, over which the river falls with a descent of thirty-three feet. On the upper ledge is built the dam, with a

mill on either side. The rocks composing the fall and the cliffs below, are freestones of the finest description, soft when dug at a depth, but rapidly hardening in the air. They are divided by joints into large masses, the strike of which, as well exposed in the fall, is N. 76° E., and the dip 22° to the North, exactly opposed to the course of the stream. The dip of the other side of the blocks is 62° to the South, the two faces making nearly a right angle with each other.

Both above and below these freestones on the stream, are soft bright-red crumbling sandstones, and upon the shore the same appear, resting upon strata of red conglomerates. The river is, apparently, a sort of fiord, worked away by the sea in the yielding sandstone. These fiords are very common along the shores of New Brunswick and Maine, and give a wild and dangerous aspect to the shore, although often furnishing safe and commodious harbors. In the present instance the tide rises to the base of the fall, and ships can be directly loaded from the mills. I strongly urged the quarrying of the freestones at this locality, which could be readily transported to a market, being at the side of tide-level and close to an excellent wharf. They also appear at some distance below upon the shore of the Bay.

Upon the day after my arrival at St. George, I drove down, accompanied by Major Wetmore, who kindly offered his services, to the Letite copper mines. The distance from St. George to the mines, which are a little more than a mile apart, is about ten miles by road, and six by water. The road is tolerable, but like all in Charlotte County, rather hilly and rocky. It could, however, be much improved, having been heretofore but little used.

The first mine which I visited is that known as "The Wheal Louisiana Mine," owned by the Messrs. Johnson, of Liverpool, and recently opened under the direction of Mr. J. B. Key, as their mining engineer.

The whole country in the vicinity of the mine is exceedingly rough and rocky, the vegetation, which was once good, having been removed by fire. The whole region has a most desolate and forbidding aspect. With some difficulty we succeeded in finding the mine, situated at the top of a bare and rocky hill. The rocks are clay, chloritic, and talcose slates, with many large veins of quartz running in different directions through them. The strike of the slates is about 15° N. of East. Through these the main lode, where the shaft is sunk, runs with a strike about 7° N. of East, and has been traced for over a quarter of a mile. As many as ten lodes have been found, and copper has been removed from each of them.

These lodes, with the numbers by which they are known at the mine, and their approximate strikes, are given as follows:—

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Number.	Strike.	Dip.	Thickness.
No. 1.	24° S. of E.	To the S. W.	
" 2.	26° S. of E.	"	
" 3.	7° N. of E.	A little W. of N.	23 feet.
" 4.	20° N. of E.	Not determined.	
" 5.	" " "	" "	
" 6.	" " "	" "	
" 7.	40° N. of E.	" "	
" 8.	35° N. of E.	" "	
" 9.	30° E. of N.	" "	
" 10.	Nearly N. W. and S. E.	N. E.	8 feet.

The lode where the main shaft is worked, (at a point on No. 10 where it intersects No. 3,) is twenty-three feet wide. This shaft, which is now about sixty feet deep, I descended, but the wet and muddy surfaces of the rocks could scarcely be examined with such insufficient light. The proprietors intend sinking the present shaft to the depth of thirty fathoms (one hundred and eighty feet). The dimensions of the shaft are 10 x 7 feet, its sides corresponding to the dip of the lode.

The rocks in this vicinity are very various and their relation complicated. Beds of common slate, chlorite, and talcose slates appear, and with them are associated syenitic and porphyritic rocks, with beds of fibrous hornblende or actinolite. In the lodes the ore is a fine brass-like sulphuret, tarnishing and assuming iridescent tints upon exposure to the air, and in some cases changing to the blue carbonate. With it is often associated some iron pyrites, and the color varies from a fine yellow to a more silvery tint. The admixture with this iron would necessarily decrease its actual value. The ores taken from the other lodes are of a similar kind, and are in many cases very rich. Sample specimens were collected and accompany this Report.

There are large masses and veins of steel-like "mundie" associated with the ore, and solid blocks of the mineral pyrrhotine, apparently pure.

At the mine of Mr. Key I met with Mr. Woodward, one of the proprietors of the "Letite copper mine," who very kindly pointed out everything of interest in the vicinity, and finally conducted me to his own works.

The Letite copper mines are about a mile distant from the Wheal Louisiana Company's works, and nearer to St. George by the same distance. They are situated near the summit of a rounded eminence, in close proximity to the shore of Passamaquoddy Bay. The main shaft is now covered with a substantial wooden building, and the raising of the ore is accomplished by means of a windlass worked by oxen. The pumping of the mine is effected through the same agency. The present depth of the main or old shaft is somewhat over one hundred feet, and its dimensions are 6 x 5 feet. It descends

NOTE.—Since visiting these mines, I have been informed by Mr. Key, that he has discovered another deposit about three miles from the above, on Adams' Island, and that he is now engaged in making an exploration of the new locality. The ore is unlike the former, being the gray sulphuret instead of the yellow, and is found in chloritic slates. This seems to resemble that found on Simpson's Island, by Mr. Allison. See description of the last locality.

perpendicularly, the lode being composed of quartz and calc spar imbedded in clay slate, and the lode-wall of trap. The height of the mouth of the old shaft above high-water mark is about thirty-five feet, and consequently the depth now attained must be sixty-five feet below the level of the Bay. The ore raised at this mine very much resembles that of the English Company, as does also its matrix, but the surrounding rocks are more difficult to mine, being hard greenstone and trap.

This was, I believe, the first copper mine ever opened in Charlotte County, and has, therefore, been worked under a number of disadvantageous circumstances. It is impossible at present to give any decided opinion as to its future productiveness. It has now been worked some three or four years, but the amount of ore yet raised is inconsiderable. This, however, may only prove that the favorable points for ore have not yet been struck. Some excellent specimens have been found, and, as the direction of the lodes is favorable, good beds of copper may yet be discovered. It is to be hoped that success will attend the labors of these companies, as they have worked under many difficulties, and failure would not only involve great loss to those immediately concerned, but to the County and Province generally.

The lands occupied by the Letite copper company, for the purposes of mining, are very extensive. They occupy, according to the Report of Mr. Key, from which I have also obtained the following interesting particulars, a space measuring "one hundred and sixty-eight rods from the north to the south boundary, and a quarter of a mile on the course of the lodes, or from the east to the western points."

"There are visible eleven lodes, from all of which mineral has been broken. These beds are imbedded in various channels of ground, greenstone, clay slate, chlorite slate and elvan, (the latter a mining term equivalent, or nearly so, to honestone or whetstone.) On No. 6 lode a shaft has been sunk, one hundred feet deep, occasionally producing good specimens of copper ore. West of this shaft there is a junction of *four* lodes, viz: Nos. 4, 5, 6, and 11, which is a most material point to reach. On No. 11 lode a shaft has been sunk thirty feet deep, the lode varying in width from two to four feet, being composed of quartz, carbonate of lime, calc spar, yellow sulphuret of copper, and sulphuret of iron, the matrix being greenstone and costly for development. This lode runs directly across the other lodes, as shown in the Plan, and a short distance west of the shaft on No. 6 lode. This lode can be easily proved, at a depth of one hundred feet, by driving west on No. 6 lode to the junction, where can be seen Nos. 4, 5, 6, and 11 lodes at one and the same cost, a great advantage and a most material point to reach, and which should be done without delay. Clay slate and elvan being in close proximity to the point, will very probably lead to good results."—*Extract from Report of J. B. Key, Esq., to J. G. Woodward, Esq.*

I visited the rocks upon the shore in the immediate vicinity of the mine and found them to be slates with an apparent strike N. 56° E., dipping eastward at an angle of 7° from the perpendicular. These are considerably ferrugi-

nous, and have a trap dyke running through them, about seven feet thick, and with the same strike as above. There are also numerous other dykes. There is said to be a lode of lead in the vicinity, but it has not been explored. There is much resemblance between the rocks at this point and those at Lubec, in Maine, where a company formed for the purpose of mining copper, and styled a "copper mining" company, now raise only lead, the copper having entirely given way to a very rich argentiferous galena.

The Letite mine is owned, I believe, by Messrs. Steadman and J. G. Woodward. To the latter I gladly return my thanks for much assistance and valuable information, as well as for illustrative specimens. These specimens, which will give a good idea of the character of the rocks and the ore raised, are with this Report laid before Your Excellency.

Since writing the above, I learn that some of the ore from this locality has been smelted at the mine, and yielded $26\frac{1}{2}$ per cent. for fine copper. This is very satisfactory, and speaks well for mining operations in this locality.

After remaining two days in the examination of the Letite and Wheal Louisiana mines, I passed over, accompanied by Mr. Key and Mr. Woodward, to examine the lead deposits on Frye's or Cailiff Island. This Island, (called also L'Etang,) is separated from the main land by what is known as the Back Bay, a sheet of water perhaps a quarter of a mile wide at the point where we crossed. At a very short distance from where we landed, we found the lead lodes of Mr. Frye.

These lodes are situated in beds of compact bluish crystalline limestone, forming a part of the metamorphic series of rocks which occupy and traverse the south eastern shore of New Brunswick. The lodes are composed of quartz principally, with fine white heavy spar, or barytes, and a little fluor. The lode, at the point where it is now laid bare, was by measurement about eight feet wide. It has been uncovered, in part, for about fifty feet, having in this length a varying thickness of from six to eight feet. At the point where the lode has been uncovered, another lode approaches from the southwest and joins the first, whose course is about E. N. E. This second lode has a thickness of about six feet, and like No. 1 is composed of barytes and quartz. In the angular space included between the two, the country rock, limestone, again appears. Lode No. 2 is succeeded by a bed of ironstone and slate, about three feet wide, and this again by three feet more of limestone. Then follows lode No. 3, six feet wide, composed of the same material as before, and pursuing a course nearly parallel to lode No. 2. The remainder of the rock is covered with soil.

Besides the lodes above described, indications of others have been found in the vicinity, but have not been thoroughly explored. The point above referred to is but a few yards distant from an arm of the Bay, left bare at low water, but filled at high tides, across which a tide-dam was once constructed, but soon gave way, being completely destroyed by the ravages of marine worms. There is a mill within a few feet of the lodes, and I believe some

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lime has been burned in the vicinity, but at present neither the mill nor the kilns are in active operation. The locality is very favorably situated for the working of either lead or limestone, as the rock or ore could be readily shipped within a very few feet of where it is first raised. Indeed the working of the two might be profitably done in conjunction, provided the amount of lead should prove considerable, a point upon which, without further exploration, it is impossible to decide. The beds of barytes, if sufficiently extensive, will also prove valuable. This locality has only been known since the year 1862, the mining privileges being in the possession of the proprietor of the Island. No attempt has been made to work the ore, only a few blasts having been made upon the surface. So far as I could judge from the indications thus exposed, the prospects are very favorable for an abundant supply of lead, and I can hardly doubt that it will yet be found in quantity on this Island, especially as it is now being raised to advantage in the vicinity of Eastport. It will be necessary, however, to descend to a considerable depth, perhaps two hundred or three hundred feet, to fully test the productive capacity of the deposit. The main lode (No. 1,) has a course about E. N. E., being nearly conformable in direction to the limestone strata, masses of which, somewhat softened and decomposed, are found enclosed in the quartz and fluor, which constitute the filling matter of the lode. The other lodes are parallel to each other and approach from the southwest. The barytes is white and tabular, being often translucent or semitransparent, and much resembles that from the Five Islands, N. S. The fluor is comparatively small in quantity, being found only here and there in small patches of a violet or amethystine color, resembling the variety called *chlorophane*. With these are associated a little Blende (sulphuret of zinc) and pyrites. According to information given me on the ground, the lead appears to be more steel grained and much more disseminated throughout the matrix as it goes down, which, at present, is but to the depth of four or five feet. As before stated there are found between lodes No. 2 and No. 3, beds of ironstone and slate, these in turn being succeeded by a belt of country rock, which in turn is followed by another lode. There are many indications of iron about the bed, and the interior of the vein itself contains a decomposing ochreous quartz.

On the shore, at a short distance from the spot opened, a lode is seen pursuing the same easterly course as the main lode above described, and is probably continuous with it. A little farther on are numerous quartz lodes passing through slates and associated with numerous trap dykes. The slates are highly pyritiferous. Limestone also appears, and alternates with chloritic and talcose slates. This limestone at one point was seen to be well charged with galena. Still farther around the tongue of land where these lodes occur, are seen some beds of *verde antique*, (a mixture of serpentine and limestone, forming a good and handsome marble, like that near Fort Howe in Carleton,) and also some seams of fair asbestos.

The following is a copy of an assay made of the ore from this locality, by Dr. Hayes, State Assayer of Massachusetts:—

1st. Crushed ore, brought to a market state, afforded 62 4-10 per cent. of lead.

2nd. One ton of ore, as dressed, contains $4\frac{1}{2}$ ounces of pure silver.

(Signed)

A. A. HAYES, M. D.

Boston, July 2nd, 1862.

About half a mile in an easterly direction from the above locality, on the most elevated part of this great limestone formation, are found a number of other lodes cropping out upon the surface. At one point as many as ten may be counted within the distance of one thousand feet, measured across the limestone strata. The three largest on the north-west side appear to be wholly composed of quartz. The remainder are more or less mixed with fluor, and one vein appears to be principally composed of that mineral, which has sometimes, from its productiveness, been styled the "mother of lead." The lode wall, as seen in a small trench dug on the line of one of the lodes, is a sort of iron stone, much decomposed, crumbling and associated with beds of yellowish and brown ochres. In the bed is a considerable quantity of specular iron and iron sand, (with perhaps a little carbonate of iron,) from which, by processes of oxidation, the ochre beds have probably resulted.

Since writing the above, operations have been commenced at the first of the above named lodes, and the prospects are represented as very favorable. Fine specimens of galena and fluor are very abundant, and the indications are very promising.

From Frye's Island I was carried in a small skiff across the Bay to the house of Mr. Randall, on St. George Peninsula. Mr. Randall is extensively engaged in the manufacture of quick-lime, which is obtained in inexhaustible quantity from the immense beds of bluish crystalline limestone, which constitute a large portion of the Peninsula. These limestones, I am inclined to think, are continuous with those which I had just visited on Frye's Island, but, as I was unprovided with any chart of the County, I was unable to determine this point. Mr. Randall has three kilns upon his property, but one of which was in operation at the time of my visit.

In the vicinity of Mr. Randall's house is an extensive bed of granular quartz, which, according to an assay of Dr. Hayes, was found to contain a small amount of gold, associated with the sulphuret of iron, but not in the metallic state. According to this assay, two thousand parts powdered, and averaged, yielded one hundred and twenty-six grains of gold.

Before returning from this vicinity, I was kindly driven by Mr. Randall to a number of neighboring localities, at which ore had been reported as occurring. The first of these was a spot on Mr. Samuel Hatt's farm, on the St. George Peninsula, where a lode was pointed out to me, showing indications both of lead and copper. The lode is about three feet wide, composed of white crystalline quartz, containing seams of iron pyrites, copper

pyrites, and a little galena. Its strike is about 8° south of east. To the south of the lode are beds of granular quartz rock, succeeded by heavy beds of trap; to the north and extending from the lode, of which they form one wall, are cliffs of granular pyritiferous and cupriferous (copper-bearing) quartz rock, resembling the "gold quartz" above alluded to as assayed by Dr. Hayes.

The ore from this locality was assayed by Dr. Hayes, and found to contain $83\frac{1}{2}$ per cent. of lead. 200 parts of ore yielded 0.007 of silver = 1 oz. 2 dwt. 20 grs. of silver, a quantity too small to be of value.

The trap dyke is very thick, and south of this is succeeded by porphyritic and quartzose rocks with frequent dykes of trap. Many of the beds are ferruginous, and veins of white quartz penetrate the masses in various directions. The associated lead and copper are found in thin seams in several places, but have not been at all explored. Although interesting, as affording additional evidence of the occurrence of these two metals at a great variety of points along the Charlotte County coast, I do not think that this particular spot is, of itself, likely to prove a valuable one, the quantity of ore present seeming to be very small. No attempt, however, has been made to remove the rock, which may possibly prove richer at some point below the surface.

