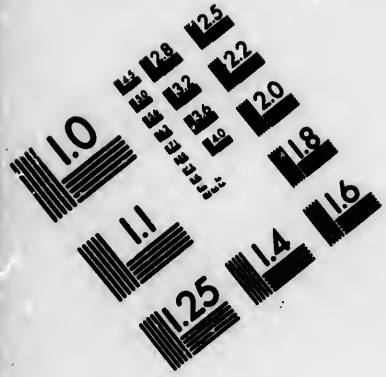

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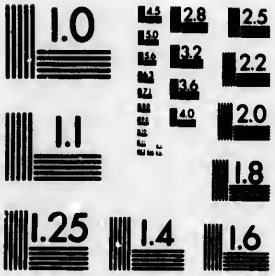

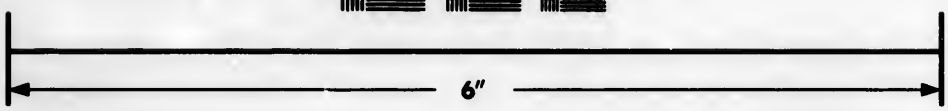

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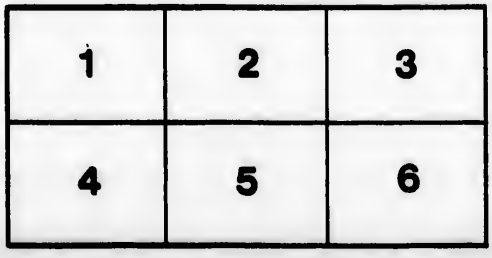

FOURTH REPORT

ON THE

GEOLOGICAL SURVEY

OF THE

PROVINCE

OF

NEW-BRUNSWICK.

BY

ABRAHAM GESNER, F. G. S.

PROVINCIAL GEOLOGIST, &c.

SAINT JOHN:

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REPORT.

TO HIS EXCELLENCY

SIR WILLIAM MACBEAN GEORGE COLEBROOKE, K. H.

Lieutenant Governor and Commander in Chief of the Province of New-Brunswick, &c. &c. &c.

MAY IT PLEASE YOUR EXCELLENCY,—

IN the discharge of the duties I have been called upon to perform, in making a Geological Survey of the Province, and in following the instructions I have from time to time received, directing me in the exploration of the mineral and other natural productions of the country; I beg leave to lay before Your Excellency, the Fourth Report on the Geological Survey of the Province; accompanied with a collection of all the valuable minerals, which have been discovered during the past season, in that division of the country where my labours have been applied.

In order to meet Your Excellency's views, so far as my abilities would allow, I have also directed my attention to the agricultural character of the districts explored; and to the development of those natural resources, which the Province is found so abundantly to contain. The features of uncleared lands have been examined, and an inquiry has been made into the advantages they offer for settlement.

In the performance of these important duties, the assistance of my son has been required; and, in many instances, Members of the House of Assembly, Magistrates and others, have kindly given their aid. It becomes me to express my obligations to the Honorable CHARLES SIMONDS, Speaker of the House of Assembly, and to the Honorable J. S. SAUNDERS, Surveyor General, for assistance, and such general information as the exploration required.

A Geological Map of New-Brunswick, will be, with this Report, laid before Your Excellency: the labour of the past season being added to that which was before completed.

A work which had been commenced on the Economical Geology and Agriculture of the Province, is also advancing; and the analysis of the different classes of soils has been continued.

It has been found impossible, in the present Report, to give much more than the topographical part of the subject. The remains of animals and plants, discovered in the rocks, are too numerous, and frequently too complex in their characters, to admit of accurate description, immediately after they have been found. Many of the fossil remains discovered in the Province, have been submitted to the examination of distinguished persons in England and the United States, by whose aid, I hope, at some future time, to be able to assign to each of them, their proper place in the great scale of nature. A few of them are very rare, if not entirely new.

A considerable acquisition has also been made to the collection of mineral substances belonging to the Province. My labours have exceeded those of any former season in these pursuits, and much remains to be performed, when sufficient time shall be afforded to enable me to discharge the less important part of my duty.

It must be pleasing to every person who is interested in the welfare of New-Brunswick, to know, that the Province contains abundantly, in her agricultural and mineral resources, the first principles of wealth, greatness, and independence.

To me it is highly gratifying to observe, that the geological reconnoissance of New-Brunswick is gradually advancing the interest of the Province; and if the present Report shall meet the expectations of Your Excellency, my highest ambition in geological pursuits will be fully gratified.

INTRODUCTION.

GEOLOGY, as a science, has been eulogised by a distinguished philosopher, as being next to astronomy, in the grandeur and sublimity of its objects, and the harmony it displays of the stupendous works of the Creator. There is no study more important and delightful to man, than that which inquires into the history, and examines the materials of the earth upon which he lives.

This science looks back into remote periods of time, and reveals what was the early condition of this planet. It examines the mutations daily going forward upon the earth, by which its features are changed, and it becomes adapted to the increase of population and the wants of the human race. It also looks forward to the future, and seeks to view the final results of operations in the consummation of that vast design, which, although incomprehensible to man himself, forms a part of the plan revealed in the works of the Creator.

But besides the grandeur of the subjects embraced by this science, it discovers where the great mineral deposits of the earth are situated, and thus contributes to supply the wants and necessities of the human race.

So rapid have been the advances of Geology during the last twenty years, and so great have been the advantages derived from the science, that now every civilized country is engaged in exploring the rocky strata of the earth, in search of their valuable minerals; and as the eye of the astronomer wanders among the planets, so the geologist, wrapt in wonder and delight, explores the deep chasms and lofty pinnacles of the earth; not only contributing to the great fund of useful knowledge, but also enriching by his discoveries the country where his labour is devoted.

It is geology that informs the miner where the treasures of the earth are to be sought for, and where iron, copper, lead, and ores of other useful metals, are deposited. It points out to him where coal, that invaluable gift to man, is to be found. This valuable mineral not only administers to man's immediate wants, but also supports manufactures and commerce. Almost all the different kinds of soil upon the earth, have had their origin in the solid rocks. The agriculturist therefore derives great advantage from geology, as it makes him acquainted with the ground he cultivates, and directs him to situations where water, nature's purest beverage, lies concealed in subterraneous reservoirs.

Many of the most beautiful edifices are crumbling to the ground, from the ignorance of their builders, in regard to the nature and composition of the materials employed in their erection. In the construction of roads, railways, docks, &c. some knowledge of this science is indispensable.

A striking illustration of the benefits resulting from geological knowledge, is afforded in what is well known in England as the "Sulphur Question." For a long period, all the sulphur employed in the manufactories of the United Kingdom, was imported from Sicily. His Sicilian Majesty, in order to increase his revenue, fixed a high export duty upon the article; and finally made a contract to supply the whole sulphurous products of his kingdom to a company of French merchants; whereby a monopoly was established, which, in its consequences, was extremely injurious to the manufacturing industry of Great Britain. This monopoly was broken up by the interference of Parliament. His "Volcanic Majesty," as he has been styled in the House of Commons, then thought fit to impose a duty of no less than £4 10s. per ton on the ore, a sum exceeding one third part of the market price of the article; and thus the English manufacturer was compelled to bear a heavy burden, and Parliament itself was perplexed with an evil there was little hopes of removing. In this dilemma, geology and mineralogy removed the difficulty. A vast quantity of iron pyrites, or sulphuret of iron, was discovered at Wicklow in Ireland. By the application of science the mine has been opened, the sulphur extracted from the ore, and the nation relieved from foreign imposition. It is stated in the *Mining Journal*, a most useful London paper, that "new shafts have been sunk, engines erected, and work undertaken, with the sole purpose of raising sulphur ores, and protecting the manufacturer by rendering an article superior in quality, and at a price which

would enable him to furnish it to the consumer at least one third less than it has been for some years past." On the breaking up of the monopoly, 60,000 tons of imported ore were thrown upon the hands of the Sicilian agents. The duty has been reduced to £1 15s. per ton, and the Sicilian King cannot now find a market for the productions of his volcanoes.

The ancient Greeks claimed the first discovery of the manufacture of iron; but it appears that the Persians were acquainted with this art as early as any other nation. There is no record of the time when the mines of Caradoch were first worked; and it is remarkable that the Persians, up to the present day, manufacture iron at less expense, and by a process far more simple, than any other people. The ore is broken and placed in a small furnace, with alternate layers of charcoal; the blast is then applied, and the metal finally sinks to the bottom of the furnace, from whence it is taken and immediately hammered into bars. The blacksmith manufactures the ore as often as it is required by him; and one smith with two assistants will make one hundred weight of excellent iron in a day. I am confident that a similar process might be introduced successfully in the manufacture of iron in New-Brunswick; where charcoal can be obtained from the wild forests, at a trifling expense. The iron ore of Woodstock seems peculiarly adapted to this cheap mode of smelting; and it is not materially different from the Persian ore. There is, however, an advantage afforded in the County of Carleton, for the manufacture of iron and steel, scarcely to be found in any part of Europe. The vast unbroken forests of wood, capable of affording charcoal, will supply a sufficient quantity of fuel, for the smelting of this ore, for many years to come; and after the present forests have disappeared, the ore might be transported to Gagetown, where it is evident bituminous coal can be obtained.

Up to the beginning of the seventeenth century, the manufacture of iron and other metals, was performed by charcoal. Smelting by coal or coke has been but slowly introduced; and the removing of smelting furnaces, from the sites of ancient forests, to coal districts, in England, has arisen altogether from the scarcity of charcoal, and for the purpose of preserving the wood of the country.

It has been remarked, by a talented writer, that the degree of civilization, attained by any nation, might be ascertained by the quantity of iron employed. It is difficult to

foresee any limits to the use of this valuable metal. The great improvements which have been made in the methods of smelting, and working iron, within a few past years, have not only rendered the metal cheaper, but also extended its application. It is now beginning to take the place of other metals, and is employed instead of wood. It is coming into use for building ships, houses, stores, &c., and, what is more remarkable, it is converted into ropes.

The invention of rail-roads, and the extension of steam, have also greatly increased the demand for iron. About a century ago, the forests of Great Britain were nearly all consumed; and necessity introduced pit coal, instead of charcoal, in the smelting and manufacture of this metal. In 1788, the production of the iron mines in England, was sixty-eight thousand tons per annum: at the present time it exceeds one million of tons. With this brief view it may be seen, how important the immense beds of iron in New-Brunswick, will be to the safety and prosperity of the Province. The deposit of iron ore at Woodstock is capable of supplying the whole of North America for many centuries. Who can doubt that the advantages offered at that place, for the establishment of extensive iron works, are equal to any in the world?—and, evidently, the time is approaching, when they will attract the attention of persons of capital. It may be said, that at this place, within the compass of a few miles, and with the facilities of access by water, are the best kinds of ore and fuel. Miners are not required to obtain this iron, and the expense of carriage would be trifling. These considerations are left with those, who may feel disposed to reflect upon the subject. The working of this ore could scarcely be viewed as an uncertain speculation; and it will ultimately yield, by judicious management, extensive profits.

In France, wood, both in a dried and in a green state, is employed in smelting iron. The substitution of green and dried wood for charcoal, in the process of refining iron, has effected a considerable saving of fuel. In some instances the wood is mixed with charcoal or coke. The use of wood is adapted to blast furnaces, and is found to answer all the purposes of charcoal.

By reason of the richness of that variety of iron ore called *hematite*, it cannot always be worked profitably in the furnace by itself. This remark applies when coal or coke is used for fuel; but, by employing charcoal, this and other difficulties are not present. This arises from the circumstance

that charcoal gives out its carbon sooner, and possesses more of it than either coal or coke. It is probable that the hematite of Woodstock contains a sufficient quantity of the slate forming the matrix of the ore, to protect the fusible part of it from the blast. The slates near it are calcareous, and limestone for a flux is not far distant.

It is now rendered certain that the Province contains many minerals which might be worked profitably if they were better known; and no opportunity should be lost in testing their qualities, and bringing them to the notice of mining and manufacturing capitalists in Great Britain.

The average value of the annual productions of the mines in Great Britain is no less than £20,000,000 sterling. £8,000,000 of this sum is produced from iron; £9,000,000 from coal, and £3,000,000 from other minerals. The mineral produce of Cornwall and Devon alone, for a single year, amounts to £1,340,000. In the above estimates the coal is valued at the mouth of the pits.

Besides the iron, it will be seen that New-Brunswick possesses one of the most extensive coal fields in the world, the supplies of which have been hitherto unknown and disregarded. To these might be added many other minerals, described in the present and former reports, with substances of great utility in the arts and agriculture.

The Geological Survey of the Province was commenced for the purpose of discovering and bringing these resources into operation; and its great utility is appearing more and more obvious. The work is now advanced towards its final completion, which will require only the labour of two more seasons.

Whoever carefully examines the structure of the earth, will soon discover that the rocks forming its framework are divided into distinct natural groups, or classes. The rocks are not, as might appear upon an imperfect survey of them, scattered over the globe in wild confusion; but they are deposited in immense formations, as they have been called by geologists; and each of these formations has characteristic features, whereby it can be distinguished from the others. These characteristics exist in the chemical and mechanical properties of each variety, and more especially in the different classes of animals and plants; the remains of which

are found in them, and are often numerously distributed throughout their strata.

Geology is therefore in itself a science admitting of a high degree of perfection. All the objects it recognises are capable of being submitted to that beautiful degree of order and harmony, which is so manifest in all the works of nature. It is the study of that great system of wonders the earth itself presents, and which, next to astronomy, exhibits those unerring laws that govern the whole universe. Viewed as mere chemical or mechanical deposits, the rocks display a beauty and harmony of arrangement truly wonderful; and although the fractured condition of the surface of the globe, at many places, shews the effects of terrific earthquakes, and the outpouring of lava from volcanoes is every where manifest; still, even in these operations, the causes may be seen, and the order of the whole system remains undisturbed. Although these violent operations have evidently been active, from the earliest date in the earth's history, all the different kinds of rocks, from the lowest ever discovered, up to such as are now forming on the surface, have been arranged in distinct classes, having been produced under different circumstances, they exhibit, in their composition and structure, the clearest evidences of the different conditions of such parts of the globe where they are found, and the changes which have taken place in the earth's physical features during the lapse of vast periods of time. The results of these changes have a degree of uniformity, at once the most striking and obvious; and whatever the climate may be where they are now seen, they offer one unvarying and almost endless system of inquiry. Baron Humboldt, in referring to this harmony, remarks, that "when travelling to distant countries, the first feeling that strikes the mind is change. The temperature becomes warmer or colder; the aspect of the country and vegetation itself assume a different character; and, by and by, the very stars themselves become altered; but while change thus pervades every thing, if we look beneath our feet, our old acquaintances, the rocks, are still with us. The granite and the coal are found in precisely the same situations in the hills of Scotland, as in the Andes, the Alps, or the mountain ranges of Australia."

There appear to have been two grand causes to which the production of all the rocks may be assigned, namely, heat and water. The rocks produced by the former are unstratified, and, for the greater part, they are readily distinguished by their crystalline structure, and other characters

resulting from the once molten state of the minerals entering into their composition. The rocks produced by the operations of water acting upon previously arranged materials, differ from those of igneous origin. They are always spread out in layers, or strata, and may be considered as mechanical deposits. Rocks are, therefore, separated into two great classes, the stratified and the unstratified, or the igneous and the aqueous.

Rocks are also divided into groups, according to their situation, one upon another, and the relative age they have, compared with each other. It is obvious that the uppermost strata have been deposited since the lower were formed; and, therefore, in the whole series of the strata, from the lowest depths up to the surface, a register has been kept of vast periods of time, which have elapsed since the lower deposits first began to be formed. The strata, therefore, afford a chronological table of geological events, not unaptly compared to the alphabet, each letter representing a formation or series of strata, peculiar in itself, and the periods of time necessary for such formations to accumulate.

The letters of the alphabet may be considered the representatives of each formation, and the periods of time embracing the history of each group. Perhaps there is not any one place in the whole world, where all these formations exist, or can be seen. In some situations a greater number of these is present than in others; and there are vast tracts of country where the newer, or more recent groups, are altogether absent. But it is one of the most admirable facts in the science of geology, that when any member, or number of members, of the whole system is absent, the next in succession above is found reposing upon the next in succession below; and thus the most perfect order and harmony are preserved throughout the whole series. If all the members represented between the letters D and Z are absent, D will be found reposing on Z, and this order is never reversed.

The older geologists separated all the rocks into three great classes, and applied names to them in reference to time. The lowest deposits they called primitive, from the supposition that they were first formed. Another class they denominated transition, from the supposition that at the time its members were forming, the earth was passing from a chaotic to an habitable state. Above these are the secondary rocks, and the tertiary group of the moderns. These terms are still used in the science, and although the older geologists

believed that some of the rocks now known to be of the age of the secondary and tertiary groups, were of primary origin, these distinctions are still found very useful. The primary rocks, such as granite, gneiss, &c. possess more of a crystalline structure; and may be distinguished by the purity of their minerals, and a greater degree of hardness. Siliceous and argillaceous earths form the chief parts of their constituents, and in them neither the remains of animals nor organized bodies have been discovered. The transition rocks frequently have a resemblance to the primary; but the minerals entering into their composition are far less perfect in crystallization, and appear to have been acted upon by mechanical operations, such as attrition in water, previous to their consolidation. In these the remains of animals and plants first begin to appear.

In the secondary formations the mechanical operations of water upon the fragments of the rocks, and in the production of strata, become more manifest. In their structure they are earthy. They are less compact than any of the older deposits, and in them the relics of organized beings are abundant.

The tertiary deposits are remarkable in their near approach to beds of clay, marl, and sand, now collecting upon the earth; and the animals and plants found in their strata begin to approximate to living species.

Beds of clay, sand, pebbles, &c. are called diluvial, from having been supposed to be the results of floods of water, which swept over the earth, and the effects of glaciers, the former existence of which has been made to appear, by Professor Agassiz, Mr. Lyell, Dr. Buckland, and others, who are now engaged in this interesting inquiry.

Alluvial deposits are those now forming by operations ever active upon the earth, through the agency of seas, rivers, and floods of water.

In New-Brunswick, each of these classes of rocks is extensively developed; and although some of the members of them, such as the chalk, and other deposits bearing local names in Europe, are absent; still the general order of superposition is preserved.

Of the primary rocks of the Province, there is an extensive, elevated, and somewhat broken district, extending from the Schoodic, in a north-east direction, to Shepody Mountain in Westmorland. Another tract of primary country, embraces the Chiputnecticook Lakes, and, crossing the Saint John, extends towards the sources of the Miramichi.

The transition, secondary, and tertiary groups also occupy different parts of the Province; the two former containing coal, iron, and other valuable minerals.

From these facts it may be seen how much time and labour are required to explore the boundaries and surfaces of these formations; especially in districts where the soil is covered with unbroken forests.

One of the advantages to be gained by the geological exploration is the opportunity it affords of making the natural resources of the country better known abroad. Until very lately, little was known in Great Britain of the true value of this part of the British Empire; and New Brunswick has been considered, by many persons, as a colony of no importance, except for the valuable timber she produces. Her excellent soil, mineral productions, and her great natural advantages, in regard to inland navigation, have been overlooked; and, therefore, it is by no means surprising, that immigration to her shores should have been retarded, while other countries less favourable to British customs and manners—less congenial to the inhabitants of a northern climate, and with fewer advantages for the surplus population of either England, Ireland, or Scotland, receive thousands of our countrymen yearly. The agriculture of the British Provinces languishes from the lack of labour thus diverted from their shores.

That New-Brunswick is well adapted for all the different classes of emigrants is evident. All the new settlements in the Province are in a flourishing condition; and there are numerous instances of persons who landed in the country but a few years ago, without either friends or money, who have, by their industry, become affluent. In order to promote immigration, the resources and advantages of the country must be made known; so that the mind of the emigrant shall be directed towards them, before he takes leave of his native land.

There is scarcely any quarter of the globe where British capital and science are not employed in mining pursuits. The sums of money expended in South America, in this branch of industry, are enormous. Neither the burning sands of the tropics, nor mountains of polar ice, limit the bounds of British enterprise. If it be enquired why foreign countries have received so many advantages from this source, while the British North American Provinces have been neglected, it will be seen, that in the former, the objects of

wealth have been made known, while in the Colonies the discovery of similar objects has been neglected.

In all new countries, the progress of mining is slow. This arises from the want of capital and the practical science and skill required in all the operations connected with such pursuits. It is, therefore, necessary to direct the attention of individuals abroad, to these resources, that they may be opened and rendered useful to the Province.

There is no science except chemistry more capable of introducing improvements in agriculture than geology; as it includes within its range the true history of all soils, and the substances by which they may be improved. All the different kinds of soils have had their origin in the solid rocks, which by the operations of the atmosphere, water, frost, &c. have been disintegrated and reduced to that pulverised condition, whereby they are rendered capable of producing plants. Geology, as connected with mineralogy and chemistry, discovers the constituent elements of every kind of soil and the substances whereby it may be made fertile. In reference to this part of the subject, I beg to introduce a letter from JOSEPH WALTON, Esquire, of Saint Andrews, a most respectable and intelligent farmer.

Saint Andrews, June 19th, 1841.

DR. A. GESNER;

Dear Sir.—In compliance with your request, I herewith give you a brief statement of the effect of the application of the Marl, found by you on my farm in the fall of the year 1838.

I opened a pit of the Marl and hauled eighty cart loads on hay land, which remained in small heaps during winter, and was spread in the spring, then ploughed, and sowed with oats: it produced a fine crop. I sowed a piece adjoining without marl, and the difference in the two crops was very great. I ploughed the stubble ground in the fall, and planted potatoes the following spring: the difference, in appearance, of the two crops, to my disappointment, was this season greatly in favour of the piece without marl—the vines being much larger and more thrifty; but I was agreeably surprised on digging the potatoes, to find that the small vines on the marled piece produced one third more potatoes than the others, and of much larger size.

In the fall of 1839 I put ninety loads of marl on one acre of potatoe ground, which I spread in the spring, and sowed with oats and grass seed; the produce was nearly double that of an acre adjoining; and this spring the difference in the grass is visible, as far as it can be seen—the one piece being covered with sorrel and white weed, and the other with beautiful clover and herds' grass. I may here observe, that the soil on which the foregoing partial experiments have been made, is dry and gravelly.

I find the marl extends up the valley about half a mile from where you found it, and from thence to the salt water, nearly a mile, and along a descent of about two hundred feet. I have also found many kinds of shells, different from those now to be found on the sea shores, which is a subject of speculation for geologists.

Your obedient servant,

JOSEPH WALTON.

In pursuing the geological exploration of New-Brunswick, I have carefully collected all the important varieties of soils; an account of them will be published when the economical geology of the Province is brought under consideration. Much labour has been devoted to the discovery of lime, marl, peat, &c. and it is satisfactory, that since the commencement of the survey, those substances have attracted the attention of farmers, who are beginning to employ them in the cultivation of their lands. The marl and lime found in the Counties of Charlotte and Saint John, will in time be extensively used in agriculture to fertilize the soil. Until a very recent period, it was doubted by many whether peat could be found in this country. It is now known to be abundant, and is finding its way into use, as a manure; and in numerous instances it has proved very beneficial to the interests of the farmer.