Leaving this locality, I next visited the farm of Mr. David Crory, at the Scotch Settlement, and was conducted to a spot where a large and irregular vein of white quartz passes through talcose and chloritic slates, bearing about N. of E. 10° . In this I found much iron pyrites, but no lead or copper. On the same shore, a little farther around, a place was shown to me where a blast had been made in a vein of quartz, and which, upon opening, showed an excellent galena. (See specimens accompanying this Report.) There is no well-defined lode, but veins of white quartz are injected in various directions through chlorite, quartz rock, and the adjacent slates. The general trend of the vein, is, like nearly all in Charlotte County, about 10° N. of E. This vein is probably but a continuation of the one above alluded to, from which it is separated only to a slight distance. The slates here are much contorted and filled with dykes of trap.

From Mr. Randall's I returned again to Magaguadavic. At this place I met a number of gentlemen, who have taken great interest in the development of the mineral resources of the Province, and I am indebted to them for much assistance and useful information. At St. George, as well as at other places in the Province, I found many persons reluctant to impart their information, or to point out mineral localities, as they declare that, owing to the present laws regulating the purchase of mining leases on Crown Lands, the spots selected must be located within an hour after the purchase of the license to mine, and that thus, other parties, seeing them lead me to the localities desired, might at the sale of the land, bid against them for the purchase. If I understand this law correctly, its tendency is certainly to retard rather than to advance the development of the mineral resources of

the Province. A person may, after considerable difficulty, and perhaps expense in prospecting, discover a locality which he thinks may yield fair prospects of success. He may wish to satisfy himself more thoroughly by the use of a few pounds of powder in blasts. This he is reluctant to do, because he thus exposes his knowledge of the spot to others, who, less industrious than himself, may be upon the watch for such discoveries. Rather than thus give his information to others, who at public auction may enter into competition with himself, he prefers to run the risk of purchasing the land without examination, and even without the opinion of those competent to decide upon its qualities, or else to allow it to stand idle for some future opportunity.

I am informed that a man is allowed to procure, for the purpose of inspection, a mile of timber land for the small sum of twenty shillings, whereas one would be charged one hundred shillings a mile for a mining right, and that too, when he is wholly unable, except from the most uncertain indications, to form any idea of what will be found below the surface. Is it not possible that some regulation could be made, which should reserve, for a limited period, to those actually engaged in prospecting, a right of choice on the public lands examined, and that the Government should then decide by means of Commissioners, appointed for the purpose, the sum for which such land should be disposed of? Mineral wealth, if we have it, is like any other kind of wealth, and should be sold for what it is probably worth, not as if it were of no more value than the barren earth around it. Moreover, for the present at least, its price, as fixed by the Government, should be low, as in a newly explored mineral country like this Province, mining is, at best, exceedingly uncertain, and if successful, would pay its fair proportion to the Government by the export duties, and by the influx of laborers and of wealth which its development would involve.

There is another law which serves greatly to discourage mining operations in the Province, viz. that parties engaged in mining are obliged to pay to the Government according to the *amount raised*, instead of according to the profits. This would seem to be unfair, as it may be a much more expensive operation to raise an ore at one locality than at another. Coal is obtained with little difficulty or uncertainty, if found at all, whereas in copper, lead, and antimony mining, there is great uncertainty, and much of the material raised is generally worthless. It would seem more just that this species of property should, like any other kind of property, be taxed upon the profits it produces, and not upon the efforts necessary to sustain it.

From Saint George, I passed, by way of Saint Stephens, Saint Andrews, and Calais, to Eastport, designing, if opportunities offered, to visit Grand Manan and some of the neighboring islands, on which metallic lodes had been discovered. In this purpose, however, I was, unfortunately, greatly disappointed, thick and continuous fogs prevailing during my entire visit in this quarter, with, for the most part, a perfect calm. One of the points which I desired to visit was Simpson's Island, where a deposit, first made

known to me by Mr. Edward Allison, of St. John, was sometime since discovered upon the shore. The deposit consists mainly of a greenish carbonate of copper, in which are found nodules of the original ore, a dark brown sulphuret, (copper glance,) from which the former has resulted by decomposition and the action of the sea. From information given to Mr. Matthew and myself, by Mr. Allison, and published by the former, I have learned the following particulars of its occurrence. The island (which does not exceed one hundred acres in extent,) is composed of trap rock, through which runs a nearly vertical band of slate, with a strike about east and west, varying in thickness from four to twelve feet. It is in this slate that the copper lode occurs, extending from low water mark to a point one hundred and fifty feet above it, with a thickness of about four feet. "The beach is composed of rock covered with sea-weed, except near high water mark, where it is shingle." A sample specimen of this ore yielded, according to published statements, 27 per cent. of copper, and nearly four ounces of silver to the ton. The island is some eight or ten miles distant from Eastport, being near the mouth of the Bay. I was prevented by the want of wind and by the constant fog from reaching it. A small quantity of the ore will be found accompanying this Report.

Copper has been found in greater or less quantities in many of the islands situated off the mouth of Saint Andrew's Bay. Another of these localities, but recently discovered, and made known to me by Mr. Woodward, is "Hard Wood Island," near Deer Island, in Passamaquoddy Bay, where a fine brass-like sulphuret is found, imbedded in layers of chlorite slate. I was not informed as to its quantity or position.

During my stay at Eastport, I visited the island of Campo Bello, but met with less success than the many reports and specimens seen from that locality, had led me to expect. The only spot visited by me was one pointed out by Captain Robinson, in the immediate vicinity of his house, where an excavation had been made, some years ago, in the side of the cliff upon the shore. The excavation is a little above high-water mark. From this pit or cave several tons of lead ore, mixed with a little copper, had been extracted, but the mine soon ceasing to be productive, was abandoned. The rocks on each side are trap, the lode itself having been chiefly heavy spar, pyrrhotine, &c., with some chloritic slate and silvery mica. The course of the excavation and the veins was a little west of north, but afterwards, I believe, tended to the eastward. The vein was wide when first opened, and the ore a rich one, being highly crystallized and associated with blende, but, at the distance of about twenty feet in, thinned out to the thickness of only a couple of inches. Specimens obtained from this locality, and kindly given me by Captain Robinson, are laid before Your Excellency. This ore, judging from these specimens, as well as from others now in the possession of the University, is purer and richer than any I have yet seen from any locality in the Province. It is to be hoped that, though the present lode has been found to fail, others of a more productive character and equal richness may

be discovered at other points upon the Island. The metal has, I believe, been found at various other localities besides the one visited by me, but from want of a guide, I was unable to visit them. The principal one is the head of Harbor de Lute. At the latter place the vein of galena is said (by Dr. Gesner, 1st Rep. p. 31.) to be four inches thick.

During my stay in Eastport, I was offered an opportunity, which I gladly embraced, of visiting the lead mines in the vicinity of Lubee, in the State of Maine, and as these are situated in the same geological region as those of Charlotte County, it may not be uninteresting to give a brief description of them.

These mines, which belong to the "Eastport Copper Mining Company," have been but recently opened. They are situated on a very narrow tongue of land, jutting out into Cobscook Bay, some eight or ten miles from Eastport, the locality being known by the name of Denbo's Point. Although by name a copper mine, these works have yielded as yet but little of that metal, their produce being at present almost solely an argentiferous galena. The ore, which is of a fine pearly granular description, not crystallized as at Campo Bello, occurs in veins running through the trappean rocks, and also in pure masses of considerable size. Copper glance, or vitreous copper, also occurs in veins in the trap, but is not so abundant as was promised at the surface, it having been displaced by the lead. The lode is composed of trappean rocks, considerably charged with calc spar and some fluor, the lode-wall containing clay slate, porphyry and serpentine.

The rocks in the vicinity are conglomerates and breccias, curiously injected with dykes of trap, and often so intimately connected with that rock, as to baffle any attempt to find a line of division between the two. With these are also associated beds of granite and some slates. The whole locality is a very singular and interesting one. The works erected at this place are much more extensive than those at any of the Provincial mines, with the exception of those in Albert County, and it would be well for those about to engage in similar pursuits in Charlotte County and elsewhere, to pay this locality a visit. There is a tolerably large engine (13 inch cylinder,) of about 40 horse power, for raising the ore and pumping. This is attached by a large walking-beam to an arm and piston descending the shaft. The latter is sunk on the course of the vein to the depth of two hundred and twelve feet, nearly one hundred and eighty feet below high water. The course of the vein is nearly N. E. and S. W., with a considerable dip to the north. The company is now engaged in erecting extensive smelting works, and evidently seem persuaded that the undertaking will be a profitable one. If this should prove true, there is every reason to suppose that those similarly situated in New Brunswick, will also prove of value.

UPHAM MANGANESE MINES.

From Eastport, I returned by steamer to St. John, and thence, almost immediately, proceeded to make an exploration of Albert County. On my way to Salisbury, while stopping for a few minutes at the Sussex Station, I noticed a large quantity of manganese ore lying near the track, ready for removal. From this pile of ore, I succeeded in selecting some handsome specimens, which accompany this Report. It had been my desire to make a visit to the exact locality from which the ore was taken, (distant, I think, about eight miles from Sussex,) but I was unable so to arrange the time at my disposal, as to allow of my visiting the Albert mines and this also. I have obtained, however, from Mr. Davidson, of St. John, one of the present owners of the mine, the following particulars of its occurrence, which will be found interesting.

The main deposit is a *pocket* in a clay and gravel bank, from which about eight hundred tons have already been removed. The ore is the *black oxide of manganese*, highly crystallized, (chiefly as *pyrolusite*,) and averages about seventy per cent. of manganese in the oxide. This is the result of a number of assays made in several different quarters. The beds were described to me as being apparently alluvial, limestone boulders being found *below*, as well as above the black oxide. The excavations have not been made into the rock below, but merely along the surface, to the depth of twelve feet. No rocks show in the immediate vicinity, with the exception of the boulders above referred to. The ore was first discovered by the accidental uprooting of a tree.

There is another deposit within half a mile, the latter being a distinct vein of about three feet in thickness, running through a limestone ledge. The strike of the vein is about north and south, and its dip about 54° to the south. The ore is the same as that above mentioned, and has been removed to the extent of about fifty tons. The ores yield in St. John about twenty dollars to the ton. These mines are near Upham, King's County, and are on lands owned by Messrs. Hunter and Casteed.

ALBERT COUNTY.

Arriving at Salisbury, I made the acquaintance, through a letter of introduction kindly furnished me by Mr. Allison, of St. John, of Mr. Alexander Wright, a gentleman who has taken much interest in the development of the Provincial mineral resources, and who showed me, during my brief visit to Albert, every possible attention. Besides furnishing me with much useful information in regard to other Counties in the Province, Mr. Wright became my guide and companion in my tour through Albert County, and at some loss to himself, devoted his time entirely to my service. This was the more gratifying to me, as in some portions of the Province, I regret to say that the same ready disposition to impart information was at times found wanting.

In company with Mr. Wright, I succeeded in making a complete circuit

of Albert County. Leaving Salisbury, by the road to Elgin Corner, (see Map of the County) we pursued a course southerly and south-westerly along the banks of Pollet River. At Davidson's mill, I was informed by a couple of farmers of a spring containing salts of copper in solution, about six miles from Mr. Wright's, which, judging from the account given, probably does actually contain the above metal, but we were unable to go, (a distance of some eight or ten miles,) out of our way to examine it.

At Elgin corner, I embraced the opportunity, afforded by a necessary delay, to pay a visit to the very remarkable ravine and Falls in this vicinity. As these Falls are not generally known in the Province, and as they have not, as yet, been described in any of the geological reports of New Brunswick, it may not be uninteresting here, to briefly notice them.

The "Pollet Falls" are, according to the statements of those living near them, about half a mile distant from the "Corner." To one, however, who attempts, as I did, to reach them, by a journey through unbroken woods and up the rocky bed of the ravine, they will scarcely seem less than a mile and a half. The approach to the spot is one of exceeding difficulty, it being necessary to climb along the edges of precipitous cliffs, and occasionally to wade through the stream below. It took me over three hours to go and return to Gifford's Inn, but the loss of time was certainly well repaid.

The gorge at and below the Falls, is a very wild and romantic one. The hills on both sides are high, almost mountainous, and thickly wooded to their summits with a rich growth of hard wood. The cliffs forming the gorge are coarse conglomerates, upon which the action of the water has been very remarkable, working away deep caverns, and leaving overhanging ledges sometimes forty or fifty feet high. The bed of the stream is likewise conglomerate of the coarsest description, through which the water works its way by innumerable channels, now working out a deep and narrow gully, now undermining the rock and bubbling out again some distance below, now falling from rock to rock in delicate cascades. At one point, the water converging from several sides is suddenly poured perpendicularly into a deep circular hole of about ten feet diameter, where boiling and surging, it passes out below by some subterranean channel. There was, so far as I could discover, no visible outlet. This spot at once reminds one of the celebrated "Pool" in the White Mountains of New Hampshire. It is said that the depth of this hole is unknown, but this is probably due to the fact that any measuring line would not sink perpendicularly, but be carried off obliquely by the current into lateral channels.

These circular excavations are very numerous and of all sizes, generally holding at the bottom either few or many large cobble stones, worked loose from the original conglomerate, and now whirled around by the eddying currents, smoothing and polishing the holes which contain them, whose size they thus rapidly and constantly increase. The fall is about thirty feet in elevation, and in time of freshet must be very beautiful. At the time of my visit, however, there was not more than enough water to make a hand-

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some double cascade. The curiously channelled rocks were to me a much more singular and interesting feature. It is strange that a spot so accessible, and so really beautiful, is so little known, even in its immediate vicinity.

From Elgin corner our road became a very rough and mountainous one. Rising from the valley of the Pollet River, we ascended hills of very considerable elevation, commanding an extensive prospect over a large portion of Albert and Westmorland Counties. After reaching the point of highest elevation, the land is for some distance comparatively level, being high table land, and then sinks abruptly into the valley of the Coverdale. From this we again rise up another mountain range, quite as lofty and as beautiful as that separating the Pollet and Coverdale. As this hill was the seat of one of the most interesting discoveries made during my trip, I shall describe our journey over it in some detail.

Along the slope of the mountain, as we made the ascent, very little rock *in situ* could be seen, as nearly all the mountain, even to its highest parts, is covered with a thick and very fertile soil, supporting beautiful and virgin forests of hard-wood, as yet untouched by that blasting element, the fire, which does so much to render the woods of New Brunswick bare and desolate. Occasionally, however, slates may be seen *in situ*, while boulders, granitic, syenitic, and of injected talcose slates, are very common along the road side. They increase in quantity as one approaches the summit, and are strewed over the level table-land at the top. These boulders must, for the most part, have been transported from regions farther north, and to a student of the great *Drift Period* in geology, might furnish some interesting facts. I was unable to observe any glacial marks upon the exposed surfaces of the rocks.

After reaching the highest ridge, the land falls slightly towards the south, and is thickly wooded. It was in this vicinity, I was informed that gold might be found. About a couple of miles from Mr. Mullin's farm in the valley of the Coverdale, and about eight from Elgin corner, we came upon a low narrow stream, overgrown with bushes, and filled with decaying vegetation. This, I was told, would be found to contain gold. I was not altogether incredulous, as the character of the rocks, talcose slates, injected with quartz, rendered its occurrence highly probable. We stopped, and before plunging into the thick woods, I examined the rocks in the vicinity. None of these were apparent at this point *in situ*, but numerous boulders of talcose, and chloritic slates, and granite, were scattered about, the former being injected with fine white quartz in seams of variable thickness, from that of paper to that of several inches, the whole appearance being very promising. We soon worked our way a few hundred feet through the wood, and came out close upon the side of the same narrow and overgrown stream, which we had already crossed upon the road. In its bed were lying granite and slate boulders, while the bed itself was a fine sand, a little mixed with a deposit of vegetable mould, and emitting no very pleasant odor. My friends, who had conducted me to the spot, went down upon their hands and

knees, and after attentive search for a few minutes, almost went in ecstasies as they bade me look into the stream and see. I kneeled and looked, my attention being at once attracted by the brightly shining particles, which had been washed up from the sand. We removed these and other particles from the stream, which, not altogether to my surprise, really appeared to be the precious metal. The pieces were all *very* small, but distinctly visible, and with a magnifying glass some of them could be seen to be rounded and twisted filiform masses, such as is commonly the case with gold.

The sand containing the gold has apparently resulted from the decomposition of quartz rock and granite. There are also some small particles of mica in the bed, but there is no danger of mistaking these for the true metal. We worked over the stream as long as we could endure it, (some two hours or more,) but the incessant biting of black flies and mosquitoes in the thick woods and over this sluggish stream, was almost intolerable. The fact once settled of the occurrence of gold at that point, we were glad to rest content, and to leave the further searching for the metal to those more willing and more able than we, to endure these insect pests.

The stream, in which this gold occurs, is a tributary of the Salmon River, not of the Petitcodiac, as its position would, at first, lead one to suppose. It is on what is known as the Blackwood Block, near the road leading from Elgin corner to New Ireland, from the former of which places it is distant about eight miles. The lands are now leased from the owners by the "*Albert and Westmorland Quartz Mining Company.*"

As I have said, the particles of gold are exceedingly small, nor is their quantity great. If, however, gold can thus be picked out with the hand from the detritus of a decomposing rock, there is every reason to believe that it may be found in greater quantity in the rock itself. Moreover, it is a peculiarity of the auriferous rocks of North Eastern America, that the Gold which they contain is more freely disseminated in invisible quantities through the matrix, than is the case with Californian and Australian ores. Rocks therefore showing no visible signs of gold, may, by the use of crushers and amalgamators, yield appreciable and profitable quantities. Gold being proved to be present at this point, I think that a more careful examination of the district would lead to important facts. At present such an examination is almost impossible, the land being low and uncleared. One of my guides informed me, that he had at other times removed much larger pieces of gold from the stream, than any found at my visit, and that he could flatten them out with a hammer, or cut them with ease. This man was a very intelligent farmer, living not far from Salisbury. He told me that he had traced the boulders, above alluded to, to the original rocks *in situ*, about two miles further back into the woods, and had found in these also some particles of gold. These I did not attempt to reach, our time forbidding a longer delay, and the character of the woods rendering such an attempt one of great difficulty. The same formation, however, outcrops a little farther on, and crosses the road, where, I was told, gold had been removed from it. The slates of the neigh-

boring boulders are very highly contorted, the laminae being folded upon one another, and frequently crossed by veins of milky quartz.

Some specimens of gold were afterwards given to me by Mr. Vernon, of Point Wolf, which, if their history is correct, were found in the same part of Albert County as that above described. The specimens were given to Mr. Vernon, by Joseph Randall, who owns the property on which they were found. This property is in Albert County, near Elgin Corner, and not more than three miles from the brook above mentioned. They were found in a stream, a branch of the Coverdale River, and are in thin pieces of considerable size. These specimens, with those from the Gold Brook, accompany this Report.

SALMON RIVER COPPER MINES.

Pursuing our route from what we may call *Gold Brook*, we continued to pass over high but nearly level ground, until we reached the Post Road from Hopewell to Saint John. On this, which is called also the *Shepody*, or *New Ireland Road*, we drove for about two miles, and then turning abruptly to our right, crossed by a very rough and little-frequented route, a distance of nine miles, to Salmon River. We thus saved nearly twenty miles, which we would have been obliged to travel, if we had pursued the regular turnpike route. By taking advantage of such bye-roads, which Mr. Wright's knowledge of the country was always able to point out, I was enabled to see much more than I would otherwise have done, and was led to exactly those parts, which, with reference to the special object of my visit, were the most interesting. I here mention these details of route, as they will be of much assistance to those who may explore this County for the same reasons as myself.

Upon arriving at Salmon River, I took the first opportunity to examine the lodes of copper ore which are now being opened in this vicinity. Of these, the first visited by me were those known as belonging to the "Williams Mining Company." As these are immediately adjoining the lands of Messrs. Vernon, Kinney, and Dixon, (not yet incorporated,) the remarks upon the position and topography of the district will apply to both.

The locality, where these lodes are opened, is about one mile from the Bay Shore, in a direct line, and about two miles from the harbor of Salmon River. The country is a very hilly one, covered with innumerable volcanic boulders, with large gravel and dirt beds. Two high and parallel ridges run nearly easterly and westwardly, and between is a deep valley, through which runs *Ellet's Brook*. Along the slope of the more northerly ridge, gradually winding up the valley side, is the road from Salmon River to Point Wolf. On each side of this, near the summit of the hill, are the excavations which are now known as "the mines." There are here several mining lots, owned by different companies, lying in immediate proximity, the productive lodes on each being, in some cases, merely continuations of one and the same. I cannot refrain from saying, that this method of parcelling out, under several different companies, mining lots which are closely adjacent, is, in my opinion, a mistake to be carefully avoided. Copper mining is an uncertain business,

at the best, requiring a considerable outlay of capital, and great concentration of effort. When it remains to be proved whether even a single company can be supported, it is almost folly to attempt to support *three*. With the position the same, the harbor the same, the water power identical, and even the lodes but continuations of one and the same, it is not reasonable that three different companies should attempt to work side by side, as, I believe, is being attempted at the locality now spoken of. The companies, if such there be, should be incorporated into one, the capital and energy of all being thus concentrated towards the development of a single object.

On the lands of the "Williams Mining Company," a number of excavations have been made and ore removed from them. The principal shaft has been sunk about thirty feet deep, and is from fifteen to twenty feet in dimensions. About half way down, a drift passes off to the northwest, with a distinct slaty lode-wall, dipping at an angle of 64° to the eastward. This did not, however, seem to be the true lode, yet some fine copper specimens were obtained at its mouth. It was too dark and wet in the shaft to make out anything satisfactorily. From this shaft about one hundred tons have, I believe, been taken, and according to the printed prospectus of the company, yielded from $28\frac{1}{2}$ to 30 per cent. of copper, of the value of \$122.40 per ton. The vein, which pursues an easterly and westerly course, has been opened for about one hundred yards, and grey sulphuret of copper (like the accompanying specimens,) has been removed at various points. The rocks are slates and trap, the lode varying in width from six to eight feet, but not with very well defined walls. The grey copper is found in bunches, and thin veins, penetrating the lode stone, and the latter is upon the surface much stained with the metal, giving it a bright green color. An adit level has been driven into the side of the hill a distance of one hundred and seventy-five feet, which, if continued for about eighty feet, will drain the mine at a depth of fifty-five feet from the surface. The apparent dip of the vein is towards the south, but there are indications which lead to the supposition that it soon changes its direction and bears to the north, as is the case with most of the other copper lodes of the Province.

The following are two analyses made of this ore. The first is by Dr. Hayes:—

"Sample No. 1, grey copper ore, contains 62 1-10th per cent. of copper.

A. A. HAYES, *Mass. State Assayer.*"

The second is from Liverpool:—

"Sample No. 1 is an excellent sample of ore, and is of a character that will always command full relative prices in this market.

Respectfully,

"MARTIN DENNIS & Co.,
Assay Office, 12 the Albany, Liverpool."

The second property visited by me at this point is in immediate proximity to that of the Williams Mining Company, above described. The mining privileges are owned by Messrs. Vernon, Kinney, and Dixon, but no distinct

company has yet been incorporated. We found Mr. Kinney at the mines, who took pains to shew us all the points of interest.

The largest and best defined lode (probably what the miners would term the *champion lode*,) passes across both mining lots, entering from the north-east corner and pursuing a course north-easterly and south-westerly, as far as has yet been traced. This lode is seen to outcrop upon the summit of a ledge forming part of a high hill, where it is of considerable size, (about six feet,) and exhibiting well defined walls. It is composed of a greenish-gray, hard, and compact rock, of an epidotic character, apparently a metamorphic aggregate, with some silicate of iron, the lode-wall being slate and a little chlorite. The lode is filled with injected quartz veins, the green rock containing grey copper, and the sides of cracks being "*drusy*" with minute crystal of the *red oxide of iron*. This lode can be distinctly traced along the rather steep slope of the hill, and pursues a course 10° N. of E., dipping about 42° to the northward. Into this hill, at a point about one hundred and ninety feet below its highest elevation, and about one hundred below the ledge where the lode outcrops, an adit has been driven to the distance of about ninety or one hundred feet in a horizontal direction. This is intended to strike the vein above described at about one hundred feet below its highest point, and thus not only to test its productiveness, but also, if the ore be found abundant, to drain the mine at this depth.

This adit I entered, but found it difficult to make any observations, from the want of light. The rocks lying about the mouth of the adit, were, however, readily observed, and were much like those seen at the copper mines in Charlotte County, consisting of chlorite, trap, greenstone and porphyry.

I have said that the main lode near the adit is six feet wide. About fifty or sixty feet west of the adit, another vein, about five feet in thickness, comes in and joins the main lode. If this second lode be followed out, it will be found to diverge about fifty feet and then to turn in again, apparently to join the main lode, at the distance of eighty or one hundred rods from the adit. The width of the lode, at this point of probable junction, is from twelve to fifteen feet. A little farther on its thickness is *twenty feet*! To the south, a number of other lodes have been struck, but not very carefully worked out. There is a spur vein entering from the north. About seventy-five rods south of the champion vein is another running 6° N. of E., which has been traced for about ten rods. Between this and the main lode is yet another running about 8° N. of E., but is somewhat distorted and irregular. All seem to have a tendency to converge towards a point where the lode is nearly *thirty feet* thick.

The position of this mine I have already described in my remarks upon the property of the "Williams" Company. Both of these properties are favorably situated for mining purposes. The level of the adit last described is about five hundred feet above high water mark, and is distant about a mile from the Bay shore. The road connecting the mines with Salmon

River, is a fair one, but winding as it does along the steep slopes of high gravel and sand beds, must be rather insecure. The slope is gradual, and yet of sufficiently rapid descent to allow of a railway being so constructed, as to cause a loaded train to draw up the empty ones, thus performing the labor of transportation to the point of shipment for an almost nominal cost. Ellet's Brook, being close at hand, with a tolerable supply of water, would also be of much service for the purposes of washing and dressing.

The geological features of this valley are rather remarkable. In the immediate vicinity of the mines, and forming the left ridge bounding the valley of Ellet's Brook, the rocks are slates and trap, as above described. The right hand ridge, which I had not time to visit, was represented to be freestone and conglomerate, together with coal, shales, and fossil fishes, the whole being evidently of the carboniferous formation. In the valley itself, in fine, are the immense gravel and sand beds above referred to, which are very numerous, and often from seventy to one hundred feet in elevation. Although probably once formed by the waters of the Bay, the highest tides could now no more than bathe their very base.

Specimens were selected from both the above mines, and are laid before Your Excellency. They consist principally of the grey sulphuret.

The lot of the "*Alma Mining Company*" is immediately adjoining that just described, and the above remarks will apply to both. Nothing has, I believe, been done upon the lands of the latter.

SAINT JOHN AND ALBERT COPPER MINING COMPANY.

From the mines last described, I drove down some three miles to Point Wolf, the residence of Mr. Vernon, with the hope of being able to visit the mining property of what is known as the "Saint John and Albert Mining Company," situated upon the Bay Shore, in Saint John County, some miles westward of the Albert County Mines. In this hope, I was, however, disappointed, the locality being almost inaccessible, by land, from Point Wolf (no road having yet been opened,) and there being no means of water conveyance at hand. To Mr. Vernon and others, however, who are interested in the mine, I am indebted for the accompanying descriptive notes.

The following is a copy of a letter addressed to Mr. Vernon, by Stephen Simmons, Esq., Mining Engineer, and will afford a good idea of the position and relations of the ore.

Saint John, September 13th, 1859.

TO JAMES VERNON, ESQUIRE,

SIR,—Having spent a week exploring your property on the Bay Shore, between Master's Head and Point Wolf, I found copper ore in veins for upwards of a mile. The main vein contains copper pyrites, or what we miners call pea-cock ore. I have traced this vein from about one hundred feet above high water mark to near the top of the hill which, I should think, is from six to seven hundred feet perpendicular. The course of the vein is nearly north and south, with a dip to the west of about three feet to a fathom, in the lower part, but it inclines more with the horizon as it gets near the top of the hill. The

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lowest point at which I traced the vein, is within one hundred feet of high water mark, where it is five feet wide, with a leader on the footwall one foot wide, containing very rich stones of copper ore. The remaining part of the vein is composed of white quartz, spangled with spots of rich ore. Below this place, the face of the hill is covered with rubbish and large boulders, which have slipped down from the hill above. About thirty feet above, a drift has been driven on the course of the vein from twenty to thirty feet, when it comes across a slide that has shifted the vein either to the right or left, beyond which it has not been seen, but there is not the least doubt of its continuing thereabouts. The men that worked in this drift, told me that they had a very good bunch of ore home to the slide, and there is no doubt, from the ore left on the bank, that they had. About one hundred and fifty feet higher up the hill, there is a bunch of yellow ore mixed with gozzan. I have been informed, on very good authority, that an analysis of that gozzan produced four ounces of *gold* to the ton. Above this is a bluff of rock for two hundred feet, beyond which I came upon the vein again. Here it is thrown off more with the horizon, and crosses and crosses by perpendicular droppers. When the veins crop each other, there are very good bunches of yellow, grey, and black ore, with the country around the vein stained with green or malachite—the exact indications of all deep copper-bearing veins at the surface. A drift has been driven on one of these droppers farther east. The men that drove it told me that they had a good bunch of ore there, but the drift is all broken, so that I could not see it. I saw some very good bunches of yellow and grey ore, mixed with gozzan, to the west of the pea-cock vein, but they must be distinct veins running parallel with the pea-cock vein, which is a very good indication for copper.

I consider the pea-cock vein to be a bold champion vein, crossing the strata at right angles. There is no fear of it wearing out, and every facility for mining is at hand. By driving a drift a little above high water, the ore may be tramed out on a floor, where it can be dressed for the market, and put on board ship without further trouble. By opening the mine at high water mark, there will be a back to take away from ten to twelve hundred feet high, without sinking shafts and drawing the ore to the surface, which is no small expense in mining. A stream of water, for washing and dressing the ore, can be brought in at a very trifling expense. It pours down the face of the hill from a height, I should think, of from five to six hundred feet. Taking all things into consideration, I think the place worthy of trial, and I have no doubt that it will turn out to be a profitable mine, if worked upon a judicious scale. No great outlay will be required to start. The whole expense will be the raising of the ore and preparing it for market. * * *

(Signed)

STEPHEN SIMMONS, *Mining Engineer.*

Since the date of Mr. Simmons' Report, the ground has been more thoroughly examined, and the lodes more carefully traced out. One of these lodes has been traced to the distance of one mile, and is found to be twelve feet broad, while another, of five feet, crosses it obliquely and trends towards the Bay. Still a third, also five feet in thickness, runs parallel to the last, but has not been traced to so great a distance.

The following is a copy of a Report of Dr. A. A. Hayes, assayer to the State of Massachusetts, on specimens of this ore, sent to him for analysis:—

"The specimens, contained in the box received, are said to represent the mining averages of ore as they are taken from the vein or bed. They naturally divide into three varieties: 1st. *Green Ore*.—A metamorphic aggregate of bisilicate of magnesia and silicate of

iron, in which both pyritous copper and peacock ore are found. Magnetic oxide of iron is present also.

2nd. Pyritous Copper in Quartz.—The ore is also in connection with dolomite and carbonate of iron, with bisilicate of magnesia.

3rd. Probably true vein-rock, highly metamorphic, the quartz having become a bisilicate of lime, with dolomite, altered felspar, mica, &c. Mixed through this is some pyritous copper. The bulk of the ore is *peacock ore* and *gray sulphuret*. Every character establishes this as a lode-rock.

The *green ore* presents the vein rock and ore, altered by atmospheric or eruptive influences. Thin coatings of carbonate and silicate of copper are seen in the flaws and crevices. There are also marks of sublimation, some of the iron scales being *specular*, while the trappean minerals have their iron in the state of *brown oxide*. Considered as mine produce, the whole of the samples being averaged, the assays show their value as follows:—

No. 1. <i>Green ore</i> ,	percentage yield of pure copper is,	13 4-10ths.
" 2. <i>Yellow ore in quartz</i> ,	" " "	18 2-10ths.
" 3. <i>Vein rock</i> ,	" " "	23 3-10ths.

Samples of the averages, obtained by reducing all the samples to coarse powder, accompany this (Dr. Hayes') Report, and may be referred to as representing mine produce.

In mining operations conducted on this ore, washing or concentrating poor ores will form a part, and to avoid excessive transportation charges, concentration may become important upon all the ore. I therefore made trials on the averages, giving to them only the usual appearance of the ore and gangue.

The assays here given are the results on carelessly washed ore.

No. 1. <i>Green ore</i> , average washed,	percentage yield of pure copper,	18 4-10ths.
" 2. <i>Yellow</i> " " " " " "	" " " " " "	26 8-10ths.
" 3. <i>Vein rock</i> , " " " " " "	" " " " " "	27 3-10ths.

These do not indicate higher percentages than would result from washing with moderate care, but the improved machines in use in some of our mines, will carry either of the averages much higher.