The geological reconnoissance has also ascertained the agricultural character of large districts, which before were almost unknown. That knowledge of this kind is calculated to promote the best interests of the Province, must be evident. It has heretofore been such, as clearly proves, that New-Brunswick possesses the elements of prosperity; and offers to industrious emigrants every encouragement they could hope for in a new country.

It is evident that any unfavourable change in the duties on colonial timber would greatly embarrass the principal trade of New-Brunswick. This trade must also decline from the scarcity of timber, and the increased expense of conveying it to harbours where it can be shipped. The Province, therefore, will soon have to depend upon her agriculture, mines, and fisheries, for the support of her commerce. Extensive public improvements are everywhere required. These will bring the natural resources of the country into operation, and introduce manufactures, for which New-Brunswick, on account of her iron and coal, is not inferior to any part of the world.

In the prosecution of a geological survey of a new country, many useful facts may be discovered, which have no re-

lation to geology itself. In complying with my instructions, it has been deemed proper to introduce into the present report some topographical and other matter, not relating strictly to the mineral deposits of the Province; and if the accounts of the exploration of certain districts should assume the features of a narrative, an apology is offered in the nature of the country, and the circumstances connected with its examination.

During the past year, the granite of the river has been extensively worked and employed in the durable buildings erected at Saint John; another lease for coal has been obtained from the Government, and others are applied for. It is not, however, to be supposed, that all these enterprising pursuits will be successful. Some of them, it is to be feared, have been commenced for purposes of speculation; and others may fail from causes common to all such undertakings. But although these discouragements may retard the general good for a time, the natural productions of the Province will ultimately relieve her from all embarrassments, and render her one of the most important Colonies of the British Empire.

PART I.

On a former occasion a section of country had been explored, from the entrance of the Magaguadavic River to the St. John, to meet a line previously followed over the Great Coal Field of New-Brunswick to the Straits of Northumberland. It was desirable that a similar line should be examined still farther westward, in order to intersect the principal formations or strata in the Counties of Charlotte and York, extending to Fredericton; and also, to examine the rocks along the Cheputnecticook River and lakes, to Woodstock. The latter line has been supposed by some persons to be the boundary between the State of Maine and New-Brunswick, but the Saint Croix or Scoodic of the Indians, mentioned in the treaty between Great Britain and the United States, together with its lakes, is farther to the westward.

By the explorations of these sections, the survey of the County of Charlotte was completed; and the examination of the south-eastern side of the Province was brought to a close.

The granitic and sienitic rocks of Oak Bay, on the St. Croix, are met on their north sides by extensive deposits of greywacke and slate; which, after crossing the St. Croix, extend into the County of Charlotte, and in an easterly direction to the River Saint John, in Queen's County. These extensive stratified deposits repose upon the sides of the granitic and trappean mountains, which run nearly parallel to the coast, and form a chain running in a north-east direction from Chamcook, at Saint Andrews, to Bull Moose Hill, in the Parish of Springfield.

As the rocks and minerals of this chain have been already described in former Reports, attention was directed to those situated to the northward. Each of these different classes of rocks has been laid down on the Geological Map of the Province, now in course of preparation, as accurately as the circumstances would admit of, but the difficulties attending the discovery of their true lines of contact, are frequently too great to be overcome; especially in the forest, where, besides the common detrital accumulations of the surface, there is a thick layer of decayed trees and other vegetable productions.

GREYWACKE AND SLATE.

It appears quite evident that the strata of greywacke and slate, about to be described, were deposited prior to the elevation of the granitic, sienitic and trappean masses upon which they rest. They are fractured in all directions by dikes and extensive elevations of those rocks. These dikes are most numerous upon the lines that may be said to separate the two different classes of rocks one from the other, and are less frequent at distances more remote from them; their inclining positions from each mountain mass and their fractured condition, in situations where they are observed in contact with the eruptive classes, shew the disturbance they have suffered since they were first collected. Nor are the evidences of the heat that attended the eruption of the volcanic rocks, less manifest; for, wherever the strata are found meeting the sienitic, trap, &c. the changes made upon them, and referable to heat, are very apparent. It appears that long after the strata already mentioned were formed, and probably were spread over a broad level surface, the hills of granite, sienite and trap were forced through them, and torrents of melted mineral matter overflowed the surface; and thus the bold scenery of these Alpine ridges received its peculiar features of grandeur and beauty; while the slates, &c. remained occupying the more low and level areas.

The strata forming the schistose groups differ much in their mineral characters. Some of them are very argillaceous, and resemble the shales of the coal measures, except in their greater degree of induration—others are arenaceous, and frequently pass into conglomerate. To the former the term argillaceous slate has been applied, and the latter is called greywacke. But these rocks pass insensibly into each

other, and hence we have that variety called greywacke slate. I was unable to ascertain which of these divisions of the strata occupies the lowest situation in the scale of superposition; but, as they repose upon granite and rocks of that class, they may be ranked with the strata called primary, so far as they have not been found to contain any organic remains.

The only fossils found in these strata appear in situations remote from the igneous rocks already mentioned, or in the upper layers of the group. They consist of a few impressions of *terebratula*, and plants analagous to those of the coal period. Although this group of arenaceous and argillaceous rocks has a general resemblance to the greywacke and slate formations of Europe, it would perhaps be generalizing too far, to affirm that they belong to the same classes and are of the same age. From the almost entire absence of organic remains, and the situation of the rocks themselves, I am inclined to believe that they may be properly classed with the Cambrian System of Professor Sedgewick, or the transition rocks of the older geologists.

Graphite or plumbago occurs at several places, interstratified with these rocks; and frequently the strata are glazed with this mineral. There are also indications of anthracite, although no workable stratum of that variety of coal has yet been discovered. If it be admitted that these minerals are of vegetable origin, then the greywacke and slate will be ranked among the transition strata. It was only at a few places where the dip of these strata could be ascertained, on account of the loose soil and *debris* every where present. Their general inclination, however, appears to be to the north west, at angles from 60° to 80°. The planes of stratification in every instance appear to be parallel to the lamina. The numerous seams running through the rocks are not parallel, and they appear to have been the result of forces applied from beneath. Although there is occasionally some variation in the course of these deposits, their general direction is from the south-west to the north-east.

Both the greywacke and slate are penetrated by numerous veins of white quartz, which are sometimes associated with chlorite; and the presence of the oxides of iron, is known by the rusty appearance of these minerals and the rocks in which they are contained.

Iron pyrites is common in these rocks. At Cornick's Mills there is a considerable vein of the pyrites, and this mineral is disseminated in small quantities both in the slate and greywacke, where it gives the rocks a ferruginous appear-

ance. The pyrites is found crystalized in cubes and octahedrons, and by its peculiar metallic lustre, has been mistaken by the inhabitants for a far more valuable ore. Among the veins of quartz, beautiful transparent crystals of that mineral are found, and are very improperly called "diamonds."

I have already adverted to the graphite on lands belonging to Mr. William Porter, and at other places northward of Saint Stephens. This mineral also appears at the "Rolling Dam," on the Digdeguash; but, wherever it has been discovered, the admixture of alumina, renders it unfit for crayons or pencils in its native state. It is, however, capable of being manufactured so as to render it useful for its ordinary purposes.

At several localities on the Digdeguash, and in the ravines adjacent to this stream, there is an abundance of alum slate. This rock will be known by being covered with an efflorescence having the peculiar astringent taste of copperas. A much more advantageous situation for the manufacture of copperas and alum was discovered, notwithstanding, at the entrance of the Musquash harbour.

The greywacke will often afford excellent building stone and sometimes flagging, but the slate in general is not well adapted for roofing, being much fractured or uncleaveable, in situations where the quality of the rock is otherwise favourable. The soil on the former rocks is silicious or sandy. The decomposition of the slate affords a tenacious clay.

The greywacke and slate, occupy a very extensive area in the Counties of Charlotte and York. The southern side of these groups of rocks, reaches from the Scoodic Lakes across the St. Croix River, and through the Parishes of St. Stephens, St. Davids and St. Patricks. In the latter parish, they diverge to the northward, and finally form a narrow belt that extends to the Piskehagan River, in a north-east direction, to the St. John, at Kemble's Manor. The northern side of the tract of greywacke and slate was found to extend from the State of Maine, across the southern extremity of the Cheputnecticook Lakes and Loon Lake, to the Saint John, below the Pokiok. The north-easternmost part of the whole area is widely forked, and the Great Coal Field of New Brunswick, after crossing the main Saint John River, reaches in a south-west direction several miles westward of the Oromocto Lake. A reference to the geological map, to be published hereafter, will shew the situations of the rocks under consideration, so far as it has been possible to ascertain their boundaries.

In crossing the country between St. Andrews and Fredericton, these rocks were found to reach in a northerly direction, to near the place where the road from Fredericton crosses the Magaguadavic, near Brockaway's. They are there met by the sandstones and conglomerates of the Coal Field.

At the head of Oak Bay, and in the Parishes of St. Stephens, St. Davids and St. Patricks, the soil possesses many peculiarities in common with the argillaceous slate beneath. In general it is a plastic clay and very retentive of moisture; except, when it is mixed with sand and gravel, of which there are numerous deposits. In general this argillaceous soil is very fertile and well adapted for grass. In the above Parishes, agriculture is advancing at more than an ordinary rate, and the new settlements opening in all directions, with the fine farms which have been made in the forest in the course of a few years, are highly creditable to the inhabitants and the Province in general. The soil on the greywacke is sandy and in general less productive than that which has been derived from the slate. By mixing these soils their fertility would be increased.

Proceeding in the direction of the road, now nearly completed between St. Andrews and Fredericton, the slate is seen stretched along the flanks of Chamcook, and the highlands running parallel to the coast. The strata are frequently plumbaginous, and are broken through by numerous dikes of trap rock, proceeding in all directions from the sienitic and trappean hills southward. Boulders of granite are scattered over the surface; these have evidently been transported from the northward: they are similar in mineral composition to granite observed *in situ* in that direction.

On the farm of Mr. Ephraim Turner, there is a singular mineral spring, the water of which contains the hydrous peroxide of iron. This spring is situated on the side of a ravine, and the forest around it has recently been cleared by the proprietor. The water issuing from the rocks beneath, being loaded with mineral matter, has thrown up a conical mound around the mouth of the spring; and a large quantity of the hydrate of iron, which now appears in beds of red and yellow ochre. The water is highly ferruginous, and has been applied, successfully, in the cure of cutaneous diseases. Its peculiarities arise from the presence of the peroxide of iron, and sulphureted hydrogen. Red, yellow, and brown ochres might be manufactured at this place; the native ore would, in general, only require grinding and

washing; and the brown varieties of the ochre, would be made red by calcination. The spring affords an annual deposit of the ochres, and the quantity already collected would supply a manufactory of paint many years.

It had been reported that there were indications of coal at a place called the "Rolling Dam," on the Digdeguash River; but upon the examination of the rocks in this district, it was found, that the substance supposed to be coal, was graphite, or plumbago. If any coal should ever be found in this quarter, it will be of the anthracite kind, as the rocks here are much older than those containing bituminous coal.

From the Warwig to Brockaway's farm, on the Magaguadavic, the distance is about twenty miles; and the few inhabitants are settled on the roads communicating with Saint Stephens and Saint Andrews. Along the tributaries of the Digdeguash, and between them and the Magaguadavic, there are some ridges of excellent land; among these are Floom Ridge, and Little Floom Ridge. Between these elevations, and along the lower grounds, there are considerable tracts unfit for agriculture. The best lands are covered with a heavy growth of beech, birch, and maple, mixed with hemlock. The swamps abound in large cedars, and black and white ash. The intervales produce majestic elms, and sometimes sugar maple. Formerly there were fine groves of pine in this quarter, but all the best trees have been removed by the lumbermen, or destroyed by fires, which have swept over the soil, and left the stately forest, a blackened and decayed assemblage of leafless trees.

Near the Magaguadavic Lakes, there are also some fine tracts of excellent soil; but no settler has yet made his appearance upon them; and the ground of future cultivation and rural industry, still remains a dark and dreary wilderness. The lakes, and the streams connected with them, abound in excellent trout, and other kinds of fish; and if the shores of the largest lake were inhabited, they would afford some very delightful scenery.

The house of Mr. Bartimeus Brockaway, is the only resting place to the traveller, as he passes through the wilderness between the Rolling Dam and the Harvey Settlement. It is built upon a terrace, produced by the bursting of a lake. This terrace, with others, will be noticed hereafter. The soil—the sediment of a former lake—is a fine light loam, and very fertile. It is elevated about ten feet above the level of the intervale, along the river, and was formerly covered with a heavy growth of pine. The higher

grounds are gravelly, and contain numerous granitic boulders. The terrace is about four miles long, and one mile broad; the place where the barrier of the lake once gave way, is still to be seen, at the lower part of a beautiful valley, farther down the stream. A high bank of sand and gravel, on each side of the present stream, shews the clearest evidences of having been broken through, prior to which period, the river took its rise at this spot; and all the intervale above was beneath the water. The remains of fresh water shells, of existing species, were found in the soil, that, long since the time of their existence, had produced the largest pines.

On the Magaguadavic River, the dams of the industrious beaver still remain; although the animals themselves have long since been destroyed by the Indian hunters. The erection of these dams across the mouths of the smaller streams, has produced tracts of grass land, commonly called beaver meadow; and the ancient labours of these creatures, have therefore contributed to the advantages offered to the new settler, in procuring fodder for his cattle.

COAL FIELD,

SOUTH OF THE SAINT JOHN.

After crossing the Magaguadavic stream, about a mile northward of Brockaway's, I found the slate formation met by a lofty hill of conglomerate, that extends around the south side of the Oromocto Lake. Crossing the lake, the sandstones and shales of the coal field were observed; and there is an outcropping of the coal, ten miles above Hartt's mills, on the Oromocto River. By these examinations it was found that the rocks of the coal field, in this quarter, extend farther westward than was before anticipated. The conglomerate, interstratified with sandstone, continues, in a northerly direction, to Fredericton; but, after leaving Mr. Nesbit's farm at the Harvey settlement, it is less elevated than it is farther southward. Many of the hills on the northeast side of the Magaguadavic, have but a scanty soil, but, nearer the above settlement, the soil is thick, fertile, and well covered with timber, the principal growth being maple, beech, birch and hemlock of large size.

Leaving Fredericton in the direction of Hartt's Mills, the road passes through the pretty village of New Maryland. The sandstones and conglomerates of the coal field are here situated beneath a fertile covering of new red sandstone. The junction of the two rocks may be seen at the bridge on the farm of Mr. Charters. The red strata are thin, soft, and sometimes very argillaceous; being readily distinguished from the grey micaceous rocks beneath. This belt of red rock is about a mile wide; its length could not be ascertained correctly.

The red sandstone also appears along the Rushagonis, where the surface is occupied with a red diluvial soil, frequently of considerable thickness. There are a number of fine settlements along the banks of this stream, and much of the intervale is of an excellent quality; having been derived chiefly from the red marly rock above mentioned. The terraces on this river are not overflown by the highest freshets of spring, and they are, therefore, called "high intervale." One of these terraces may be seen on the farm of John Peabody, Esquire, and is elevated eight feet above the highest level of stream. At the mouth of the Rushagonis, there is a sunken tract of a thousand acres; it appears to have been a lake, which is now fast filling up, and will, in the course of a few years, be capable of producing grass. Another terrace appears on the south branch of the Oromocto, in the Parish of Blissfield. The beautiful settlement here is upon the bed of an ancient lake. The lake has been drained by natural causes, and the soil which had been deposited from the water is extremely fertile. The farms are situated upon a level plain, and surrounded by high lands, which add much to the admirable features of this remarkable village. It is not a little surprising that even in these remote places, persons are deceived by the boasted virtues of the "mineral" or "divining rod," and pages might be written on their golden dreams and constant disappointments. The time wantonly thrown away in digging for money, might be profitably employed, and those who believe that the first inhabitants of New-Brunswick buried their money in the earth; or, if they did so, wandered far into the interior to deposit their wealth, would do well to seek some employment more certain of reward, than to search for riches where they can never be obtained.

Between the sources of the Nerepis and Black Creek (a tributary of the Oromocto,) there are several small tracts of red soil, derived from the soft and yielding rock beneath. These tracts are limited in extent; and beds, which at their thickest parts do not exceed ten feet in depth, thin off until the strata entirely disappear. At many places, a thin covering of red soil, is the only indication of the presence of the new red sandstone. The strata in general are soft and slaty, and alternately composed of arenaceous and argillaceous matter. They are seen advantageously between Mr. Darby Gillon's and the Oromocto.

At the entrance of the Oromocto, the coarse dark grey sandstones of the coal field are covered with the red soil, and

a fine diluvial sand. At the village, this deposit was the ancient burying-place of the Indians. In opening a new road, several skeletons, axes, knives, kettles, beads, wampum, &c. were exposed. Through the politeness of H. T. Partelow, Esquire, I have obtained a number of these interesting relics, which throw light upon the history and customs of the ancient inhabitants of the country. The bodies dug up were carefully wrapped in garments made of beaver-skins; that still exhibit much ingenuity, and superior workmanship. The head of each individual was placed in a copper kettle, and the whole body surrounded by a strong wrapping of birch bark. The mixture of French beads with those made of shells, some of the axes, and the copper kettles, are evidences that the French had visited the country previous to the interment of these bodies.

On the west side of this river there is a steep embankment, immediately on the border of the intervale. There can be no doubt that the river, now half a mile distant, once swept along the base of this steep bed of sand; but as the soil is diluvial in every part of it, the origin of the apparently recent collection of sand, must be attributed to remote causes; or those which produced the level ground upon which Fredericton is built.

The conglomerates and sandstones of the coal field also appear in the higher grounds, of the vicinity of Fredericton. In many situations, they are but scantily covered with soil. Although it is far from being improbable, that coal might be procured at the very capital of the Province, the rocks themselves offer but few evidences of its existence near the surface; it is only at considerable depths that it might be expected to occur, and therefore the expense of the operations required to discover its strata, is an obstacle few will be ready to encounter at the present time.

In all these sandstones and conglomerates, the remains of plants belonging to the coal period are numerous; and although they do not offer so great a variety, and are less perfect than the fossil plants of the northern counties, interesting specimens may be often procured, where the rocks have been exposed in constructing new roads, or where quarries have been opened. The impressions of the leaves of *stigmaria*, ferns, and other vegetables possessing tropical characters, with fragments of the trunks of *coniferous* plants, are the best guides in determining the boundaries of these rocks; as they are present in every part of the great carboniferous district.

The soil produced by the disintegration of these rocks, is light and sandy: but from the general distribution of detrital beds of sand and pebbles, in this district, there are few instances where the rocks beneath have contributed to the production of the soil immediately above them; and which, from being composed of mixed mineral matter, is rendered fertile, under a proper mode of cultivation.

The beautiful level plain upon which Fredericton is built, consists of beds of sand, gravel, and clay, distinctly stratified throughout. From the situation of this open flat, it might be supposed that the level area, on the margin of the river, was produced by those causes to which the diluvial terraces owe their origin: but it is evident that the above beds of sand and gravel are diluvial, and the operations that were active in their formation, have now ceased to exist. Similar deposits were observed along the whole valley of the Saint John, where the beauty of the scenery is often greatly increased by the level tracts extending from the river to the flanks of the hills.

The beds or strata of sand and gravel, frequently contain considerable quantities of the peroxides of iron and manganese. The workmen in sinking a well for the Honorable Neville Parker, at Fredericton, passed through a deposit of ochreous sand, capable of affording a good pigment. Near Government House, the peroxides of iron and manganese have collected in such a manner as to cement the beds of pebbles, and form a conglomerate, having a high metallic lustre. Water highly charged with these minerals, percolates through sand until the interstices become filled; and thus the sand is converted into sandstone and the pebbles into conglomerate. As the oxides of iron form the chief cement for the older sandstones, the process by which they were consolidated, may, in some degree, be seen going forward at the locality above mentioned. Many of the sandstones already noticed, will afford excellent grindstones, freestones and flagging; and quarries of these useful materials, might be opened within a short distance of Fredericton. The rocks of the Coal Field extend about five miles above the town, where they are obscured by detritus, and finally met by greywacke and slate, which will be noticed hereafter.

EXPLORATION

OF THE

SCHOODIC AND CHEPUTNECTICOOK RIVERS AND LAKES.

Having examined all the country situated between Fredericton and the Bay of Fundy, and that part of the Coal Field discovered south of the Saint John, it was deemed necessary to explore the whole line of country from the entrance of the Schoodic, in the County of Charlotte, to the monument; and from thence to Woodstock, along the line which has been supposed to separate the Province from the State of Maine. The strata between the monument and Woodstock are intersected by the Saint John, and therefore a better opportunity is afforded for their examination along the sides of the river, than can be found by pursuing a line through the forest.

As the shores of the Schoodic above Saint Stephens, the Cheputnecticook River and Lakes—with Eel River and its Lakes, are uninhabited, the only facilities for geological operations are offered along their margins; and as the tributaries entering into them, are numerous and extensive, I was enabled to examine the general features of a large tract of country. An accurate survey of the boundaries of each formation, and the examination of the minerals contained in them, cannot be made in the present wilderness state of the country, and unaccompanied by a geographical survey. The limits of the different divisions of rocks, notwithstanding,

have been at many places ascertained, and laid down on the geological map of the Province. But there are situations where the rocks are covered with detritus, a dense growth of trees, or submerged beneath the lakes, bogs and meadows of the wilderness, so as to render a knowledge of the lines where they meet uncertain. It is only on the sides of the lakes, rivers and ravines, where the strata are exposed; and even in such situations, they are frequently concealed to great distances. Remote from the streams, a rock *in situ* can scarcely be found over an area of many miles in extent. Under all these disadvantageous circumstances, I have laid down each formation as correctly as the opportunities afforded would allow; leaving it for future explorers, to correct any errors that may exist, when the country becomes cleared, and greater facilities are offered for geological inquiries.

Having procured three expert Indians with canoes, and being accompanied by my son and Mr. Charles Ketchum, a volunteer—with a sufficient quantity of provisions and the requisites for encampment, a portage of twelve miles was made from Saint Stephens to the Upper Schoodic, or Grand Falls. These Falls are situated directly below the bifurcation of the river, where one branch, called the Schoodic or Saint Croix, comes in from the westward, and another called the Cheputnecticook descends from the northward. The rocks along this portage are chiefly varieties of the greywacke and slate, already described. The strata vary in their courses from N. E. to N. N. E. being highly inclined. About five miles from Saint Stephens, we crossed a narrow ridge of sienite, which extends some distance in an east and west direction, and crosses the Saint Croix between the "Upper Mills" and the Falls. This rock is composed of hornblende and feldspar, and frequently resembles granite. At the above places, and in the neighbourhood of Saint Stephens, it is remarkably ferruginous, being impregnated with the oxides of iron. These oxides appear to have been produced by the decomposition of pyrites contained in the rock, where it is exposed to the operations of the atmosphere and moisture. The surface of this syenite is almost sterile, and it produces only a few stunted alders and white birch. The slate, from being more readily acted upon by meteoric agents, affords a fine argillaceous soil, well adapted for potatoes and different kinds of grain.