To suit various markets, or for convenience of transport, these ores may be mixed and rapidly melted without preparation, when a "*white copper*" of 32 to 34 per cent. will be obtained. The mixed ore melts very easily, and mine produce could thus be every day concentrated, and rendered of immediate market value.

Other Metals. The ores all contain more or less *gold*. In the sulphuretted ores, its separation apart from the copper is not easily effected. In the *green ore*, much decomposed, it may be readily taken out. An assay on the most decomposed part of a red-brown portion, afforded *twenty-two dollars* to the *ton* of ore. As this piece contains very little copper ore, it is barely possible that the gold belongs to the *pyritous iron*, and may be found in the talcose metamorphic rock, where it is most decomposed. I advise some search in it, and have therefore enclosed and labelled a piece of ore, which will serve as a guide to the eye. As the gold, if important in the ore, can be concentrated in the smelting works, further research did not seem called for in this direction. All the ore contains magnetic oxide of iron, but no other useful metal besides copper is found in the ore.

The general view taken from the study of these ores is, that rarely does a collection of copper ore embrace the characters of so much certainty, in regard to quantity and richness of mine produce. The mineral associates are those of the *great developments of copper* and *copper ores over the globe*. That rock mixture, which forms in large part every

specimen of the green ore, is also found by the side, or attached to, every mass of native copper or copper ore, which has been raised near Lake Superior. In Germany, it contains most of the beds and veins of copper ore. On the Island of Cuba, every mine of value has it as a wall-rock, and both the Chilian and Peruvian ores all carry it with them. It is in the quartz of your yellow ore, and accompanies the pea-cock ore in its minutest ramifications. The metamorphic action which has changed these rocks, declares that they are intrusive, and come up from below as dykes in metallic veins, leaving no doubt of igneous or hot-water action. It does not appear probable, from any sample in hand, that the quartz will become the bearer of the lode, as the work descends; but a closer assimilation of the ore will probably be noticed at lower points, and either bunches and strings or continuous veins will be found.

Every inducement for the investment of capital in mining, with energy, is afforded by these ores, in connection with the present high price of copper. Within two weeks, notwithstanding an unusual production, the price has advanced, and by no means yet reached the highest point. I am uninformed in relation to facilities of transport of raw ores, but if they can be sent, I should venture to state, they can be smelted at once at the smelting works near this city.

Respectfully,

(Signed,)

A. A. HAYES, *Assayer to State of Mass.*
Boston, 16 Baylestone Street, Sept. 28th, 1855."

In another letter, referring to other samples from the same locality, Dr. Hayes remarks—

"This ore contained much rock and was not dressed ore. One hundred parts in two assays afforded 25 4-10ths parts of pure copper. In the averages, the predominating ore was the "peacock ore," which always yields largely and easily its contained copper. It presents all the characters of an original or permanent ore, and with the pyritous copper characterises the largest deposits of copper ore worked.

If, therefore, this ore is found near the surface in sufficient quantity to follow, it presents every favorable indication so far as ore is concerned. The accompanying minerals, *calc spar*, *brown spar*, *pyrites*, and *iron oxide*, all belong to true veins, and if the situation of the ore, or the hardness of the surrounding strata, offer no impediments, I cannot see any risk in boldly opening the mine. If the direction of the ore is not precisely that of the strata, (nearly N. E. and S. W.), then no doubt of its forming a true vein can exist, and should it conform to the general direction, it reposes as a bed between the strata."

And again, in a letter of the same date,—

"If you have this ore in quantity, I most heartily congratulate you on its possession. You may work it to 35 per cent. easily, including all the ore and rejecting part of the rock only. But ores of 25 per cent. are very valuable and bear transportation well. * * If you have ore, systematic mining might be commenced, for where such ore abounds, capital and enterprise can always be found."

In a letter dated May 30th, 1856, he again says:—

"I have to-day finished averaging and assaying your second sample of copper ore. This is a mixture of altered copper ore, carbonates, silicates and oxides, with iron and much rock. One hundred parts of the average afforded 18 8-10ths per cent. of pure copper. With the true ore was so much rock, that the sample actually contained 56 per cent. of rock, aside from iron ore. Forty four parts of *pure ore*, yielded, therefore, 18 8-10ths of copper, or 42 per cent. * * * * * This, like a former parcel, could

be washed to a higher percentage, and was evidently derived from a very rich ore of copper. We distinguish the so-called *altered ores* from the original ones, which, as the primary source, are always more abundant than the altered ones, and more reliable."

I have quoted the preceding letters almost entire, thinking that the facts therein stated, coming from one who has had much experience in these matters, would be of service to all engaged in copper mining throughout the Province. As a corroboration of Dr. Hayes' results, I will quote those obtained from a few other and widely separated sources.

The first is as follows:—

Office, Baltimore Copper Company, Baltimore, July 2, 1856.

MESSRS. LOMBARD & Co., BOSTON.

The cask of copper was carefully analysed, and found to yield eighteen per cent. in copper, by the humid process. It could, however, be easily dressed up to a richer yield, by breaking off the stony gangue, or by crushing and jiggling the ore. * * * * *

(Signed)

D. KEENER, *Agent.*

The next is from Swansea, relating to the same ore.

March 4th, 1857.

The sample of the ore in the keg is all composed of a rich kind of sulphuret of copper, generally called pea-cock ore, and it has given on the assay 20½ per cent. of fine copper. The sample in the box was a poor carbonate, and made only 5½ of copper. There are 4 ounces of silver per ton, in the ore contained in the keg but the copper produce being so high, the silver would be of commercial value.

Another is dated—

Copper Warehouse, Liverpool, March 7th, 1857.

JAMES DOUGLAS, ESQUIRE,

DEAR SIR,—I have now the pleasure of handing you Mr. Herman's note, (our assayer at the works,) giving the produce of two samples of copper ore, being 20½ per cent., and 3½ per cent. respectively in produce of copper to the ton. The price ores of these produces of copper, sold for this week at the general Swansea sale of ores, for 20½ per cent. at £25 1 6 per ton, and for 3½, £3 18 6 per ton. The first is a most valuable ore, and the other may even be worked to advantage, providing it underwent the first process of smelting near the *mine*, so as to reduce it to a more valuable state called *regulus*, when it would then pay freight to this country; but your friends need not trouble themselves about the *low* produce ore, if they have the *other* on their property of 20½ per cent.

(Signed)

RICHARD EVANS.

The last is from the same source and is dated—

Liverpool, December 2nd, 1856.

DEAR SIR,—In reply to your favor of this date, our Swansea House reports the assay of the copper ore sample at 24½ per cent., and worth, at this produce, about £25 or £26 per ton, delivered at this port, according to present price of copper.

But please note that the sample was a rough one; otherwise the produce, if it could be relied on as an *average* one, would be considered very rich. This is as high as the West Coast, or Australia, or Cuba ores, while the produce of our home mines, (Cornish,) averages but about 7 per cent.

I am unable to add anything to the full details above given.

HOPEWELL MANGANESE MINES.

Having visited all the accessible localities in the neighborhood of Salmon River, we commenced our return journey by the road to Harvey Corner and Hopewell. At a short distance from the latter place, we turned off from the regular road to Hillsborough, and crossed by the flanks of Shepody Mountain to the Albert Coal Mines. This route was chosen in preference to the common one, in order that we might pay a visit to the mines of Manganese, which are situated by its side.

These mines, are, I believe, called "The Hopewell Manganese Mines." They are owned in part, if not entirely, by Mr. Steadman, (the brother of the Postmaster General,) and are situated in a ravine, upon the slope of Shepody Mountain, commanding a beautiful prospect of Hopewell and Shepody Bay. The mountain, in entire height, is about one thousand feet, and slopes to the Bay gradually. The ravine, in which the adits are driven, is about four hundred feet above high water, and at the base of a sloping ridge, also about four hundred feet high. The spot is about three miles from the nearest tide-water, and a good road connects the two. There is one main adit driven into the side of the ravine, which, after entering a few feet, pursues the course of the ridge about thirty rods (five hundred feet.) Two air-courses are driven in, higher up the ravine, to maintain the circulation. From the adit about four hundred tons, have (according to information given me by Mr. Steadman,) been already removed and shipped to England and the United States, where it sold for about £10 (currency?) per ton. The ore is a compact black oxide, less crystallized than those of Bathurst and Sussex, and stated to yield, by analysis, from 90 to 95 per cent. (of the oxide?). This percentage, however, I am disposed to regard as much too high, the ore, apparently, being less pure than those of Bathurst and Upham.

The geological position of these mines is peculiar. The mountain, which constitutes, according to Gesner, the highest land in this portion of the Province, is said to be about ten miles in circumference at its base. It is triangular in shape and is somewhat varied in the characters of its component rocks. According to information given to me at Hopewell, the south-western half of the mountain is composed of chloritic and talcose slates; the south-eastern side, at the same level, is sandstone, while capping both, and rising to the summit of the mountain, are coarse red conglomerates. One side of the ravine, where the adits are, (the right hand looking down towards Hopewell,) is composed, as I myself saw, of chloritic and talcose slates, with a little steatite, dipping about south-east. The bottom of the ravine is the point of junction between these rocks, and those in the immediate vicinity of the adits. These rocks, between the slates and the manganese, are limestones, (resembling mountain limestone,) and are about three or four feet thick, forming a sort of foot-wall; and with them is associated a little clay. The manganese occurs in veins and beds, some of the latter being from one to five feet in thickness. The course of the ravine and also of the lode is about N. E. and S. W., with a dip to the south-east.

There were, at one time, extensive chemical works in operation at this place, in the immediate vicinity of, and in connection with, the manganese mines. They have, however, been abandoned, and the machinery having been removed, they are now rapidly falling into ruins, presenting a cheerless and melancholy aspect. It is always discouraging to see works, erected with considerable effort, and necessarily at great expense, going to decay, and the present spot excites these feelings in no ordinary degree. The remains of huge furnaces and retorts, falling chimneys, bent and broken pipes, are piled in confusion under the crumbling walls, and form but a melancholy feature in the beautiful landscape which surrounds them. The products of these works were alum, soda-ash, and bleaching salts, (*chloride of lime*.) The alum was not made, as is commonly the case, from decomposing pyritous shales, there being none of these in the vicinity, but from clay beds found associated with the manganese.

I was informed that operations had been suspended, and the machinery removed, in consequence of difficulties having their origin in the American war, together with the high price of sulphur, nitre, and other chemicals. I am inclined to think, however, from the very ruinous condition of the works, that they had been partially abandoned, previously to the outbreak of that contest, and that the distance from any market, with the cost of transportation of chemicals both to and from the works, was one fruitful cause of their failure.

Specimens of manganese, selected from this locality, accompany this Report.

ALBERT COAL MINES.

Ascending from the manganese mines, and passing over the lofty flanks of Shepody Mountain, a drive of some six or eight miles brought us at last to the great attraction of this County, the Albert Coal Mines.

Of these mines, it is scarcely necessary that I should speak. So singular is their history, so lengthy are the reports and disputes concerning the true nature and position of the coal, and so extensive are their present operations, that much more time than I was enabled to give, would be necessary for a full account of their present condition, and of the facts which have been developed, since they were first opened. I cannot, however, for the general interest of the Province, refrain from referring to the extensive operations now conducted at this spot, as illustrating what a fair amount of energy and perseverance may do, in overcoming apparently insurmountable difficulties in mining operations. I am the more anxious to do this, as I cannot help thinking, that a little of the same vigor and effort applied to other localities, and more particularly to one only a few miles distant from the Albert mines, and soon to be described, would lead to favorable results, and would do much to overcome that lethargy and want of enterprise, which, in too many cases, has been the cause of failures in the Province.

That a fair idea may be entertained of the great advancement of the Albert Mines to-day, as compared with their position a few years back, and

to describe, in correct and brief words, the present condition of this very remarkable locality, I have taken pains to collect such facts as lay in my reach, and have combined them in the following sketch, which I trust will be of interest to all engaged in such pursuits, as well as to the public generally. For the information therein contained, I am especially indebted to Mr. Alexander Wright, himself one of the earliest shareholders, and most energetic prosecutors of the mines.

At the present time, the Albert Coal Mines are in a most flourishing and satisfactory condition. As proof of this, I may mention a few interesting facts as to their present power of production, their prospective means, and the number of hands employed. Of the latter there were, at the time of my visit, about one hundred engaged in employment immediately about the works, together with twenty-two horses. The company are now shipping, or intend to ship, during the present season, from sixteen thousand to eighteen thousand tons of coal.

The works are in a high state of efficiency, and are under the able management of Mr. Byers, the obliging Superintendent, to whose kindness I am indebted for an examination of the works, and for much useful information. Under his care, the mines, (at one time pronounced utterly valueless,) are becoming more and more extensive, and adding largely to the prosperity of the immediate vicinity, as well as of the Province at large.

The orderly arrangement evinced in every department connected with the works is especially noticeable. Every man seems to have his place, and every operation to be mechanical. There is no noise, no confusion; each one has a certain duty to perform, and is required to do it. Nor is this almost military discipline confined alone to the miners; all the employés, of whatever grade, are accustomed to consider and obey the same laws. This is probably the explanation of the very few accidents occurring in these mines. Only two employés have, I believe, been injured during Mr. Byers' administration, and these, I was told, were hurt entirely by the result of their own carelessness and disobedience.

The day of our visit to the mines, was the day appointed for the settlement of the monthly accounts, and we thus had an opportunity of observing the orderly way in which this department is conducted, under the able management of Mr. Ketchum, the secretary and cashier of the company.

The monthly pay roll is regularly kept, and each man's time is accurately noted therein, the entire amount due being given in one column, the sums to be deducted for schools, house rent, &c., in another, and lastly, the amount which the person concerned is entitled to receive. Each one comes into the office alone. The treasurer recognises him, scans his roll, reads off the number of day's worked—the gross amount—the deductions—and the nett balance due. This he hands to the workman, who, without a word, passes out from the office to resume his work. Not in *one single instance* was an objection raised or question asked by any party receiving his wages, and the only indications on the part of the recipients that they were not all

minutes, was an occasional "*Thank ye.*" The monthly wages vary from \$1⁰⁰ to \$40. The deduction for schooling, above alluded to, is a tax, amounting to ten cents for each man, which is levied for the maintenance of a competent teacher for the children of those employed. At present this school is said to be well conducted, under the management of a Mr. Duffy. Every child, whose parents are employed in the works, has the opportunity of receiving an education, without any extra charge beyond the monthly one of ten cents. In addition to the amount thus raised, which of course is but small, the teacher receives from the Government the ordinary teacher's allowance, and an additional sum from the Company, making for his salary a sum total of \$400 per annum. The teacher, like all other employes, has his name entered on the monthly pay list, and like them is liable to suffer deductions for time lost, or the non-fulfillment of his duties. The school tax is equally applicable to both single and married men.

There is quite a village, composed of the houses of the miners, surrounding the works, and everything has an air of active busy life. Most of these houses have been built by the Company, and are rented to the workmen. There are others which are the property of private individuals, and which are used for the purpose of providing the miners with the necessaries of life. The Company do not now, as formerly, keep either goods or a store of any kind, but each man is paid *in cash*, and thus allowed to expend his earnings in whatever manner he may see fit.

I have entered into the above details, which to some may appear trifling, as I think that such attention to order and morality, have had much to do with the present prosperity of the Albert Mines, and furnish an example which it would be well for other mining companies in the Province to follow. Anything which is accurate, concerning the operations of a company so successful as the present one, cannot fail to be of interest to the public generally. This is more particularly the case, as the Albert Mines have had to struggle against many difficulties. The most unfair and unjustifiable means (as I have been informed,) were used to prevent their early development. For years the company were obliged to defend their rights (at a great sacrifice of time and money,) from the attempts that were made to wrest the property out of their hands. Disputes followed disputes, and nearly the whole scientific world of America, and to some extent of England also, was employed in the determination of the vexed question whether there was any *coal* here at all!