It may not be improper to remark here, that the principal river emptying into Passamaquoddy Bay, and known under the name of the Saint Croix, was called by the aborigines

of the country, *Schoodeag* or *Schoodic*, a word signifying, in their language, low and swampy ground. This name was, and still is, given to the most westerly branch of that river, which drains a large tract of low and sunken land. The river and lakes of the westernmost branch still bear the name of the Schoodic or Saint Croix; and the inhabitants on both sides of the reputed boundary line, call this stream the main river; but that branch of the Saint Croix that descends from the northward is called the Cheputnecticook. As the western branch has always been called the Schoodic, or main Saint Croix, it is evident that the starting point in deciding the question of the American boundary in this quarter, should be taken from the westernmost source of this river; nor can there be any doubt that this was the place of departure referred to in the treaty of 1783.

Having encamped just above the Grand Falls, we had an opportunity of examining the branches of the river, where they diverge, and the rocks over which they pass. The Falls are separated into the "upper" and "lower": between them the water passes over an inclined plane, producing thereby a dangerous rapid. At the lower fall, the water descends ten feet in the distance of two hundred yards. On the east side of the river, a dam has been erected, to deepen the stream so as to allow rafts of timber to pass, in the summer season. About half a mile above this place is the upper fall. The water here passes through a narrow gorge, and descends perpendicularly about twelve feet. A dike of trap rock intersects the strata of slate at this place; and has probably been the cause of the sudden change in the level of the river's bed. All the waters of the Schoodic and Cheputnecticook rivers, descending from large lakes in the interior, rush over these falls, and along the rapid between them, with incredible fury: large pieces of timber and logs seventy feet in length are frequently poised high above the water and instantly plunged into the foaming pool beneath. Large trees are frequently broken in several pieces, in passing the gorge, and the sound produced by the violent concussion of the logs against the rocks, and each other, is like that of artillery at a distance. The water of the river, from being confined between the cliffs, on each side, and in a contracted channel, rushes forward with great violence, until it is thrown into the more tranquil part of the stream; where the surface of the river is concealed beneath beautiful waves of white foam.

At the time of our visit to this place, the rivers above the falls were blocked up with an immense quantity of logs

and squared timber, which had been driven down the streams by a party of "stream drivers," forty in number. Some of these men had been four months engaged in their laborious and dangerous employment; and their manner of urging the enormous pieces of pine over the rapids, is alike creditable to their courage, patience, and hardihood. Still pushing the rafts of timber downward, and moving with the current, that daily transports the bark that covers their moveable camps—stung by the unceasing industry of swarms of insects, both day and night, these men possess more patience under their hardships and sufferings, than those of any other class in the country. Half a dozen of them will frequently navigate the stream, astride a log of timber, which they paddle along, with their legs in the water, with considerable swiftness; and they will force the light skiff up a perpendicular fall of three feet; where the roaring of the water is truly deafening, and where there is constant danger of being plunged into some whirlpool, or dashed against the rocks.—Although they are frequently rendered giddy by the revolving motion of the eddies, they fix the pole upon the bottom, and move away against the foaming torrent, or cross the stream upon the slippery blocks of pine. Such is the power of habit, that these men view the forest as their home, and the river as their resting place; constantly exposed to the inclemency of the weather, and the water of the rivers, they appear contented, and seem to regret when the labour of the season is ended. In situations where the water is more tranquil, a singular spectacle is sometimes presented; each of the drivers mounts a log, or piece of timber, and with their pikes in hand, move slowly along like a floating regiment, until some fall or rapid warns them to reimbark. Not unfrequently a rapid becomes blocked up with timber, in such quantities that it refuses to pass.—This is called a "jam." The clearing away of these "jams" is the most dangerous part of the stream-driver's employment, and occasionally several men are thrown down a rapid or fall into the boiling pool beneath.

The quantity of timber in one of these "drives" is enormous; and their progress along the rivers where the timber becomes entangled among the rocks, is therefore slow; especially, when the summer is advanced, and the volume of water is consequently diminished. In order to deepen the water, "wing dams" have been constructed on the sides of the most troublesome rapids. The depth and velocity of the water being thus increased, the floating timber passes

along more readily; but these dams greatly impede the passage of canoes in ascending the streams.

The hardy lumberman having passed the winter amidst the deep snows of the wilderness, felling and collecting the lofty trees of the forest, retreats to the river as the summer advances; and having escaped the frost of the colder months, seeks the dangers of the fall and rapid, bringing with him those vast supplies of timber by which the trade with the mother country has been supported. Like the employment of the sailor, the work of the lumberman is peculiar. He requires much practice and experience; and it may be safely asserted, that should any change take place in the Timber Duties, unfavourable to the British North American Colonies, thousands of men will be thrown out of employment, who have as little disposition to engage in Agriculture, as those who have been employed as sailors or fishermen. This description has been given as being connected with the topography of the district under consideration, and in compliance with those instructions by which I have been governed in the performance of my duty.

Immediately above the upper fall, there are two small islands, situated at the confluence of the Schoodic and Cheputnecticook rivers. The average breadth of each of these streams, at this place, is sixty yards; and on the 23d day of June, the water was eight feet deep, with a current of seven miles an hour, at the spot where the measurement was made. Two miles farther up the Cheputnecticook branch, there is another dangerous rapid, called the Cheputnecticook Falls. —This rapid was found to be filled with timber, and we were compelled to make a portage with our canoes and baggage half a mile.

Along this part of the river there are considerable quantities of low intervale, bearing a species of grass called "blue joint." This wild grass affords excellent fodder for cattle, and is very useful to the settler on wild lands. The uplands have been covered with fine groves of pine; but these have been removed, and all the best timber has been transported to St. Stephens and St. Andrews. Greywacke and slate were observed at a number of situations. The strata run north-east and south-west, and the dip is north-west, at angles of 60, 70 and 80 degrees. The greywacke frequently contains veins of quartz and chlorite: with these minerals there is also sulphuret of iron, in amorphous masses and in crystals.

Our next encampment was near the mouth of the Canoes River, a branch of the main stream, extending to the

north-east. From this place to the Little Cheputnecticook Falls, the river presents a series of rapids, separated by quiet ponds of deep water. We here met another party of "stream-drivers," who were floating several thousands of tons of timber along the troubled stream. A barrel of flour had been allowed to remain a short distance up the river by the party; and at the moment of our arrival a large bear was seen eating its contents, having torn the hoops from the barrel, and removed the head. Before we were within gunshot, bruin retreated into a thick cedar swamp, and escaped the fire of our rifles.

About ten miles above the Canoes Stream, the river passes through a narrow fissure in the slate, and over another dike of trap rock, forming the Little Cheputnecticook Falls; this was the site of our next encampment. The river here falls perpendicularly about ten feet; just above the cataract is a small but very beautiful little island, which completes the resemblance, in miniature, of this fall, to the magnificent cataract of Niagara. For the information of those who may hereafter take this route, it is proper to state, that the portage, at this fall, is on the east side of the river, and the path has been well beaten by the Indians, who passed this way to their hunting grounds, long before the country was visited by Europeans. About six miles farther up the stream, the river expands into a lake, surrounded by a tract of low ground, called "Porter's Meadows." From these meadows to the first Cheputnecticook Lake, the distance is about eight miles. Four miles are occupied by rapids; the most dangerous of these are the "Elbow Rips," at the foot of the lower lake. Our canoes were pushed up, over an evenly inclined plane, two miles long; where all our strength and skill were required, to overcome the swiftness of the current. After much labour and difficulty, the light barks were urged upward over the last rapid; and we paddled along the surface of the lake, where the water is quiet, and its gloomy stillness is strongly contrasted with the roaring of the river below.

The Cheputnecticook is an exceeding rapid river. The distance from the mouth of the Schoodic to the first lake, is nearly seventy miles, along the courses of the stream. Above the Canoes River, the sides and bed of the Cheputnecticook become rocky, and the granitic boulders, of large dimensions, scattered over the surface, obstruct the passage of the water in its descent.

It is evident that all these boulders have been transported from the north, as they are identical in their compo-

position with the rocks of the mountains surrounding the lakes. They are all rounded, or water-worn; and, frequently, upon their sides, the deep grooves and scratches, produced by friction against each other, or the rocks over which they passed, remain distinctly visible. These boulders, and the causes of their transportation, will be again referred to.

All the rocks, from the syenite of Saint Stephens to the lower extremity of the lakes, consist of varieties of greywacke and slate. At the outlet of the lake, these rocks are met by the granite; and the physical features of the country are immediately changed. Instead of the low undulated surface of the stratified rocks, the country becomes elevated and mountainous; and lofty hills appear in every quarter. Instead of the fine argillacious and productive soil of the slates, the surface is spread over with immense boulders; or broken by cliffs and precipices, so as to render it, at many places, unfit for agriculture. The boundaries of the granite, where it meets the slate and greywacke, may be traced by the eye, as it wanders over the uninhabited forests; and the bold and mountainous aspect of the country, from these lakes in a north-east direction to the Saint John, are sufficient indications of the rocks beneath. The lands between the above river and the Digdeguash, are, for the greater part, of a good quality; they do not attain any considerable degree of elevation, and the surface is sufficiently furrowed to secure the necessary drainage from the numerous springs and rivulets, that flow in every direction. The timber consists of pine, hemlock, birch, and maple: the lower grounds abound in cedar and alder, and sometimes in "blue-joint" and other kinds of wild hay. Extensive settlements might be made in this part of the Province, and the success of those who have already commenced to open the sides of this great forest, offer the best encouragement to persons who may be disposed to follow their example.

The Cheputnecticook Lakes are about forty-five miles in length; their breadth is very irregular, being not more than a quarter of a mile at some places, and ten miles at others. They present a series of narrow straits and wide bays, with deep inlets and creeks. The general course of the chain is about north-west: on the northern side of the lakes, there are a great number of deep and narrow bays and coves.—Some of these bays are seven miles in length; and all of them run in a direction nearly parallel to the main lake. The south-west side is also remarkably indented. From these circumstances, and the numerous islands and narrow passa-

ges, the navigation of this beautiful sheet of water is rendered very intricate, and we were sometimes much perplexed to find the passage from one part of the lake to another.

Notwithstanding the water is generally deep, and capable of being navigated by vessels of considerable size, vast white granitic boulders rise above the surface, or may be seen at various depths beneath the transparent water. The shores are also lined with these boulders, which, at many places, form natural wharves, with twenty and even thirty feet of water around their perpendicular sides. The hills in general slope gradually down to the shore, where the blocks of white granite appear like solid masonry, and exhibit a degree of neatness and beauty seldom seen on the borders of lakes. The numerous islands are thickly covered with cedar, hemlock, spruce and birch. The hills on the sides of the lakes bear lofty groves of pine, hemlock and larch; elm, ash and cedar being the productions of the less elevated lands. The surface of the country is generally occupied by vast collections of granitic boulders, having their interstices filled, and being sometimes covered, with granitic sand; above which, there is a strong and fertile soil. There are also large tracts of diluvial sand and gravel, which are capable of cultivation. The sand produced by the disintegration of the granite, is peculiarly favourable for the production of forest trees, which, in this quarter, have attained the largest size. Even in situations somewhat remote from the lakes, and where the boulders apparently cover the whole of the earth's surface, groves of beech and sugar maple were seen strongly rooted in the interstices of the rocks. The chief part of the best pines, that grew near the lakes, have been felled, and floated down the river to Saint Stephens and Saint Andrews: there are, however, in situations remote from the means of transportation, large quantities of excellent timber.

Our next encampment was at the "Narrows," between the first and second lakes.—During the night, we were aroused from our slumbers by the trampling of a large moose, which had approached within four yards of our camp-fire:—from the bustle and confusion of making the guns ready, the animal escaped and bounded into the woods unhurt.

Between the second and third lakes, there is a narrow and tortuous channel; and the water, in escaping from the upper lake, is broken by several falls and dangerous rapids. By crossing a portage of about a quarter of a mile, we ascended into the third or Grand Lake—an expanded and beautiful sheet of water. This lake, from being relieved

from the influx of any muddy streams, is remarkably clear; and the waters are so transparent, that the fish, which are abundant, may be seen near the bottom at considerable depths. At its narrow outlet, a kind of dam has been erected, whereby the water can be restrained, and a vast reservoir formed. By discharging a quantity of water from the lake suddenly, the lumbermen are enabled to float down the timber when the water in the river has become too shallow for that purpose.