The capitalists of New Brunswick held aloof from investing in what they pronounced to be an "uncertain and hazardous undertaking." Lengthy reports were published on the geological relations and chemical characters of the coal, and yet nothing, or at least little, was done towards the raising of it, until it had for the most part passed out of the hands of New Brunswickers into those of foreigners. The undertaking has now survived all the harsh treatment it met with at its first stage, and may be ranked among the most profitable mining operations of North America. As I have said, it is not the

pioneers of the undertaking who have reaped the reward of their early labors, nor have the citizens of New Brunswick to any great extent, the nett gains passing out of the Province into the United States. Yet the Albert Mines are to-day a real and an invaluable gain to the permanent resources of New Brunswick. They have given employment to a large number of persons from our laboring population, both in the raising of the material, and in the carrying trade; they have given an increased value to real estate in their neighborhood, for miles in extent; they have directly contributed to the revenue of the Province, a yearly royalty of some \$3,000 to \$4,000. They introduce foreign capital into the country, and tend to raise the moral and social condition of the people living near them. This is rendered evident by the superior class of buildings, already erected, or in process of erection, in the neighboring village of Hillsborough, and elsewhere in the vicinity. It is only necessary to compare the present condition of Albert County, and its principal towns, with the same some twelve years back, to see the great improvements now being made, and which may be either directly, or indirectly, attributed to the influence of these mines. Everything, in and around this flourishing locality, gives evidence of great and increasing material prosperity.

As I have said, there is now quite a village at the mines, consisting of the various buildings employed for the company's operations, and the houses of the operatives. The buildings for the raising and shipment of the coal are especially striking and substantial. Most of these I visited, in company with the Superintendent, who very obligingly pointed out and explained everything of interest connected with them. Great improvements are now being made, which, when completed, will nearly double the effective capacity of the works. There are at present, I believe, four steam engines employed, ranging from ten to one hundred and fifty horse power. These are to be in part supplanted by a single engine, of enormous size, (four hundred horse power,) which was, at the time of my visit, in process of erection. This is probably as large as any steam engine employed for coal-mining purposes on the continent, and will result in a great saving of both fuel and manual labor. The building, in which this engine is now being placed, is remarkable for its strength and solidity, being built of huge blocks of stone, also the products of Albert County, many feet in thickness.*

It was at one time thought that the supply of coal would soon become exhausted, and many evinced hesitation as to the propriety of erecting expensive machinery, over a mine which might at any moment cease to be of value. This uncertainty arose from the fact, that the distribution of the coal does not seem to follow the same laws which are generally observed in coal-mining districts, and frequently, when a level is being worked in a particular direction, the supply is found to suddenly fail. This is, of course,

* I may here mention that these stones, which are found in great abundance in several parts of Albert County, form a very valuable article of commerce in the Province, and have been largely exported to the States for building purposes.

partly due to "*faults*," but not entirely so, as, in many cases, the coal shows no conformability with the enclosing rock. It has been found, however, that in such cases other beds may be readily found, after a little drifting, and the proprietors have now no hesitation in urging on their works. The coal is of a perfectly uniform character, wherever found, there being no division possible into various qualities, and all commands the same commercial value.

For further details regarding the geological position and internal character of the Albert Mines, I would refer the reader to Dr. C. T. Jackson's Report, (Geo. F. Nesbitt & Co., New York, 1851,) and others published at the time of the celebrated controversy upon the character of this deposit.

CALEDONIA OIL WORKS.

From the Albert mines, we returned again to Salisbury, having been employed exactly five days in our tour around the County. Having yet another day at my disposal before returning to Saint John, I determined to visit the works of the Caledonia Coal Oil Company, at Baltimore, near the Albert mines. Spending Sunday, therefore, at Mr. Wright's, at Salisbury, we again drove down on Monday morning, to the interesting locality above named. The works referred to are situated in a deep valley, at the base of the Caledonia Mountain, intersected by the road leading through the Baltimore Settlement to Hopewell and Shepody. They are distant from Hillsborough, by a good road, down grade from the mines, about eight or nine miles, and are about the same distance from Hopewell. They are also about nineteen miles from the Salisbury Station, and about five from the post-road. The Albert mines lie about three miles to the westward, while along a line joining the two, there has been some boring for coal, with reasonable prospects of success.

The whole of the Country about the mines is similar to that about the Albert mines, being hilly and almost mountainous, the outcrops of coal being at the bottom and sides of deep valleys. The hills are covered with a fine growth of maples and other hard woods, slightly interspersed with soft wood, the land being exceedingly fertile, and destined at no distant day to become a fine locality for settlement. At the present time there are four farms in the immediate neighborhood, in a good state of cultivation; one of these is owned by a Mr. Bazely, who kindly showed me about the premises.

Before examining the works erected here for the manufacture of oil, Mr. Wright and myself, in company with Mr. Bazely, proceeded to examine a number of spots where the coal outcrops on the farm of the latter. I call the substance here referred to "coal," although in the vicinity generally known by the name of "shale." According to the statements of Dr. Roob, however, for whose opinion upon such matters I have great respect, it is neither a "shale" nor a "schist," but a true "cannel coal," having all the characteristic properties of the substance to which that name is given in other localities. Pieces of this coal are found scattered over the farm in

numberless places, mixed up with the layers of soil, and in several places the beds which contain it outcrop directly upon the surface.

Openings have been made upon six different strata, in the immediate vicinity of the oil works, and coal has been removed from them to the extent of one thousand tons and upwards. One of these openings I descended, and also passed for some distance into an adit, of which the above opening was one end, examining in both cases the beds above and below. The coal was found to form a distinct stratum, and, at the point where I measured it, was about four feet in thickness. This was about ten feet from the surface. In descending, the bed rapidly increases both in thickness and in purity, for, as just stated, it has, at the depth of ten feet, a thickness of four feet, whereas, near the surface, it does not exceed a thickness of seven inches. I measured the dip of the hanging and foot-walls, and found it to be about 44° to the north, the strike being nearly east and west. These walls are composed of highly-bituminous shale, emitting considerable odour. Indeed, a strong smell, resembling that of gas-works, was prevalent in the whole vicinity, notwithstanding the fact that operations at the oil works have been, for a considerable time, suspended. The shales and coal are perfectly conformable, the coal being a true *stratum*, and not a mere *deposit*, like some portions of the Albert coal.* The shales are a good deal distorted, and the coal itself shows numberless streaks of various shades of color. This is especially noticeable in portions which have been more or less weathered, a brownish wood-like color being then assumed, marked with various, and often beautiful, parallel and contorted bands. The unweathered coal is dark black, and unlike the true Albertite, entirely lustreless. It admits, however, of a fine polish, and beautiful ornamental objects might readily be cut or turned out of it, its color being little inferior to that of jet. The dark oily streaks add much to its beauty when thus polished. It is not at all brittle like the Albert coal, but, on the contrary, rather tough, breaking with a large conchoidal fracture. It is nearly homogeneous in character, but occasionally contains irregular seams and masses of a brightly shining and brilliant coal, apparently identical with true Albertite. It is also very hard and heavy, containing so much volatile bituminous matter, as to allow of being readily ignited by the flame of a match or candle.

Taking an average of all the beds yet opened, their thickness would be from two up to about seven feet. One of these beds is said to outcrop upon the very summit of Baltimore Mountain.

After finishing our explorations among the outcropping strata, we concluded our visit by a short examination of the neighboring oil-works.

These works, known, I believe, as the "Caledonia Works," have been at one time quite extensive. At present, however, lying idle as they are, they

* At the time of the celebrated controversy upon the nature of the Albert coal, this fact was one of much importance. One party contended that the Albertite was a *mere deposit*, and hence not *coal*, but *asphalt*; the other that it occurred in true strata of the coal measures, and was therefore really a highly bituminous coal. The latter is undoubtedly the correct view, yet Mr. Byers informs me, that while, in some portions of the mines, the coal is in beds conformable with the natural stratification, in others it is directly at right angles to it.

present but a melancholy spectacle. Erected, as they evidently were, at a very considerable outlay of capital, fitted with all the necessary apparatus for the manufacture of oil, and still possessing every facility for obtaining the coal in the deposits near by, with convenient water-power for the various operations of manufacture, they are yet, to all appearances, profitless, and on the rapid road to ruin.

There are five buildings immediately connected with the manufacture of the oil, besides three others, also erected by the company, for the accommodation of the employés. The main building, which is of considerable size, was used for the first processes of manufacture, upon the raw material. In this building are stampers, two large revolving iron retorts, furnished with appropriate condensers, and a steam engine of considerable power, for revolving the retorts, and performing other necessary operations. Below the building are iron tanks, into which the crude oil was conducted, before being submitted to the second stage of the process. This second part of the manufacture took place in a different building, into which the oil passed by iron pipes, and was conducted into a second series of large retorts, (not revolving as before,) where the oil underwent its first process of refinement. This was as far as the manufacture was conducted, the crude oil being drawn off into barrels, and thus sent to various places in the United States, where it was more completely refined, and introduced into the market. Several thousands of gallons of oil have thus been manufactured and sent into the States. It was used for a variety of purposes, its quality being pronounced as equal to the very best varieties of coal oil.

It may very naturally be asked, why these large and expensive works are allowed to remain in idleness. It is more easy to ask the question, I think, than to supply a satisfactory answer. Of course, interested parties will reply, "It does not pay—there is not sufficient capital, &c." But *why* does it not pay? I am told that the reason of the failure is the duty laid on the importation of coal oils into the United States, where the only market is to be found. Let us examine this answer a little, and see whether the difficulty could not possibly be obviated. The first question which naturally suggests itself is, why is not the oil *refined upon the spot*? Why ship to New York and Boston a crude oil, to be there refined, thus being obliged not only to pay all the import duties, but to have the oil again refined where fuel and labor are dear? Why not take advantage of the fuel afforded by the yet uncleared lands, in the immediate vicinity of the works, and thus send off not the *crude* but the *refined* oil ready for use? Another fact suggests itself. Of course crude oil is useless for home consumption, but if refined to the proper degree for ordinary purposes, could not this oil find a home market sufficiently great to pay the cost of its manufacture? Large quantities of oil are used in the Provinces. Considering the cheapness with which it might be here manufactured, might it not compete favorably with the other oils so largely imported? There would seem to be no reason, why all the processes of refinement should not be conducted on the spot. The proximity

of the coal, its unlimited quantity, the facilities for obtaining fuel, and the conveniences of water power, are such as to lead one to suppose, that any vigorous prosecution of the work must result favorably to those interested. At present everything is lying idle, and, what is worse, idleness necessarily implies decay. The machinery, engine, &c., cannot fail to suffer from neglect, and, indeed, already show very evident signs of a want of proper care. To illustrate to what extent losses are being endured, I may state that there are from twelve hundred to fifteen hundred cords of wood, lying close to the work, already corded and ready for use, yet fast passing to decay. They have been in this condition, I believe, for some two years or more! It certainly seems as if a little more energy and enterprise, on the part of those interested in the works, would lead to favorable results. It is *not* creditable to the citizens of New Brunswick, to allow their opportunities of developing their resources, and of reaping the advantages to be derived therefrom, to slip out of their hands into those of foreigners, as has already been done in too many cases. The Albert Mines for instance, in themselves a source of unbounded wealth, and at one time owned almost entirely by inhabitants of New Brunswick, was but a source of constant dispute and loss, so long as it remained in their hands, until at last it passed from their grasp, and is now annually carrying *out* of the Province, a clear gain of many thousands of pounds.

There can be no doubt, that the supply of coal, in the vicinity of these oil-works is very great, and its quality excellent. There is no good reason, therefore, why, with a little more energy and enterprise, it should not prove a source of wealth and profit to those immediately engaged in working it, and also to the Province at large. Even if it yielded only *one-half* the produce yielded by the true Albertite, it could not fail, I should think, of giving profitable results. At all events, why let the present supply of coal and fuel go to waste? why let fifteen hundred cords of wood decay in the open air, rather than perform their office under the retorts of the oil works? One thing is certain; if these mines and manufactures are not worked by New Brunswickers, they will be by foreigners. Parties from the United States are already acquainted with, and interested in, this locality; and I feel no doubt that if the present condition of affairs is allowed much longer, it will pass into their hands, and that the Caledonia works will share the fate of the Albert Mines.*

NORTON LEAD LODE.

Returning from Salisbury to Saint John, I stopped upon the way for a few hours, to examine a locality in the vicinity of Norton, King's County, to which I had been directed by Mr. Edward Allison, of Saint John. This locality contains a small amount of lead ore.

* NOTE.—I trust that no one interested in the Caledonia Works, will misconceive the object of the above remarks, or take offence at the freedom, with which I have ventured to criticise the condition of affairs at this place. It is quite possible, that other reasons than any known to me, have caused the present inaction, and reasons in every way rational. I have only desired to express the convictions forced upon me as a stranger, by a casual visit to the spot. I am wholly unacquainted even with the names of the parties interested.

It is situated about a mile and a half from the Norton Station, in a ravine near Coate's (now Blair's,) mill. The rocks, at the point shown to me, are limestones, and a considerable quantity of this rock has been calcined upon the spot, the remains of the kilns being still visible, although none are now in active operation. Descending into a cavity, some twenty feet long and ten deep, in the ravine above mentioned, I found thin seams of galena branching here and there through the lime-rock, but not appearing in any considerable mass. The ore is remarkably soft, uncrystallized, and probably contains a good percentage of silver. I could, however, detect no sign of a distinct lode, or lode-wall, nor do the lead veins pursue any very determined course. Some of the lime-rock is well crystallized and translucent. Lead has been removed from one or two other spots in the vicinity, but not in any considerable quantities. From present appearances, I should regard the limestone as more valuable than the lead.

From Norton I returned to Saint John, and thence, on the 14th of August to Fredericton. Thus ended my explorations, the results of which I now have the honor to lay before Your Excellency.

In the preparation of the foregoing report, I have been constantly reminded of the desirability of bringing before Your Excellency, the Government and people of New Brunswick, a clear, concise, and complete account of the present state of mining operations in the Province. It will at once be seen, that the preceding report has chiefly aimed at attaining that object, no particulars, even the most trivial, having been neglected, from the belief that in a country like this, where mining operations are in their very infancy, such details are of inestimable value to those about to engage in such pursuits. Considering the very short time employed, and the very large extent of country travelled over, it is natural that this account should be incomplete in many particulars, which a more thorough examination would have sufficed to supply. As to its accuracy, I can only say that I have spared no pains to make my own observations correct, and for other information, have appealed only to those whose knowledge and integrity I cannot doubt. Among others, I am especially indebted to Messrs. Allison, Woodward, and Matthew, of Saint John, Mr. Baldwin, of Bathurst, and Mr. Alexander Wright, of Salisbury.

There are but a few other localities of special interest in the Province, which have not as yet been alluded to in this Report. Among these I may mention, more particularly, Woodstock and the West Beach. Considering the object for which this Report is written, namely, to give as accurate an account as possible of the present mining operations in the Province, it would seem to lack completion, without some allusion to these interesting localities. Neither of them was visited by me during the present season, but, from reliable authorities, I have been able to obtain the following facts, most of which have not before been presented to the public.

WOODSTOCK IRON WORKS.

The Woodstock haematite beds, where the works now referred to are located, were discovered, in the year 1836, by Dr. C. T. Jackson, of Boston, during a geological survey conducted under his guidance, by the authority of the State of Maine. Their value was at once recognised, and, from the date of their discovery, they have been well known and highly prized, for their extent, and the fine quality of the iron which they yield. When first made known by Dr. Jackson, in his Report to the Governor of Maine, in 1837, the bed was described as being nearly nine hundred feet wide, and of unknown length. The following calculations were then given as to its probable productive capacity.

"The ore," says Dr. Jackson, "is the compact red haematite, and will yield 44 per cent. of pure metallic iron, and 50 per cent. of cast iron. Allowing its specific gravity to be 3.5, and some of it will range still higher, a cubic foot of the ore will weigh two hundred pounds. If the ore were wrought to the depth of one hundred feet, and five hundred feet in length, we should have for the cubic contents, $900 \times 100 \times 500 = 45,000,000$ cubic feet of ore. Every cubic foot yielding 50 per cent. of cast iron, we should have 225,000,000 pounds, as the amount of cast iron that can be wrought from this bed, within these narrow limits."

I am indebted to Mr. Norris Best, one of the proprietors of the property, for the following interesting particulars, as well as to the seventh Annual Report of the Maine Board of Agriculture, where, in a letter from Mr. George L. Goodale, Secretary of the Board, to the Governor of Maine, some interesting details are given, which will be found below.

The ore upon which the Company is at present engaged, is a reddish compact peroxide of iron, generally known as *haematite*, but, judging from the quantity of water which it contains, more properly termed *limonite*. There are, however, two localities from which the ore has been obtained, one of which, according to Mr. Goodale, contains a true compact red haematite, the other a hydrous per oxide, or limonite. These ores are found, according to Mr. Best, over the greater part of the northern and north-eastern portions of the County of Carleton. The spot, where the ore is now raised, is in Jacksontown, situated about two and a half miles from the furnaces, and about three or three and a half from Woodstock. The ore occurs in beds or veins, included, I believe, in calciferous and manganesian slates, having, with the latter, a strike nearly N. E. and S. W., and with a thickness varying from six inches to as much as eight feet. The greater part of them are about three and a half feet in width. The depth is entirely unknown, as no shafts have yet been sunk, but Mr. Best informs me that he has found "from surface inspection," the same vein they are now engaged upon, at a level of two hundred feet below the present workings. These veins or beds (as they should more properly be called,) are found very close together, often not separated to a distance of more than three feet, and are strongly adherent to the slates which enclose them. They are nearly vertical in position, but

are at times somewhat tortuous, being apparently interrupted by some disturbing force. Whether these irregularities are the effects of faults and dislocations, or are due to the beds having been originally formed by slow deposition from water, in irregular crevices of the enclosing slates, I am unable to determine, without a personal examination of the ground. I am inclined to believe them the results of disturbing causes. These slates are represented as being particularly hard, of a fine red color, and very difficult to blast. They are eminently characteristic of the haematite beds, and in the present instance led to their discovery.

As I have said, no shafts have as yet been sunk upon these beds, operations having been heretofore confined to a simple quarrying of the ore, within a few feet of the surface. The proprietors, however, are now preparing to open a large number of the veins on one level, which, when accomplished, will give "a face of about 40 feet in height."

The beds of haematite, above described, together with furnaces employed for the reduction of the ore, are the property of a company known as "The Woodstock Charcoal Iron Company," composed of two members only, Mr. Norris Best and Mr. Ellis Smith. They employ in the raising of the ore an average of about forty men. The ore is conveyed from the mine to the furnaces, which are situated on the river bank, a short distance above Woodstock, by waggons during the summer season, and by sleds in winter, thus employing, on an average for the year round, about ten pair of horses, with their necessary drivers.

The furnaces, used in reduction, are somewhat similar in construction to ordinary lime kilns, but unlike the latter, are provided with grates and doors, and are of a model not now generally employed. They are thirty-nine feet in height from the hearth to the top; the "boshes" (or inverted conical cavity above the crucible,) being nine feet nine inches in width. The fire brick employed in the lining of the furnace, is obtained from Sturbridge, England. The hearthstones have, I believe, been also imported until recently, when the company have endeavored to procure substitutes from the sandstone beds of the Tobique. Whether the latter have proved satisfactory, I am not yet informed. They are said to have been obtained at a distance of about forty miles from its mouth, probably from the red sandstone formation above Plaster Island. Mr. Best informs me, that it is rather a quartz rock, than either a true sandstone or a grit, but its red color would seem to imply that it belonged to the formation above referred to. I should think that good hearthstones might be found at a variety of places on that stream.

The machinery for maintaining the "Blast," consists of two steam engines of thirty horse power each, with two "Blowing" or "Air Cylinders" of sixty inches diameter and five feet stroke, respectively, the latter being capable of generating sufficient wind for these furnaces. The wind, thus generated, is conveyed through ovens placed near the top of the furnace, these ovens being themselves heated by the gas escaping from the shaft, by

NOTE.—I have already remarked upon the existence of similar beds on the Nepisiquit River, and the probability of future discoveries in that interesting region.

which ingenious arrangement, a temperature of 800 or 900° is imparted to the blast. The same gas is also made to pass under the boilers, and thus saves the use of any fuel for obtaining steam. The average duration of each crucible and hearth is about twenty-four weeks, during which time an average production is attained of fifty tons per week. It is thought that this amount may in the future be somewhat increased.

I have stated that the number of men, employed in raising the ore, is on an average about forty, while ten pair of horses, each with a driver, are occupied in removing the ore from the quarries to the furnace. During the process of reduction, the number of men employed, only a single furnace being used, averages about fifty per day. The company have now in course of erection another furnace, which will necessitate an increase of two-thirds in the number of men employed. In addition to those employed in the various processes of raising, removing and reducing the ore, as above stated, a number of men and horses are also required, during the winter season, for cutting and hauling in the wood for the year's consumption. The following are Mr. Best's calculations upon this point. He says, "The wood is all cut during a space of five months. Last winter we had delivered to us, in sixteen weeks, nearly ten thousand cords, each cord containing one hundred and thirty-eight and eight-tenths cubic feet. Assuming, then, that a man will cut, chop, and split one cord per day, it would take eighty men, twenty-four *working* days each month, for *five* months; and assuming that one span (two horses,) with a driver, bring on an average two and a half cords per day, it would give employment for seventeen weeks, (five working days to the week,) in round numbers, to fifty teams, or one hundred horses, and seventy-five men. This is some faint outline of present operations; of course another furnace will double the requirement." As at the Albert mines, the proprietors invariably make full cash payments to all their employés.

The Woodstock iron has been long known and valued for its remarkable density and strength. I am indebted to the letter of Mr. Goodale, above referred to, and published in the Report of the Maine Scientific Survey, page 418, for the following interesting statement. "The English Admiralty instituted experiments at Shoeburyness, England, in order to test the resistance which iron plates would offer, to the heavy ordnance of Sir William Armstrong. In that trial, every plate was shattered, except a triple plate made of Woodstock iron. This plate was indented by the shot, but not pierced, and immediately attracted considerable attention. The fine results obtained by the Woodstock plate determined the use of the iron in mail-plating the ships in the English navy. An interesting account of the experiments testing these plates can be found in "The Artizan." The paper was prepared by William Fairbairn, Esquire, F.R.S., and gives the following results:—

Tensile strength in tons per square inch, 24.80.

Scrap-iron plates were readily shattered by the shot.

In the same connection I find it stated by Professor C. H. Hitchcock, that

in a course of private experiments, instituted by the English Government, a variety of scrap-iron plates of the best quality were shattered by a 230 lb. shot, from an Armstrong gun, while plates manufactured from the Woodstock iron, were only indented in a slight degree. Six different trials were made, with the same result.

Mr. Best writes me that the iron has been used by the largest Armor Plate Maker in England, with entire success, and that it has given the greatest satisfaction. Some fine boiler plates, in the manufacture of which a portion of this was used, resisted a tension of twenty-three tons to the inch. He ascribes its superiority to the manner in which the ore is treated during the process of smelting, which gives it a more than ordinary amount of carbon, and to its great density, which of course gives it an extra resisting power. The metal, when cast, is a fine fibrous silver-gray iron, singularly close-grained, and ringing, when struck, very much like steel. I have already said that a mixture of two ores is employed in its manufacture, the one being a haematite, the other a hydrous peroxide, or limonite. According to Mr. Goodale, two hundred pounds of one of these ores is usually reduced in a charge with 1.150 of the other. According to the same authority, the following are the proportions of iron-ore, fuel and lime:—

3 barrows of ore, 450 lbs. each, 1,350 pounds.

20 bushels of charcoal.

70 pounds of limestone.

The metal is cast into pigs of 90 lbs. each.

The proprietors believe the iron thus wrought to be superior to Swedish, Russian, and East Indian Pig Iron, and draw their conclusion from the fact, that one cubic inch of the Woodstock metal will weigh, at least, 22 per cent. more than either of the above, and is something like 26 per cent. heavier than most of the "Scotch brands."

The following is an analysis of the ore made by the Company, being considered as an average of all the specimens examined:—

Peroxide of Iron,	...	...	...	...	...	39.285
Protoxide "	...	...	...	...	...	1.140
Alumina,	...	...	...	...	...	3.116
Oxide of Manganese,	...	...	...	...	...	5.872
Lime,	...	...	...	...	...	1.120
Magnesia,	...	...	...	...	...	4.602
Potash,	...	...	...	...	...	.762
Soda,	...	...	...	...	...	.512
Sulphuric Acid,	...	...	...	...	...	1.274
Phosphoric "	...	...	...	...	...	1.389
Silica,	...	...	...	...	...	25.964
Carbonic Acid and Water,	...	...	...	...	...	14.964

100.000

Metallic Iron, 28.377

Some specimens have been found to contain a greater, some a less percentage than the above, but the analysis now given may be considered as a

fair average of the whole, *i. e.* every ton of the ore used, has, upon the whole, produced the above percentage of metallic iron.

The limestone employed in the process of reduction, is obtained by the Company from lands belonging to them, on "The Pecaquimic," about seven miles from the works. The charcoal is made upon the Company's grounds, in kilns constructed for the purpose.

To conclude, it will be seen, from what I have now stated, that the Woodstock Iron Works are in a most flourishing and satisfactory condition. It is true that their production of metal has so far been but small in comparison with that of the other great iron regions of North America, but now that the quality of their metal seems to be so firmly established in the market, it is to be hoped that their facilities will be so increased as to render the supply adequate to the demand. The Company, above referred to, are already making preparations for an increase of their works, while, I believe, another Company has recently undertaken operations in the same vicinity. This County may yet prove one of the most valuable in the Province for its metalliferous deposits.

I should not omit to state that a deposit of copper exists in the vicinity of Woodstock, situated, according to Professor Hitchcock, in syenitic calcareous rock, the common rock in the vicinity being a micaceous quartzite, traversed by dykes. The strings are represented as perpendicular, but none of them over half an inch in width. They were formerly mined, but have since been abandoned.

IRON ORE OF WEST BEACH, SAINT JOHN COUNTY.

The West Beach locality of iron ore was visited by me, in company with Mr. Matthew, in the summer of 1862, at which time we spent nearly a fortnight in the examination of the country in this vicinity. Soon after our return, a short account of the locality was drawn up by Mr. Matthew, for the Natural History Society, which for convenience of reference, I shall here introduce in his own words.

"*Iron ore of West Beach.*—The bed of ore at this place, in which the mine has been opened, is included in the upper part of a large mass of coarse, reddish-gray conglomerate, dipping to the S. E. at an angle of about 30°, and distant a furlong from the shore. The pit or quarry, from which the ore has been extracted, has been opened in a bed of dark reddish-brown haematite. One or more schooner loads have been taken away, and a quantity still remains awaiting shipment. The conglomerate is abundantly scamed with quartz, containing scattered masses and veins of micaceous and specular iron, in tabular crystals.

Two or three miles eastward from the mine, the iron ore again appears on the hill-side. Here, however, three or four beds of ore, (one of them twenty feet thick,) are visible, and the associated rocks are different, consisting of beds of trap-ash, trap-ash slate, and talco-micaceous slate. The ore beds were not traced on the eastern side of Black River. Were it not for their

variable thickness, they might be sought for here with much probability of success.

A continuation of the same rocks holds beds of limestone at Emerson's Creek, a few miles to the eastward. The facilities for working this ore are, therefore, in some respects, unusually good, but no smelting operations have hitherto been undertaken. From its association, it would appear that this ore was originally deposited in the state of a finely divided ferruginous mud, in a shallow sea, and within the influence of active volcanoes."

The ore is favorably situated for mining, the fuel and the flux being both abundant in the vicinity, while the transportation to Black River, or the shore in the immediate neighborhood, would not be difficult. The ore yields, as I am informed by Mr. Allison, about 68 per cent. of metal.

There is but one other portion of the Province where metalliferous deposits exist in sufficient quantity to deserve mention here. I refer to the County of King's, in which, at various points, ores of the different useful metals have been reported. Two of the localities, that yielding lead, at Norton, and that from which manganese is now extensively removed, at Sussex, have already been alluded to. Besides these, galena is reported as occurring in limestone, on the north shore of Belle Isle Bay, (probably similar to that at Norton,) and at Quispamsis; a large bed of magnetic iron ore west of Bull Moose Hill; also at Kingston; specular iron at Clifton, and to the north of Baxter's Inn. None of these last named localities have been visited by me. For information regarding the Bull Moose Hill deposit, and also another large ore-bed, near the Nerepis, see Gesner, 1st Report, page 72, also 3rd, page 52.

RARE METALS.

Besides the above named common and useful ores, such as lead, iron, copper and manganese, I may briefly allude to a few of the rare metals, which have from time to time been discovered in the Province. None of these, in the quantities at present known, are of commercial value, but are interesting as indications of the districts where greater quantities may yet be discovered, and also as defining more clearly those regions in which mineral wealth is to be expected.

GOLD.—As before stated, gold was found by me during my tour in Albert County, in the vicinity of Elgin Corner. This locality is worthy of more attentive and thorough examination. The precious metal has also been stated to occur on some of the streams in the vicinity of Bathurst, and on the Serpentine, or left branch of the Tobique. I have also seen an excellent specimen, said to have been found on the Wapskahegan, a tributary of the Tobique, as described in an earlier portion of this Report. A very striking fact, and one which goes far to prove the correctness of some or all of the above statements, is that three of the localities, at least, are situated in the same geological formation, and that, one which in itself is a highly promis-

ing field for such discoveries. It is scarcely to be expected that persons with little or no geological knowledge, and in widely separated districts, should thus have stumbled upon the same formation, had there not been some foundation in fact for the reports they now present. A still more satisfactory corroboration of these facts is furnished by the actual discovery, by the geologists of the Maine Scientific Survey, of gold at Baileyville, Maine, and on the land of Mr. Bolton, of Saint Stephen. Both of these localities are situated in the same geological formations as those above referred to, namely, the great metamorphic belts of micaceous and schistose slates, which cross the Province parallel to the great central granitic range. Even the locality in Albert County is of a like description. The deposits of auriferous rocks, where yet discovered, are generally associated with considerable pyrites. In this character they bear much resemblance to some of the gold-bearing rocks of Nova Scotia, many of which will yield a good return of fine gold, by crushing and amalgamation, when exhibiting no external signs of the metal. It will be remembered, in this connection, that the pyrites accompanying the copper ores at Mr. Vernon's mine, in Albert County, yielded Dr. Hayes, of Boston, gold to the amount of twenty-two dollars to the ton. This is a profitable quantity, especially when obtained in connection with other ores. Rocks yielding less than twenty dollars to the ton, are not worth the cost of crushing. Besides the above, there is a bed of quartzite, of considerable extent, in the vicinity of Mr. Randall's lime works, in Charlotte County, which yielded Dr. Hayes a small amount of gold, but not sufficient to appear profitable.

Silver is generally associated in greater or less quantities with all lead ores. Those of Norton, L'Etang, and Campo Bello, seem to be argentiferous, but the quantity has not been definitely ascertained. (See earlier part of this Report.) The copper ore of Simpson's Island is also said to yield a small but unprofitable amount.

Zinc blende occurs, associated with galena, at Campo Bello, but only in small quantities. It has also been found on the Nerepis, and in boulders in the vicinity of Dalhousie, Restigouche County. The latter has afforded good cabinet specimens, but no workable quantities.

Tin is said to occur in the granite rocks at the mouth of the Pokiok River, in York County, (some six miles from the Antimony mines,) but the ore is rare and valueless. I have seen no specimens.

Molybdenum, a rare metal, has been found in gneiss, near Saint Stephen, and in the vicinity of the "Rough Waters," between the Pabineau Falls and Bathurst, on the Nepisiquit. It has no useful applications in the arts.

COAL.

The preceding portions of this Report will be found to contain all the information which at present it is possible to obtain, upon the occurrence of the more useful metals, and the ores from which they are derived. It may now be of service to give a few general remarks on some of the more com-

mon and abundant minerals, which, while not employed as a source of obtaining metals, are yet of considerable value for other economic purposes.

Of such minerals, coal, of course, is the most useful and the most important. At the same time, its occurrence is better known in the Province, than that of the metallic ores, and requires much less consideration. It will be unnecessary, therefore, for me to dwell upon its distribution, especially as nearly all which can be said upon the subject, has already been included in the Reports of the Provincial Geologist, and of my predecessor, Dr. Robb. My purpose being more particularly to search for metallic ores, I purposely avoided the great central coal field of the Province, merely passing over a portion in the eastern part of Albert County. Some remarks upon the remarkable localities in that section have already been given. I have only to add, that oil has recently been discovered on a slip of land between the Memramcook and the Petitcodiac, in Dorchester. It is found floating upon the surface of a stream, where, upon exposure to the air, it hardens into a sort of pitch. I believe it is intended to make some borings in the vicinity, to ascertain, if possible, the existence of oil-wells. It might be profitable to undertake similar experiments in other parts of the Province, especially where the substance termed *maltha* is found in quantity.

For facts relating to the whole subject of the distribution of coal in the Province, see *Dr. Robb's Letter in Johnston's Agricultural Report*, pages 38—48.

Since writing the above, I have been furnished, through the kindness of Mr. C. W. Wetmore, with the following particulars in regard to the coal deposits of the Grand Lake region.