The traveller here will not fail to observe the gloom and stillness reigning over these lakes and the forest around them. In every direction, so far as the eye can see, from the tops of the highest hills, not the appearance of a clearing, nor any marks of cultivation can be observed. Not even the "log-road" can be discovered far from the water; and the traces of human beings are only to be seen in the ancient trails of the Indians, and the naked poles of the lumberman's deserted camp.

The lake, ornamented with islands, and branched with deep placid bays and inlets, is stretched out before the adventurer, and fantastically decorated with rocks of snowy whiteness. Hill after hill, and mountain after mountain rise in the distance, where the physical features of the country remain as they were, when the aboriginal Indians were Lords of the soil. But it is difficult not to view these lakes as they will appear when the hand of industry shall have removed the primeval forest; when market towns, manufactories, and rural island retreats, shall be seen in every direction; when steam-boats and barges shall ply along this almost unknown district, and when agriculture shall have covered each slope with green fields and meadows. At present, these lakes are the summer resort of the eagle, goshawk, tern, several species of ducks, and other birds, broods of which were frequently disturbed by our visit; and often the carriboo and deer were seen to start from the shores, where they plunge into the water to cool their heated limbs, or to evade the incessant stings of the black fly and mosquito. The shores are also inhabited by large tortoise, whose eggs are very delicious, and may be sometimes obtained in considerable quantities in the sand.

In the unfrequented forests, the wild animals of the country are very numerous. Moose, carriboo, deer, wolves, and bears, are frequently seen. In the new settlements on the Cheputnecticook river, deer sometimes enter the fields, and gambol with the calves and other young cattle. Wolves

are but recent visitors to the Province; they have entered our borders from the westward in pursuit of the carriboo and deer, which they have driven over the line in great numbers. In consequence of the high price of bear skins, and the bounty offered for the destruction of those animals, they are pursued with great diligence by the Indian hunters. The lakes and rivers abound in the finest trout; three varieties of which were taken at the outlet of the lake. The white trout are called "*shiners*", by the lumbermen; and each of these varieties differs, in some particulars, from European kinds: but equal them in size and flavour. A species of salmon, called "togue," is also taken in the Grand Lake. This is the *salmo huco* of Sir Humphrey Davy, and weighs from fifteen to twenty pounds.

At the time of our reconnoisance, nets were drawn across a narrow passage, between the Grand Lake and the North Lake, and also at Monument Brook, where several barrels of white perch were taken daily by a party of Americans.

As all our provisions, except salmon trout, had been consumed, it was found necessary to proceed to the reputed American side of the lake; we accordingly encamped, and procured provisions from the Baskahegan Settlement, situated on the road leading from Calais to Houlton. The Baskahegan River is a branch of the Penobscot, and some of its tributaries approach the lake within a distance of three miles. We have to acknowledge our obligations to the American inhabitants of the above settlement, for their ready aid, and hospitality.

The Cheputnecticook Lakes may be said to be situated in the mountains. They are much elevated above the Saint Croix and Penobscot; and, on this account, they are peculiarly favourable to the inland navigation of the country.—I regret that my instruments had become too much injured, during the exploration, to ascertain the height of these lakes above the level of the sea, with any degree of accuracy.

From the extremity of the Grand Lake, there is a narrow but deep passage, called the "thoroughfare"; it is a mile in length, and communicates with the North Lake, extending, in a north-east direction, towards Eel River Lakes, emptying into the Saint John. On the north side of the North Lake, there is a considerable stream flowing in from the northward, called the Monument Brook; its source being the site from which the due north line was taken by the commissioners appointed, under the treaty in 1814, to settle

the boundary between New Brunswick and the United States. This stream is navigable for canoes, about eight miles, and its source is ten miles from the lake. The Monument, of which so much has been said, is a cedar tree, marked on the British side, and that supposed to be on the side of the United States. On this brook, the granite is met by the slate group extending to Woodstock.

We next encamped on the east side of the North Cheputnecticook Lake, whence there is a portage to Eel River Lakes. The difficulty of discovering an old Indian path, in the woods, is always great to the unpractised eye; and as the portage trail had become obscured by the growth of grass, during the summer, and none of our Indians had ever passed this route, it was feared that the advantages of the path, for carrying the canoes and baggage, would be lost, and we should be obliged to steer through the thick forest by the compass. From this embarrassment I was relieved by the discovery of some Indian hieroglyphics, upon a tree, which expressed clearly the necessary information. On the clean wood of a large cedar, there was rudely marked, in a peculiar black and durable ink, an Indian carrying a canoe; and the direction of the figures were exactly those of the portage: so that, the old winter paths of the lumbermen were readily avoided. Two deer, with an Indian presenting his gun at them, were also exhibited; indicating to the traveller to look out for those animals.—This information was important, and found to be strictly correct.

In another instance, when we were about to descend a dangerous rapid and fall, on Eel River, and our lives were in jeopardy, we discovered a large drawing of two Indians, with their heels uppermost, and their canoes placed above them, neatly executed upon a large cedar. This warning was quite sufficient, and we immediately landed to avoid the hazard before us. The information conveyed through the medium of these hieroglyphics is often very remarkable, and for brevity far exceeds a written language. The above portage is three miles long; it was travelled by the aborigines on their voyages from the Penobscot to the St. John and the Gulph of St. Lawrence, before America was discovered by Europeans. The trail is a deep narrow path, worn out by human feet; and at some places, the solid rocks were found deeply furrowed by the moccassins of our native tribes.—After carrying our canoes and baggage across this portage, we again embarked for the exploration of the rocks of Eel River and its lakes.

These lakes are large sheets of water, with passages or thoroughfares between them; the river—their only outlet—empties into the St. John. There are a number of islands in these lakes; and the scenery, along the shores, is very beautiful and romantic. Between Eel River Lakes and the sources of the Magaguadavic, there still remain some groves of pine, and there are large tracts of land of an excellent quality; notwithstanding, many of the hills are too rocky for cultivation.

The elevated and mountainous character of this district, is evidence of the existence of primary rocks. Frequently the granite rises in great grandeur, exhibiting the mural cliff and deep ravine, in all their picturesque forms. Prospect Mountain, on the south side of Loon Lake, and other elevations between the sources of the Magaguadavic and Eel River, belong to this granitic range; and, from their summits, offer some of the most extensive views in the Province.

On the north-east side of the lower Eel River Lake, I found the granite again meeting the older greywacke and slates. The latter rocks extend in a northerly direction to Woodstock, beyond which place, they have not been explored. The course of the strata at the lake is north-east, and the dip is north-west, 81°.

In descending Eel River, to the distance of sixteen miles from the lake, the stream passes through a large tract of intervale, covered with cedar, alder, ash, and elm. As the uplands here are generally good, and the upper part of the river offers many facilities for water communication, it is remarkable that no settlers have yet been located along the stream. As the lower part of Eel River abounds in rapids and falls, we were compelled to make another portage of six miles, to the Saint John, the distance along the stream being no less than nineteen miles.

Before I take leave of the topographical description of this part of the country, it may not be unnecessary to advert to the facilities of water communication; and although these are afforded, in general, by comparatively small streams, they are of the highest importance to the district, and more especially to the new settler. It will have been observed, by what has been already stated, that a natural water communication is open, almost from the mouth of the Schoodic, directly across the country from Saint Andrews, to the Meductic, a few miles below Woodstock, on the Saint John. By clearing the boulders of rocks from the lower part of Eel River, it may be rendered navigable for boats; and then

the only interruption to the communication by water, into Passamaquoddy Bay, will be the falls on the rivers, and three miles of land between the North Cheputnecticook and Eel River Lakes. By cutting through a portage of ninety-six rods, between the Second and Grand Cheputnecticook Lakes, a crooked and broken channel may be avoided, and this route may be greatly improved. There is, therefore, an almost uninterrupted chain of lake and river, along the above line, and from thence to the Saint Lawrence, along the River Saint Francis, or *Tuladi*, northward of Lake Temiscouata. This was one of the ancient Indian routes from Passamaquoddy to Quebec. Extensive tracts of land in the wilderness explored, between Saint Andrews and the Saint John, are of good quality,; and the numerous small lakes and streams, emptying into the larger rivers, will afford the channels of communication, before good roads can be constructed through the forests. By ascending an arm of the lower Cheputnecticook Lake, called the "Palfry," the lakes at the head of that stream may be entered; from thence the distance is only three miles into the Shogamoc, emptying into the Saint John, or West River of Magaguadavic, or Loon Lake, a large sheet of water open to the sea, by the Magaguadavic River. Canoes or light boats can pass readily from the City of Saint John to the Oromocto Lakes; from thence, the distance into the Magaguadavic is only three miles; the beforementioned course may then be followed into the Cheputnecticook, which is separated from the Baskahegan, a branch of the Penobscot, by a distance of only three miles. This was also a line of the old Indian hunters, many centuries ago. But it is unnecessary to enter upon all the channels, which nature has opened, through this part of the Province; they form, however, a considerable part of the natural wealth of the country, and will be found, as the population increases, of great advantage to the inhabitants.

The southern side of the granitic district beforementioned, extends from the reputed American boundary, across the lower part of the first Cheputnecticook Lake; and from thence, by the lower extremity of Loon Lake, in a north-east direction, to the River Saint John; its northern side crosses Monument Brook, and the lower Eel River Lake. The termination of the range, in a north-east direction, has not yet been explored.

On the north side of this granitic and primary ridge, there is an expanded tract of greywacke and slate, which

has been followed northward to the Meduxnakeag, and is known to occupy a large area, between Woodstock and the Grand Falls. The characters of the greywacke, in this quarter, do not differ materially from those of the rocks of Charlotte County; but the slate, in general, is more calcareous than any other found in the Province. It will be seen by reference to the geological map, that this ridge of granite extends in north-east and south-west directions, or along a line parallel with the course of the strata. It forms an anticlinal ridge, against which, the stratified deposits lean; evidently, having been forced through them subsequently to the period of their formation.

The granite crosses the main river at the mouths of the Shogamoc, Pokiok, and Nackawick; where its mountainous character may be observed in ascending to Woodstock.

The Pokiok, having passed over a high and broken ledge of primary rocks, tumbles into the Saint John through a deep chasm in the granite. This chasm is twenty-five feet wide, about seventy feet deep, and a furlong in length. The river falls over a perpendicular ledge, and bounds through the dark channel, from step to step, until it is lost in the more quiet water of the main river, which passes along, unruffled by its noisy and troubled tributary. This chasm has no doubt been opened by an earthquake, or some other terrestrial disturbance; the depressions and protuberances on its sides, are such as prove, that they have been separated from each other, and have not been produced by the action of water, in wearing out the channel. Similar chasms and fissures are seen in every part of the granite district, where the rocks have been rent asunder, by the most powerful causes, and operations that have long since ceased to exist. The granite is of two kinds—in one of these the feldspar is of a light red colour, and the crystals are large. The granite further westward is coarse grained, with white feldspar, and, so far as present discoveries extend, contains but few minerals.

At the Meductic Point, and on the farm of Mr. Peter Watson, a vein of iron pyrites is found in the greywacke at the foot of the hill; it varies from an inch to a foot in thickness, and the pyrites in small masses is disseminated through the rocks. Some specimens, taken from this place, were found to contain the sulphuret of copper; but, no vein of that mineral has yet been discovered, of any practical importance.

The rocks of the Coal Field meet and overlie the greywacke, already mentioned, about half-way between Frederic-

ton and the mouth of the Keswick. The former rocks consist chiefly of a coarse sandstone of a grey colour, and occasionally a conglomerate containing pebbles of quartz, trap, sienite, &c. The course of the strata is from the south-west to the north-east, and the dip is from 60° to 80°.

Near Brower's Inn, and a short distance above the mouth of the Keswick, on the opposite side of the river, there is a narrow belt of rocks, belonging to the New Red Sandstone group; it is about a mile in length, and runs north-east and south-west. A continuation of this belt is seen on the north side of the river, below the entrance of the Keswick Stream. The strata consist of argillaceous sandstone, with marly and ochreous clay, from one to four feet in thickness. The rocks are of deep red, claret, and chocolate colours, and are associated with thin strata of grey sandstone and conglomerate. The soil covering these rocks is of a deep red, or crimson colour, and it is, therefore, readily distinguished from any other in that quarter.

RED PAINT.

From the peculiar red appearance of the ochreous beds, and the presence of the peroxide of iron, I was induced to suppose that they would afford pigment; and, upon trial, my expectations were fully gratified. The best layers for ochre will be known by their deep colours and the fine state of their materials, which, by being washed from the particles of sand, and finely pulverised, will afford a good and durable paint. It has been successfully tried in imitations of oak, mahogany, and other kinds of wood, and will be found a valuable native paint. The following is an analysis of a specimen of medium quality:—

Silex	58.20
Peroxide of Iron	20.00
Alumina	4.20
Carb. of Lime	1.00
Water	16.60
	100.00

The silex exists in a state of minute division; and I have no doubt that the pigment may be found, free from any gritty

particles, requiring but little preparation, except grinding and washing, before it is applied.

LIMESTONE.

Interstratified with the above deposits, there is a limestone, generally of a light red colour. At one situation, near the base of a high hill, this limestone was found to contain a small quantity of magnesia, which would render it unfit for agricultural purposes; at other situations, the magnesia is absent, and good lime may be obtained. At present almost all the lime used in the upper settlements of the Saint John, is conveyed from the kilns of Indian Town, and Grand Bay. The above deposit of calcareous rock, is therefore a fortunate circumstance for the inhabitants between Gagetown and Woodstock; and it is capable, under proper management, of supplying all the inhabitants along that part of the river.

WOODSTOCK.

Near the mouth of the Meduxnakeag, the greywacke is met by clay slate, as it extends in a wide formation from Houlton towards the north-east. How far this formation reaches northward, I have not been able to ascertain by examination, but I have been informed that it continues uninterruptedly to Lake Temiscouata, and at several localities will afford good roofing slate. The strata, in their general course, run E. N. E. and W. S. W.—They dip W. N. W. from the granite, at high angles. The planes of cleavage are not always parallel to the strata, and frequently the rock is in a semi-crystalised state, falling down, when exposed to the weather, in small columnar and needle-shaped fragments. As the whole surface is covered with a thick soil, few opportunities are afforded for the inspection of the strata. The rock, however, is quite different in its structure and mineral composition, from any of the slates farther eastward. The strata are frequently much contorted, and appear to have been twisted before they were consolidated. There are also instances where they have been fractured, and the disjointed parts forced away from each other at right angles, in the manner of faults. The rock in general is a fine clay slate, containing occasionally a considerable quantity of mica. In some instances there is a sufficient quantity of silicious matter present, to constitute greywacke slate; but the most peculiar circumstance, in its mineral composition, is the presence of lime, which sometimes exists in sufficient quantities to afford a pure limestone. At Ivey's farm, about six miles from Richmond corner, the limestone has been found sufficiently pure for agricultural purposes; and a small kiln has been put in operation. I observed that attempts had

been made at several other places to calcine the rock, but the lime it contains is insufficient to allow it to slake, after it has been burned. It is from the presence of lime that the soil in this district is so fertile; and the composition of the slate is such, that as soon as it is disintegrated, it forms a productive soil. In a work I have commenced on the Agriculture of the Province, the soils have been classed with reference to the rocks from which they have been derived; and nowhere is the propriety of such a plan rendered more obvious, than in the County of Carleton, where the rocks, and the soil upon them, are identical in their composition.

IRON ORE.

The slate sometimes contains veins of quartz; but more frequently there are narrow seams of the carbonate of lime. No iron pyrites was observed, and the soil is generally free from those salts and compounds of iron and sulphur, that would injure its fertility.

About two and a half miles from Woodstock, and near the main road leading through Jackson Town, there is a very extensive and valuable bed of iron ore, on land belonging to Colonel Ketchum. This ore is interstratified with the slate, and, like the strata on each side, extends from W. S. W. to N. N. E., in layers nearly perpendicular. This deposit of iron had been supposed to exist in one stratum, but upon examination, I found it to be laid in three separate beds.—Measuring across the outcropping and the strata, it appears at the surface in the following manner:—

Clay Slate.
- Ore..... 28 feet,
- Slate..... 250 do.
- Ore..... 15 do.
- Slate..... 100 do.
- Ore..... 27 do.

Clay Slate.

Total thickness of ore, 70 feet.

The above is the most accurate measurement I could obtain, under the obstacles presented by the detritus, and a luxuriant growth of trees, and other herbage upon the surface. These beds of iron can be traced to the distance of half a mile; they doubtless extend to a great distance, and

may hereafter be found crossing the Saint John. The ore itself is distinctly stratified, and conforms to the position of the strata of slate; and the difference of quality in different beds, is not such as will materially affect its properties for working in the furnace. The ore is a compact red, or redish brown hematite; or the hydrous peroxide of iron. Wherever it is exposed to the atmosphere, its colour becomes changed to black, or dark blue; from which fact, it has been supposed to contain a considerable quantity of manganese; but these colours are deceptive, and arise altogether from the operations of the atmosphere, moisture, &c. By descending a few inches into its solid masses, the true characters of the mineral may be readily observed.

The analysis of a specimen from the middle of the bed gave—

Peroxide of Iron.....	78.40
Silica.....	1.20
Alumina.....	5.80
Water.....	12.60
Peroxide of Manganese...	*a trace.*
	98.00

The structure of this ore is frequently fibrous, and it appears as if it had been imperfectly crystalized. It is easily reduced in the furnace, and will produce from forty to fifty per cent. of excellent iron. From the situation and extent of the beds, no expense will be required to open a mine, and so great is the quantity of ore, that it would supply America with iron thousands of years. A beautiful variety of hematite was found near the most northerly bed; it is of a bright red colour, breaks with a conchoidal fracture, and is very sonorous; it will not, however, yield so large a quantity of iron as the kind already mentioned. The discovery of this great deposit of iron in the County of Carleton was claimed as late as 1836, but it is well known that specimens of the ore had been sent abroad and examined as early as 1820; and its existence was known to the first inhabitants of Woodstock.

The slate on each side of the ore is of a brick red colour, and very ferruginous; but the ore itself is quite distinct from its matrix. From the great abundance of wood in this district, and the occurrence of limestone, every advantage is offered for the manufacture of iron. Up to the beginning of the seventeenth century, the smelting of iron and all the metals was performed by charcoal; smelting by coal or coke

was introduced in consequence of the scarcity of wood, in countries where it was formerly abundant. For this reason, smelting furnaces in Europe were removed from the sites of ancient forests to the coal districts; but in reference to the iron ore under consideration, as it exists in the native forest, there will be an abundant supply of fuel for the purposes of its manufacture for many years to come. It is very evident that all the strata of slate were produced by the agency of water, which collected their argillaceous materials and spread them out in broad layers of fine sediment; these, by great pressure and time, have become consolidated, and are now seen in solid rocks with their strata uplifted. The iron ore was probably once a ferruginous mud, or it may have been a deposit of the hydrate of iron, similar to the collections of bog iron ore, now forming on the surface of the earth. The hematite of Nova Scotia abounds in the remains and casts of marine shells, the most certain evidences of its having been formed at the bottom of some shallow estuary of the sea. In the slates and ore of Woodstock, I have not yet discovered the remains of testacea, although they may yet be found.

The iron of the County of Carleton forms an important part of the natural wealth of the Province. Situated in a very fertile district, near the State of Maine, where it has a communication with New-Brunswick by the Houlton road, and within a short distance of the Saint John where it is navigable for steamboats, it is of great value and importance to the Province. Hereafter, should a communication by railroad be opened between Saint Stephens and Woodstock, or by water along the Cheputnecticook River and Lakes, a new channel of transportation would be offered. Again, the extensive demand for iron in the upper part of the Province, where the rivers and lakes, bordering on the high road to Canada, are open for water communication, places this deposit of iron in a very important light; especially as in this quarter the nature of the country is such, that the time cannot be far distant when a general improvement will be made of its natural advantages. This part of the Province is also destined to become of considerable national value, on account of its being situated near the American frontier, and the border of that immense tract which unites New-Brunswick and Canada. And although the State of Maine has within a few years past offered to claim the upper part of the Saint John, and its lakes and tributaries, it can scarcely be supposed that the British Government will ever yield to a demand so unrea-

sonable, and likewise so very dangerous to the best interests and safety of a flourishing and loyal Colony.

From Park's Hill, the Houlton road, and the higher grounds in the neighbourhood of Jackson Town, the summit of Mars Hill, and a chain of high lands running in the direction of Mount Ktaadn, are distinctly visible; and evidently form a part of the "high lands" referred to in the treaty, as forming a natural and reasonable boundary between the Province and the United States. The soil on the slate is of a superior quality, and wherever it is cultivated, it affords excellent crops; this arises, in a considerable degree, from the greater quantity of lime entering into its composition than is contained in the soils which have had their origin in the arenaceous rocks. In general it is of a light brown colour, very tenacious when wet, but light and friable in a dry state. In consequence of the lime in the argillaceous strata, the rocks, when they are disintegrated, supply a *debris* which becomes immediately fertile; and the lime, silex and clay, appear to exist in such proportions, that little improvement of them can be made by art, until the soil becomes impoverished by long culture. Not only is the difference in the appearance and character of the soil on the slate obvious to the common observer, but by a careful examination, I have found the increased strength and productiveness of the soils in this quarter to arise almost altogether from the presence of lime, and in situations where the lime is absent, the fertility of fields has been invariably found to be less than where it is present. This hint may be of some advantage to farmers who cultivate silicious or clayey soils, to which lime should be applied; especially in situations where the calcareous rock can be obtained at a moderate expense. It has long been known that lime is necessary to the production of wheat, and it is on this account that the argillo-calcareous soils of Carleton are so well adapted for raising that kind of grain. The fertile covering of the argillaceous slates, already mentioned, resembles the recent alluvium of the Saint John, great quantities of which have been conveyed down the stream from those rocks by the river.

It may be said that all the alluvial deposits along the St. John, which are sufficiently elevated to admit of cultivation, are productive, but none of them are equal in fertility to those at Woodstock and other parts of Carleton. The latter have been produced altogether by the river currents acting upon the rocks, and the numerous small streams conveying

the fine sediment from the calcareous strata. This peculiar light brown calcareous soil is also found in the intervales and along the banks of the Saint John, and at levels much above the flow of the highest freshets; but it will be seen hereafter that this majestic stream has been lowered—it has left its ancient bed at many places, and worn for itself a lower and deeper channel.

The characters of all rivers are greatly influenced by the nature of the rocks over which they pass; an illustration of this fact is very clearly exhibited by the Saint John, which intersects, in its course, rocks of different degrees of hardness, and such as are unequally acted upon by its currents.

Near the mouth of the Saint John, the river passes through unyielding masses of trap rock, sienite and limestone; and although it is by no means certain that this river has made its exit through its present narrow channel for any long period of time, its passage is deep and narrow. At Grand Bay, where the river makes its way through deep beds of gravel and coarse sandstone, it becomes expanded; at the Long Reach the hardness of the trap rock and granite, on each side, has compelled the river to move along a deep narrow channel. The more yielding strata of sandstone of the coal field, between Fredericton and the head of the Long Reach, has allowed the stream to enlarge itself, and make room for Islands. In passing through the greywacke above, the stream again becomes contracted, and the granite of the Pokiok and Meductic shew their effects in the narrowness of the channel and rapidity of the water. These causes have added greatly to the beauty and variety of the scenery, which is now alternately bold and tame, according to the nature of the rocks forming the country around.