During the year 1863, as far as can be ascertained, the amount of coal raised was about three thousand chaldrons. The coal is found in a bed of from fourteen to twenty inches thickness, outcropping at many points over an area of several miles. The bed is found at depths varying from six to thirty feet below the surface. The mining operations have for some years been confined chiefly to the Newcastle Stream, but a little coal has also been removed near the mouth of the Little River, and of late on the Salmon River. The bed at the latter locality is said to be of the same thickness as that at Newcastle.

Where the coal is within six or eight feet of the surface, the miners remove it by "*stripping*," but when the earth is deeper, and there is sufficient inclination to carry off the water, adits are driven, three or four feet in height by seven in width, which sometimes attain a length of several hundred feet. From these main levels, lesser ones are driven at right angles on either side.

There are numerous parties engaged in mining, and no very extensive operations have yet been undertaken. The miners are chiefly old country people. The plan usually adopted by the landholder and miner is the following. The landholder opens the main level and drains at his own expense, and hauls the coal to "the bank," (or first place of shipment,) when it is equally divided between the miner and himself. This bank is at a distance of from four to six miles from the Newcastle mines, and from here, with the

exception of a short time during the spring freshets, the coal has to be scowed a distance of a mile and a quarter to the Lake.

The price of the coal at the "bank" varies according to the quality, the usual price of the best unscreened being from sixteen to eighteen shillings per chaldron, subject, however, to a Government duty of one shilling, and sometimes two shillings. The necessity of so often handling the coal tends to break it up, and thereby greatly lessens its value. It is thought by persons well acquainted with the stream, that the small portion of it between the Lake and the bank, which requires dredging, could be rendered navigable and a wharf be built, for about £500 or £600. If this were done, vessels could proceed to the bank and load in one day, instead of in four, as now required. A saving of one shilling on the freight would thereby be effected, and the value of the coal itself would be enhanced by saving, to a considerable extent, the loss by breakage.

The locality, however, is not altogether a promising one, and unless a thicker bed should be discovered, which is not probable, mining operations cannot be carried on very successfully. The coal is of the "eaking" variety, igniting readily, but requiring frequent stirring for complete combustion. One of the principal objections to its use is the presence of pyrites, which in some portions is very abundant. For further information concerning this locality, see Johnston's Report, page 42.

LIMESTONE, GYPSUM, GRAPHITE, &c.

Next to coal, limestone and gypsum are of the highest importance, but are two well known to require extended notice here. I have already alluded to the immense beds of the latter, which characterise much of the red sandstone district of the Tobique River, in the vicinity of the Wapskahegan and Plaster Island. Of other localities, one of the finest and most productive is the vicinity of Hillsborough, in Albert County, where the very pure and beautiful variety, termed alabaster, is extensively quarried and calcined. It occurs also at Sussex, and at Cape Maranguin, in Westmorland. Limestone is too common to require notice. In the limestone district of Restigouche, at Belledune, a beautiful crystallised variety (termed Iceland spar,) occurs, and is of the best quality for optical purposes.

Heavy Spar or *Barytes*, (*sulphate of baryta*), is quite commonly associated with metallic ores. When abundant, it is valuable for the purpose of admixture with white lead, and is sometimes employed alone. The only locality known to me, where the quantity is likely to prove large, is the L'Etang Island, where it must necessarily be removed in the mining for lead, which has been undertaken in that district. Limestone is also abundant in that vicinity, and the three might be profitably worked together.

Pyrites or *disulphuret of iron*, (the *nundie* of the miners,) is a very important mineral production, and none is more common in the Province. Under certain circumstances, its value cannot be over-estimated. From it are prepared, by very simple processes, some of the most important chemicals

employed in the arts--copperas, (or green vitriol,) alum, sulphur, and carbonate of soda. The great advantage in its use lies in the fact, that from it two of the most useful substances, sulphur and alum, may be obtained at one and the same time. By simple roasting, one part of sulphur is obtained in a pure form, and this variety of sulphur is now more highly prized, for commercial purposes, than the native mineral. The residue, *protosulphuret of iron*, is then, by simple exposure to the air, and frequent moistening, oxydized, and converted into sulphate of iron, or copperas. I mention these facts, because, although well known in many quarters, they do not seem to be so well known to those whose interest it is, more particularly, to take advantage of such facts. Pyrites is almost invariably removed in large quantities, during the processes of mining for metallic ores, and is generally thrown aside into the refuse heap. If simply piled up over appropriate vessels and slightly roasted, a very considerable and valuable amount of vitriol might be obtained. It is also of importance to know these facts, because, in case of a foreign war, the Province might be obliged, as other nations have been, to seek their warlike materials from their own resources. They would then be obliged to manufacture both sulphur and alum from iron pyrites. To make the business profitable, however, when conducted by itself alone, it is necessary that there should be a very large supply of the material. I am not aware of any locality in the Province where it exists in sufficient quantities for such a purpose, unless it be the pyritiferous sandstones, noticed by me on the lower portion of the Nepisiquit River. In that section it seems to be very abundant. A large amount of mundie (pyrrhotine,) is also removed from the Wheal Louisiana Mines, in Charlotte.

Alum Slate.—The rock so called may be either a slate, actually containing alum as such, or else a pyritiferous shale, which may yield alum by exposure and lixiviation. The localities, if any, are the same as those referred to under pyrites. Alunite is also said to occur at the Hopewell Manganese Mines, where works for the manufacture of alum, &c., were once established. The rock is a valuable one, when abundant.

As regards materials for purposes of building, such as granites, marble, sandstones, and slates, my tour has afforded me little in addition to what was already known. Excellent slates were seen on the Nepisiquit River, but are too far from a market, and too difficult of transportation, to be of much value at present. Good granite also exists in the same locality. I have already alluded to the admirable freestones in the vicinity of the Mills, on the Lepreau River, and think their quarrying might readily be found profitable. There are excellent beds of clay in the same neighborhood.

Graphite or Plumbago.—This valuable substance has been found in several portions of the Province in greater or less quantities. The largest bed yet known is that at the Falls of the River St. John, and extending thence around a portion of the City. In 1853, according to Mr. M. H. Perley, 89,936 pounds were exported, but all work upon the deposit has since been discontinued.

I find in the Museum of the University a fine specimen of graphite, labelled as occurring near Dorchester, in Westmorland County. The specimen is remarkably soft, brilliant, and apparently free from impurities. I am ignorant of its extent and mode of occurrence.

Bog Iron, Manganese, and Ochres.—These are remarkably abundant in the Province, and were it not for the presence of purer ores of the same metals, might possibly prove of value. At present they are not likely to receive any useful application. The ochres may, perhaps, be considered as an exception. These are quite abundant and of great purity, and have already received a local application as different varieties of mineral paint.

LOCALITIES OF MINERAL SPECIES.

In addition to the Minerals now enumerated, there are a number of others of less importance, which do not require individual notice. They are, however, of interest scientifically, and many of them may receive a limited and local useful application. As it is designed to make the present Report one of reference for all subjects connected with the distribution of Ores and Minerals in New Brunswick, I have determined to present, in a tabular form, a list of all the species known to exist in the different localities of the Province. To accomplish this object, I have been obliged to rely, for the most part, on the labours of those who have devoted a longer period to the study than myself, and whose special object has been the exploration of our mineral wealth.

The accompanying List of Mineral Localities was originally drawn up by Mr. G. F. Matthew, of St. John, (himself one of the most earnest and successful laborers in this field of study.) from the writings of Dr. Gesner, Dr. Robb, and from his own observations. The original list has already been published in the St. John papers, and by Mr. O. C. Marsh in the March (1863) Number of Silliman's Journal. My own labors, however, during the past summer, having allowed me to add so many new localities, and to define with more precision the position of so many deposits, before only imperfectly known, I need scarcely offer an apology for presenting the list anew. It is, moreover, desirable that such a list should be allowed to circulate through the Province in a convenient form for reference, which is not now the case.

The method adopted in the arrangement of these Tables is the same used in all lists of mineral localities. Ordinary specimens are printed in ordinary type; fair specimens are italicized; choice specimens are marked (!); and two marks of exclamation (!!) indicate that the specimens are *unique*. Marks of interrogation placed after a word, express a degree of *doubt* as to the correctness of that word.

ALBERT COUNTY.

BALTIMORE.—Cannel (?) *coal*! formerly mined and used for the manufacture of oil.—(See Report.)

BLACKWOOD BLOCK.—(eight miles from Elgin Corner.)—In the sand of a brook, and in quartz rock, penetrating *talcose slates*, Gold. (See Report.)

COVERDALE RIVER.—Elastic bitumen.

GRINDSTONE POINT and ISLAND.—Barytes, iron pyrites, lignite.

HOPEWELL PARISH.—ALBERT MINES.—*Albertite*!!

DEMOISELLE CREEK.—Gypsum (*alabaster* and *selenite*); per-oxide of manganese.

PETITCODIAC.—Bluff below Edgett's, mineral paint, iron sand.

POLLET RIVER.—Fifteen miles from mouth, coal.

SHEPODY MOUNTAIN.—Alunite in clay, (formerly used for the manufacture of alum, &c.); barytes; *calcite*, (rhombs with manganese); iron pyrites, *manganite*? *psilomelane*, *pyrolusite*, *steatite*.

TURTLE CREEK.—Coal.

UPPER SALMON RIVER.—Two miles from mouth, copper pyrites, iron pyrites, *erubescite*, *malachite*, *chrysocolla*, *red oxide of copper*, (*cuprite*).—(*Alma*, *Kinney's*, and *Williams Mines*.)

CARLETON CO.

BRIGHTON.—Limestone.

BULL'S CREEK, (near Woodstock.)—Chalcopyrite, *marcasite*, copper pyrites, (formerly mined), *pyrrhotine*—*soapstone*.

WOODSTOCK and vicinity.—Estey's farm, Jacksontown, (five miles above Woodstock)—*Haematite*, iron pyrites; fifteen miles above Woodstock, *haematite*; Poulle's farm, *pyrrhotine*; (precise locality doubtful) *cubic pyrites*, (vein in *haematite*); *rock crystal*, *marble*, *galena*; Moose Mountain, *honestone*.

CHARLOTTE CO.

ADAMS' ISLAND.—Copper ore.

BEAVER HARBOR.—Chlorite, *jasper* (red.)

CAMPO BELLO.—Micaceous iron, specular iron, bi-sulphuret of iron, bog iron, blende, *galena*, *anglesite*; at Welchpool, blende, copper pyrites, *erubescite*, *galena*, iron pyrites; at head of Harbor de Lute, *galena*, (4 inch vein); at Head Harbor, *copperas*, iron pyrites.

DEER ISLAND.—Copper ore; on west side, *calcite* (in amygdaloid), *magnetite*, quartz crystals (in trap.)

DIGDEGUASH RIVER.—Chalcopyrite, *felspar*; on west side of entrance, *calcite*! (in conglomerate), *chalcedony*; Long or Jasper Island, *galena*; Rolling Dam, *graphite*.

GRAND MANAN.—*Analcime*! pure silica, specular iron; between Northern Head and Dark Harbor—*agate*, *amethyst*, *apophyllite*, *calcite*, *hematite*, *heulandite*, *jasper*, *Thompsonite*, *magnetite*, *natrolite*, *stilbite*; at Whale Cove, *calcite*! *heulandite*! *lawsonite*! *stilbite*! *semi-opal*!; at Fish Head, two miles south of Eel Brook, *chlorite* in quartz, (abundant); at Rosse's Island, quartz crystals; at White Head, *chlorite*, quartz crystals.

HARDWOOD ISLAND, (near Deer Island, Passamaquoddy Bay.)—Copper pyrites (yellow sulphuret) in chlorite slate.

L'ETANG ISLAND.—(Frye's or Cailiff ISLAND.)—On the northern side, at the Mill, *galena*, *calc spar*, heavy spar, *fluor*; on shore, half a mile from Mill, *serpentine*, *verde antique*, *asbestos*, iron pyrites; on highest part of Island, *galena*, *fluor*, *calc spar*. (See Report.)

LATETE.—"WHEEL LOUISIANA MINE."—*Copper pyrites*, iron pyrites, *stalactitic ochre*, *pyrrhotine*, *actinolite*.—(See Report.) "LATETE MINE."—Copper pyrites in quartz and greenstone, *galena*.

LONG (or Jasper) ISLAND.—See Digdeguash River.

MAGAGUADAVIC RIVER.—At entrance, azurite, copper pyrites in veins, malachite, (probably identical with the LaTete mine): one eighth of a mile east, (M^lLeod's?) galena.

MILL TOWN, (near St. Stephen.)—Shorl (in granite.)

MOORE'S MILL.—Actinolite, black wad; red, green and striped jasper; serpentine, sulphurets of iron and copper.

NEW RIVER.—At Mills, actinolite? (in porphyry.)

RED HEAD, (on Mace's Bay.)—Red jasper.

SEELY'S COVE.—Hill half a mile north, calcite, iron pyrites, magnetite, quartz crystals.

SIMPSON'S ISLAND.—Copper pyrites and green copper ore—malachite, on the shore below high water. The quantity is considerable.

ST. ANDREWS BAY.—Dick's farm, plumbaginous earth.

ST. DAVID.—Native copper.

ST. GEORGE PENINSULA.—Randall's, limestone; on the farm of Samuel Hatt, galena and yellow sulphuret of copper; on David Crory's farm, (Scotch Settlement) galena. (See Report.)

ST. STEPHEN.—Erubescite, *specular iron*! magnetic pyrites, wad; four miles north, graphite in slate, molybdenite in gneiss, quartz crystals; at Mill Farm, iron pyrites; nine miles north-west from Calais Bridge, in plumbaginous slate—Gold. (Vide Report, Maine Scientific Survey, p. 424.)

WAWIG RIVER.—*Mispickel*; three miles up, at Cormick's Mills, pyrites in boulders, garnet, felspar crystals, tourmaline; at Bartlett's Pond, quartz crystals; at Oak Bay, hepatic pyrites (in grauwacke.)

GLOUCESTER CO.

BATHURST.—Coal, rhodonite?; Somerset Vale, plumbaginous slate.

GRANT'S BROCK, (a branch of the Little Nepisiquit River.)—Auriferous (?) quartz, (See Report); lead ore.

NEPISIQUIT RIVER.—On the right bank, near Nepisiquit Bridge, a sedimentary deposit of lignite and malachite, in conglomerate; formerly some tons were removed, and yielded 52.5 per cent. of copper. "Rough Waters," (between Bathurst and the Pabineau,) *molybdenite*! Above the Grand Falls, pyritiferous sandstone, cubic pyrites in slate, *haematite*? (See Report.) Reported as occurring on the Stream, copper pyrites, galena.

NEW BANDON CAPE.—*Nodular red haematite*, (in clay of coal measures).

NIGADOO RIVER, (near the Falls.)—Galena.

TATTAGOUCHE RIVER, (eight miles from Bathurst.)—At the Falls, *copper pyrites* and *oxyd of manganese*!! both formerly mined; (See Report); iron pyrites, hydrous silicate of manganese; jasper with *mispickel*; on Kent's farm, boulders of magnetite.

KENT CO.

BUCTOUCHE RIVER.—Coal.

COCAIGNE RIVER.—On branch, three miles from Bridge, coal.

KOUCHIBOUQUASIS RIVER.—Coal.

RICHIBUCTO.—Black wad, pea iron ore, (in meadows.)

RICHIBUCTO RIVER.—Three miles above Ford's Mills, and at Big Brook, coal; at Bass River, iron pyrites; Liverpool, limonite.

KING'S CO.

BELLEISLE BAY.—On north shore, galena in limestone, hornstone, jasper (in trap); at Bull Moose Hill, large bed of magnetite, chert.

BUTTERNUT RIDGE.—(Price's Mill, Havelock,) gypsum.

CLIFTON.—*Chlorite*, *epidote*, *hematite*, *orthoclase* in crystals. *prehnite*, quartz crystals, *specular iron*.

HAMMOND RIVER.—At Sherwood's, graphite in limestone.

DOUGLAS VALLEY.—Shorl, in granite, (at Fall Brook.)

HAMPTON.—At Darling's Lake, in loose pieces, agate, carnelian, jasper.

KINGSTON.—On ridge south of Village, magnetite, magnetic pyrites; also chlorite and red jasper.

NEREPIS.—Near Hatfield's Mill, pyrites; near Mather's Inn, amethyst, felspar, quartz crystals; *blende*, purple and dark talcose slates, *hornblende*.

NORTON.—One mile and a half from Station, (near Blair's Mill,) argentiferous galena in limestone. (See Report.)

QUISPAISIS.—Copper pyrites, galena, iron pyrites, laumontite.

STUDHOLM.—Gypsum.

SUSSEX.—One mile north of Baxter's Inn, *specular iron* in crystals, limonite; on Capt. M'Cready's farm, east of Church, *selenite*!! (crystals containing sand, and forming in mud of a spring.)

UPHAM.—On Dutch Valley Road, eight miles from Station, near West Hammond River, extensive beds of oxide of manganese, with limestone, (now mined—See Report); *manganite*, *pyrolusite*, barytes; salt springs; four miles east of Titus' Mills, gypsum.

NORTHUMBERLAND CO.

BARNABY'S RUN.—Opposite mouth, coal.

BOIESTOWN.—Coal.

CHATHAM.—Coal, iron pyrites.

"CLEAR WATER"—(19 miles above Boiestown.)—Bog iron ore.

NEWCASTLE.—Coal.

NORTH WEST MIRAMICHI.—*Iron froth*.

QUEEN'S CO.

GAGETOWN.—Concretions in sandstone—"fossil cocoanuts."

GRAND LAKE.—At Grand Point, barytes, copperas, and pyrites in fossil trees; Salmon River, (on Crawford's farm,) coal, copperas, pyrites, limonite; Newcastle River, coal mines; Coal Creek, coal, (formerly worked.)

IRONBOUND COVE.—Coal.

LONG REACH.—Opposite Vanwart's, chlorite.

RUSH HILL.—Bog iron ore.

WASHADemoak RIVER.—Two and a half miles from Long's Creek, coal; a few miles above mouth of W. River, on south-east side of small cove, carnelian, chalcodony, hornstone, jasper, quartz crystals.

RESTIGOUCHE CO.

BELLEDUNE.—*Calcite*! *Iceland spar*!! *serpentine*, *verde antique marble*.

DALHOUSIE.—*Agate*, carnelian, chalcopyrite, *manganite*! *asbestos*, (in *serpentine*); *zinc blende* in boulders.

POINT LEGARD.—Agates and prase.

POINT LENIM.—Coal.

ST. JOHN CO.

BLACK RIVER.—On coast, calcite, chlorite, copper pyrites, pyroxene, (green earth,) quartz crystals, *specular iron*!

BRANDY BROOK.—Epidote, *hornblende* (in boulders), quartz crystals.

CAPE SPENCER.—Asbestos, calcite, chlorite, specular iron.

CARLETON.—Near Falls, red calcite.

CHANCE HARBOR.—*Calcite* (deep red) in quartz veins, chlorite in argillaceous and talcose slates.

GOOSE RIVER.—Erubescite.

LANCASTER.—Quartz crystals.

LITTLE DIPPER HARBOR.—On west side, in greenstone, amethyst, barytes, quartz crystals.

LITTLE SALMON RIVER.—Ten miles above Quaco, *Native Copper*!!

MOOSE PATH.—Felspar (red), hornblende, muscovite, black tourmaline.

MARTIN'S HEAD.—Between this and Point Wolf, (6 miles from the latter, at the *St. John and Albert Mines*.) copper pyrites (yellow), *Peacock ore*, magnetite, dolomite, chrysocolla?, asbestos, chlorite.

MUSQUASH.—On east side of Harbor, copperas, graphite, pyrites; east side of Musquash, *quartz crystals*! (in conglomerate.)

PORTLAND.—At the Falls, large bed of graphite, (impure); at Fort Howe, calcite, (fine crystals in several forms), graphite; Crow's Nest, asbestos, calcite (fibrous), *chrysotile*, magnesite, *serpentine*, steatite; Lily Lake, white augite? *chrysotile*, graphite, *serpentine*, steatite, talc; Howe's Road, (two miles out), epidote (in syenite), steatite in limestone, *tremolite*; Drury's Cove, graphite, pyrites, pyralloite? indurated tale.

QUACO.—St. Martins, coal; near Coal mine, galena in grit; at Light House Point, large bed of oxide of manganese; west of Point, lignite; east of Quaco, at Fuller's Creek, graphite, iron pyrites; farther eastward, asbestos, *chrysotile*, black tourmaline.

RED HEAD.—Calcite (fibrous), red jasper.

SHANNON'S.—Chrysotile, *serpentine*, verd antique.

SHELDON'S POINT.—*Actinolite*, asbestos, calcite, *epidote* (pistacite and zoisite), malachite, specular iron.

ST. JOHN CITY.—Cubic pyrites in metamorphic slate.

TEN MILE CREEK.—Coal (in slate and sandstone).

WEST BEACH.—Morrison's, micaceous iron ore, *specular iron*, *red haematite* (yielding 65 per cent.); at east end, on Evans' farm, chlorite, tale, *quartz crystals*; half a mile west, chlorite, copper pyrites, magnesite (vein), magnetite; Beveridge Cove, haematite and specular iron.

SUNBURY CO.

LINCOLN.—Bog iron ore (abundant), wad.

OROMOCTO RIVER.—Ten miles up North Branch, coal.

VICTORIA CO.

AROOSTOOK.—(Hon. Wm. Black's farm,) haematite.

LITTLE FALLS?—(Emerson's) or Trois Pistoles? *galena* (in cubes.)

QUISIBIS RIVER.—(Madavaska.)—Blue phosphate of iron, in clay.

RIVIERE DES CHUTES.—Haematite.

TOBIQUE RIVER.—Agate, carnelian, chalcedony, jasper; at mouth, south side, galena; near the Red Rapids, north side, *calc spar*! (in geodes); at mouth of Wapskahegan, red and white gypsum; (in this vicinity there is a salt spring); Plaster Island, gypsum, (with red sandstone, in high cliffs); three miles above Wapskahegan, stalactites; Nictau Lake, (head of Tobique River), hornblende.

WESTMORLAND CO.

BELLEVUE.—Iron pyrites.

CAPE MARANGUIN.—Clay iron stone, coal.

DORCHESTER.—Anthraconite? *graphite*! red felspar, wad; Dorchester Island, nodular red haematite; on Taylor's farm, cannel coal, clay iron stone; on Ayre's farm, Peti-codiac, asphaltum, petroleum spring; on Godie's farm, maltha.

GRAND ANCE.—Gypsum, *selenite* (large crystals), apatite, (Vide Gesner.)

MEMRAMCOOK.—Albertite in beds, and in veins running through limestone.

SACKVILLE.—Wood's Point, coal.

SHEDIAC.—Four miles up Scadouc River, coal.

TEDISH RIVER.—Coal.

YORK CO.

DOUGLAS PARISH.—At McLeod's Hill, (six miles from Fredericton,) quartz crystals in vesicular trap and wacke; on the Nashwaaksis, anthracite.

DUMFRIES.—Little Pokiok River, anhydrite.

FREDERICTON.—In large bed near Government House, wad.

KINGSCLEAR.—Maltha?

NASHWAAK RIVER.—Coal, pyrites; Jay Creek, coal.

NORTHAMPTON.—Gypsum.

POKIOK RIVER.—Near mouth, in granite, *tin pyrites*, (rare.)

PRINCE WILLIAM.—Felspar, *cubic pyrites*!; three miles from Marshall's Inn, at the mines, *antimony ore*, *crystallised*, (*stibnite*!), also in veins, bunches and masses; quartz crystals, (in boulders and in the shaft), soapstone, hornstone, *sulphantimonids of lead*; quartz boulders, crystallised, and containing *specular iron*, *sulphantimonids of lead and chlorite*.

QUEENSBURY.—Wad.

SOUTHAMPTON.—At the Meductic, iron pyrites, Lydian stone, (Basanite.)

GENERAL CONCLUSIONS.

Having now given the results of my personal observations, during the past summer, and added thereto, in tabular form, all that is at present known about the distribution of our mineral wealth, it only remains to be seen, what general and useful deductions can be drawn from the materials thus accumulated.

1st.—*The Geological Position of the Metalliferous Rocks.*—To understand this subject clearly, a slight reference is necessary to the geological structure of New Brunswick. By reference to the geological map of Dr. Robb, (published with Johnson's Report,) it will be seen that the Province is essentially divided into two portions, by a wide belt of igneous rocks, passing across from the State of Maine, in the vicinity of the Cheputnecook Lakes, to the Pabineau Falls, on the Nepisiquit River. This ridge forms a large anticlinal axis, and, including its development in Maine, has, according to the geologists of that State, a length of nearly two hundred and ninety miles. Its width, as laid down in the geological map, is a mere matter of guesswork, this portion of the Province being almost unknown and inaccessible.

To the south of this great granitic chain is another, entering the Province near Calais, and passing, with a single interruption, to the St. John River. Against the flanks of these granitic ranges, on both sides, rest the lowest aqueous rocks, termed *Cambrian*. The precise age of these latter, which consist for the most part of metamorphic slates, is a matter of some dispute, but the question is one which does not need discussion here. Whatever their name and age, they form two parallel bands of considerable width, stretching along the slopes of the central granitic range. The upper extends from the shore of the Bay Chaleur to the Maine boundary, and probably crosses the head-waters of the Serpentine and Miramichi Rivers. The lower is parallel to this, but does not reach Bathurst, while towards the west it bends around the coal measures, occupies the greater part of Charlotte, and thence extends in two parallel bands to the eastward, one of these terminating at Bull Moose Hill, the other at Shepody Mountain. In the triangular space thus left, is included the great New Brunswick coal field, separated

from the metamorphic belts by a thin band of red sandstones and conglomerates, which attain their greatest development at the two eastern extremities. These sandstones probably underlie the coal measures, and are in turn resting upon the Cambrian slates.

To the north of the upper metamorphic belt, are beds of Silurian strata of vast extent, whose limits are at present but little known. My own observations at the head-waters of the Tobique and Nepisiquit, have convinced me that essential alterations must be made in the coloring of this portion of our geological maps. With this portion, however, we have little at present to do. If, by means of the list which has already been given, we trace out upon the geological map the precise localities of the various metallic ores, we shall find them, almost without exception, to be situated in the great metamorphic belts of slate and schist, which have been termed the Cambrian rocks.—Bathurst and the Tattagouche, with their deposits of copper, manganese, lead and iron, the head-waters of the Serpentine and Wapskahegan, the iron and copper beds of Woodstock, are in the northern metamorphic band; the antimony of Prince William, the gold and specular iron of St. Stephen, and the iron ore of Bull Moose Hill, are in the lower band of a like character. The copper of Charlotte County and Albert, with the manganese of Quaco and Shepody, are in similar rocks; but the latter are associated with beds of limestone, and are considered as Lower Silurian rather than as Cambrian strata. According to Dr. Robb's map, the mines at L'Etang and LaTete, with the deposits of the neighboring Islands, would be supposed to occur in a red sandstone district, the whole of St. George Peninsula being thus marked. These mines are, however, like the rest, in beds of slate and limestone, with hornblende rock, which are frequently injected with dykes of trap. They belong to the Lower Silurian strata.

One other fact is to be noted in this connection, namely, that extensive beds of igneous rocks, trap, syenite, felspar and porphyry, are found in close proximity to the metalliferous districts, and seem to determine in some measure the presence of the ores. This will be found to be the case in all the localities above mentioned.

2.—*The character of Mineral Lodes and their Country Rock.*

a. As regards deposits of copper in the Province, it will be seen that the lodes which bear this metal, are of one or the other of two kinds, either quartz rock, or a "*green metamorphic aggregate of bisilicate of magnesia and silicate of iron.*" The former rock predominates in Charlotte County and the various Islands in Passamaquoddy Bay, the latter at the deposits in the neighborhood of Point Wolf and Salmon River. The country rock for copper is metamorphic slate, especially in the vicinity of trappean dykes. Copper is sometimes found in the slates or chlorite, but these do not form the true vein-rock. The deposit at Bathurst is sedimentary.

b. *Antimony.*—The true vein-rock of this metal is quartz, the country-rock being metamorphic slates. The lode-walls (or at least one of them) are almost invariably dykes of trap. Chlorite and steatite are found in connection with these.

c. *Lead*.—The lodes, which bear this metal, are not homogeneous, but consist chiefly of quartz, barytes, and a little fluor. This is the case at L'Etang, which is almost the only distinct lead lode I have seen in the Province. None of the others are well defined. Barytes and fluor are very favorable indications for this metal. The country-rock of lead is metamorphic limestone. With lead is often associated *blende*, the ore of zinc.

d. *Manganese* is generally found in quartz or barytes, especially the latter, the country-rock being slates. At Upham, King's County, it has been described as occurring in limestone.

e. *Iron*.—The haematite of Woodstock occurs in calciferous slate, belonging to the mica-schist formation; that of West Beach also in slates, and to some extent in conglomerate. The latter, (*i. e.* the West Beach ore,) is of sedimentary origin.

3. *The Direction of Metallic Lodes*.—This is a point of some interest to determine. It requires, however, for sure results, a considerable number of observations. So far as my own experience has shown, these lodes, especially as regards lead and copper, pursue a course not varying far from east or west, and have as a rule a dip to the northward. This will be more readily seen by the following Table:—

	Strike.	Dip.
Antimony Mines at Prince William,	N.E. & S.W.	to the North.
Key's Mine, (Charlotte,) Champion lode,	7° N. of E.	a little W. of N.
“ 5 subordinate lodes,	“ “	unknown.
L'Etang Lead Mine, principal lode,	E. N. E.	“
Hatt's Lode, (Charlotte,)	about E. & W.	
Croory's Lode,	10° N. of E.	
Campo Bello Lead Vein, not well determined, but tending to E.		
Mines at Salmon River—Champion lodes, 10° N. of E.		
Subordinate lodes, 6° & 8° N. of E.		
Tattagouche Copper Mines, (Bathurst)	E. & W.	to the North.
“ St. John & Albert Mines,” (Martin's Head)	a little E. of N.	to the West.

If the above rule is found to be a universal one, it may serve to distinguish the subordinate from the champion lodes, the difference being a very material point to ascertain. It will be noticed that the above prevailing line of strike coincides nearly with that of the coast line of the Bay of Fundy, and also with that of the central granitic band.

From what has now been said, I think I am warranted in drawing the following general conclusions:—

- 1st.—The principal metalliferous deposits of New Brunswick, (excepting sedimentary beds), are confined to metamorphic slates and mica schists, of Lower Silurian or Cambrian age.
- 2nd.—That in these metamorphic belts, the best mining districts, so far known, are near where the slates and schists have been injected by deposits of igneous rocks, trap, syenite, &c.

- 3rd.—That copper, manganese, and antimony, are generally found in lodes of quartz or greenstone, the country rock being slate.
- 4th.—That lead lodes are principally composed of barytes, quartz, calc spar, and fluor, and their country rock is limestone.
- 5th.—That the metallic lodes of the Province, as a general rule, preserve a course not varying far (10° to the N.) from east and west.
- 6th.—That their dip is generally to the north, at a high angle.

As to the probable productive capacity of these metalliferous rocks, it is impossible to speak with certainty, until mining operations, on a much more extensive scale than at present conducted, shall have fairly tested their yielding powers. Most of the operations now in progress, with the exception of those of the Albert Mines, are on the most limited scale, and generally confined to mere superficial deposits, or at most to a depth of less than fifty feet. It is to be hoped that the Mines recently opened in Charlotte and Albert Counties may be vigorously worked, until the question is fairly settled whether the useful metals, of which there are there so many indications, may really be found in sufficient quantities to make their extraction profitable. If they succeed, it will give an impetus for the further employment of capital and labor in this direction; if they fail, after a careful selection of the most promising points for trial, then others may well hesitate to invest more capital, in what is almost sure to prove an unprofitable speculation. Above all things, persons engaging in this branch of industry, should avoid a tendency, now far too common in the Province, to parcel out the same mineral district under the control of some half-dozen different companies. Until it has been satisfactorily proved that even a single one can be sustained at a given locality, it is absurd to suppose that three or more can be. Concentration of capital and effort are now more needed in the Province, than are promising fields to work upon.

In conclusion, let me express my sincere thanks to Your Excellency, for the kindness which entrusted to me the present commission, permitting me to visit a far greater portion of the Province than I should otherwise have been able to do, and allowing me to render such little assistance as lay in my power, towards developing its mineral resources. I trust that these resources may increase more and more in value, and be of lasting benefit to the Government and people of New Brunswick.

All of which is respectfully submitted.

I have the honor to be,

Your Excellency's most obedient servant,

L. W. BAILEY,

*Professor of Chemistry and Natural History,
in the University of New Brunswick.*