The scenery between Fredericton and Woodstock, is much bolder than it is near Gagetown, and the banks of the stream frequently rise with beauty and grandeur from its sides. Although there are many fine farms situated along the flanks of the hills, the surface bears the aspect of a new country. At Woodstock the landscape is much improved; and the beautiful and luxuriant fields, situated upon the ancient bed of the stream, and rising in parallel steps from the river, give a new and very interesting feature to the scenery. The meadows are ornamented with fine native trees, and the majestic Saint John rolls along towards the ocean, bearing downward the pine of the forest, beneath which the aboriginal tribes chased the moose and carriboo, now fast disappearing before the introduction of the axe and the plough.

That this part of the Province is destined to become a great agricultural and manufacturing district, can scarcely be doubted; and the facility of obtaining lands in the Province, offers every encouragement to the inhabitants of the country, and immigrants, to settle them. Still farther west, an immense tract of excellent land remains in its native wilderness state; and thousands of the surplus population of the mother country would find comfortable homes, where, at present, the forest is unbroken and the rivers are unexplored.

It is possible for steam-boats, properly constructed, to ascend the river as far as the Grand Falls, seventy-five miles above Woodstock. Independent of such a communication, the great improvements made in the roads within the last four years, have produced a most favourable change in the whole of the upper country. It is to be hoped, that, in a short time, the communication with Quebec will be com. pleted, and intercourse with Canada, thereby increased. Extensive settlements are opening in the County of Carleton, and the villages on the Houlton road, and bordering on Jackson Town, are in a very flourishing condition. Woodstock, from being a frontier town, will always be a place of importance to the Government, and the natural resources of the country around will secure its prosperity.

NORTHAMPTON, SOUTHAMPTON, QUEENSBURY, AND DOUGLAS.

The rocks were examined between Woodstock and the mouth of the Nashwaak, opposite Fredericton: the several formations of granite, greywacke, slate, and sandstone, already described, cross the Saint John, in following their courses to the north-east. The several points at which they terminate, still remain to be explored. The soil upon the greywacke of Northampton, is generally good. Nothing of any practical importance was found in the rocks of this Parish. Iron pyrites sometimes occurs in small quantities. The strata in general run E. N. E. and dip W. N. W.

High beds of diluvial sand and gravel are common. In one of these deposits at the Meductic, a number of ancient Indian graves were opened, in making a new road. Several curious kinds of tools made of stone were found, and have been carefully preserved. There is a tradition that a great battle was once fought at this place between two of the aboriginal tribes, and the graves are said to be those of the Indians who fell in the conflict.

The granite meets the greywacke about two miles westward of Parent's Inn. The soil here is light and sandy, and frequently filled with boulders. It is nevertheless very productive, and well adapted to the culture of indian corn. In the Caverhill Settlement there are some excellent farms, and good crops are raised wherever attention is paid to agriculture.

On the west side of the Keswick, there is a high ridge of land known by the name of the Keswick Ridge: the granite was also found to continue to this place. It is deeply covered by beds of diluvial matter and an excellent soil. This ridge is now the site of a very extensive and flourishing settlement. The Mactaquack River is also stretched along the north-east side of a ridge of greywacke. The country here becomes more mountainous, and to the north there are hills of considerable altitude. From the farm of Mr. Sheridon there is a very extensive view. Mount Prospect, Peaked Mountain, and Oak Mountain, in the neighbourhood of the Magaguadavic, are seen to advantage. The high and uninhabited country at the sources of the Pekagamic River is also distinctly visible.

MINERAL SPRINGS.

There are two very interesting mineral springs in the Keswick settlement. The most important of these is situated on the farm of Mr. Humphrey Sisson, about six miles from the mouth of the river. It breaks out at the foot of a hill of detrital sand and gravel, and near the margin of a swamp. At the time of my visit, it was venting about a gallon and a half per minute. The odour of sulphureted hydrogen was perceived at some distance from the spring, and the peroxide of iron collects along the bottom and sides of the water-course leading from it. The inhabitants have already discovered the water to be medicinal, and they employ it in the cure of cutaneous and other diseases. It has a ferruginous taste, and when taken in any considerable quantity,

it excites nausea and exhibits cathartic properties. The following is the most correct analysis of the water I have been able to make, for it is liable to undergo some change during its transportation, unless it is secured from the air.

In one pint of water—

Carbonic acid—	*cubic inches*	1.0
Sulphureted hydrogen—	*do. do.*	3.0
Sulphate of lime—	*grains*	1.2
Sulphate of magnesia,		*a trace.*
Sulphate of soda—	*grains*	11.5
Peroxide of iron—	*grains*	2.8

The water reddens the infusion of litmus and with the nitrate of silver throws down a brown precipitate. The tincture of galls gives a dark purple colour; the sulphates of soda and magnesia are readily detected by the common tests. A similar spring will be found not far from the mills on the above river.

The medicinal properties of these waters have been in some degree already ascertained; and when it is considered that they flow in a beautiful and healthy part of the country where every comfort might be obtained for invalids, it is evident that the time cannot be far distant when they will become places of fashionable resort. Were these springs situated in many parts of Europe, they would soon procure fortunes for their proprietors; nor can it be doubted that when they are better known, and their virtues are more duly appreciated, even in their present situation they will be valuable.

The Keswick river runs through a deep valley to the distance of twelve miles—the length of the settlement. At its exit into the Saint John, there are several large and very beautiful islands, ornamented with native trees, and forming some of the finest meadows in the Province. One of these islands, the property of the Hon. Colonel Shore, is remarkable for its fertility and beauty. The soil in the valley of the Keswick is generally sandy. The stream itself passes through rich alluvium.

About one mile below the mouth of the above river, new red sandstone appears again, and reposes on the grey-wacke; it extends towards the north-east, in a belt about a mile wide. The strata are of a deep red, or chocolate colour, and do not differ very materially from those near Brower's farm, on the opposite side of the Saint John. Four miles

below the Keswick, there is an elevated mass of trap, called Clarke's Hill. The rock is very hard, and on the surface it is broken in angular pieces. This hill of trap is contemporaneous with a similar one on the road to Stanley. On the Royal Road this rock is elevated into a cliff from a hundred to a hundred and fifty feet in height, with a slope of *debris* piled along its base. The trap consists of the amorphous and amygdaloidal varieties; which sometimes contain veins and nodules of calcareous spar and magnetic oxide of iron. I did not, however, discover any of the zeolites so common in the trap rocks of Nova-Scotia. These elevated trappean ridges afford all the usual evidences of having been forced upwards through the sandstones, since they were deposited, and which were thereby changed in the inclination of their strata.

TERRACES.

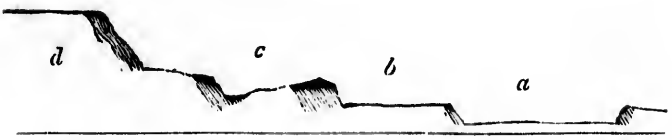
I have heretofore deferred entering upon the subject of terraces, until my observations should be more extended, and embrace the facts collected from the principal rivers of the Province; for a hasty and imperfect examination of any phenomenon must often be followed by incorrect opinions.

It is not intended to shew, on the present occasion, by what means valleys in general have been formed, or how far they have been produced by the uplifting of the strata, or the action of water in wearing them out. Of themselves, the valleys of New-Brunswick would afford an interesting subject. But those peculiar embankments seen on the rivers of this Province, require a little consideration. On the banks of these rivers, we frequently find in ascending from the margin of the water, several parallel steps, which rise abruptly from one level surface to another in succession. Most frequently these steps are composed of diluvial matter, or that which is collected by the ordinary operations of water. It is certain that in all those places where these steps or terraces appear, the bed of the stream has been lowered, or the surface, formerly covered with water, has been drained. I will first endeavour to give some illustration of this subject, by referring to the terraces themselves, and afterwards enquire into those causes from which they have resulted.

The effects of change of level in the bed of the St. John, are well displayed at the ferry four miles below Woodstock. In travelling here from the river to the higher grounds, we ascend by successive steps, and see the ancient shores of the stream rise in regular order by a series of steep embankments, as represented by the following wood cut.

Terraces near the lower Ferry at Woodstock.

CROSS SECTION.

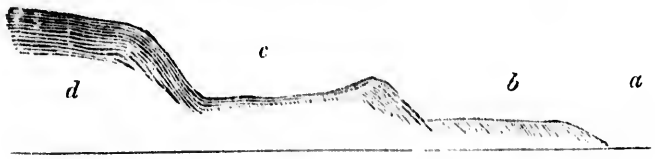


a. The River.
b. First Terrace, twenty-two feet above the river level; distance across, fifty yards.
c. Second Terrace, twenty-eight feet above river level; distance across, forty yards.
d. Third Terrace, forty-eight feet above river level.

The first and second terraces are composed altogether of alluvium, which contains the remains of fluviatile shells; the most certain evidences of its having been collected by the river, during the present order of nature. The third terrace, *d*, is composed of diluvial gravel, sand and pebbles, which once formed the shore of the Saint John at this place; but from which the water has retreated by successive steps.

Near the mouth of the Maduxnakeag the ancient bed of the river is now dry, and bears excellent crops of grain, potatoes and grass. The following section of these terraces was taken farther eastward, where the still more ancient bed of the stream has been deserted.

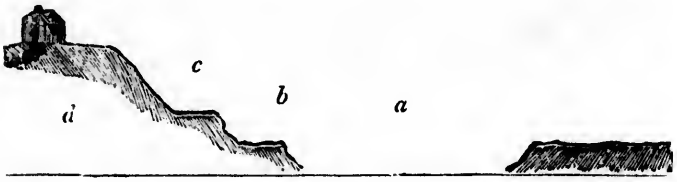
CROSS SECTION.



a. River.
b. First Terrace.
c. Second Terrace, and ancient river channel.
d. Diluvial sand and gravel.

The third terrace is thirty-five feet above the level of the river where it now runs.

The following section was taken near the upper church, and crosses the river above the entrance of the Maduxnakeag.



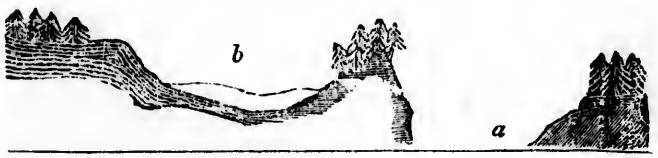
a. River. *b.* First Terrace. *c.* Second Terrace.
d. Sand and gravel.

Near the mills on the east side of the above river, the alluvium is found reposing upon the diluvium, in the manner represented below.

a. Diluvium. *b.* Alluvium, with recent fresh water shells.

These terraces are beautifully displayed near the ferry; but they do not differ in any important particular from those represented by the above cuts. About a mile below the ferry, and at the farm of Mr. James Rankin, some explanation is afforded of the manner by which these terraces might have been formed, and there is evidence of the sudden fall of the river at this place. We have here the deserted bed of the stream, which is chiefly composed of alluvial matter, now elevated thirty-five feet above the Saint John, as it now runs on the right hand side of the road and the ancient river bed; in proceeding towards Mr. Rankin's house from the westward, there is a high mound of sand and gravel of diluvial origin: between this place and the high lands to the northward, the

peculiar furrowings made by the stream are seen, and the furrowed channel now forms dry and excellent tillage land. The mound of diluvial sand and gravel is about thirty feet higher than the ancient river channel, and sixty feet higher than the present river, which now sweeps close along its southern base, and beneath a steep embankment. The following cross section will afford a better idea of the subject than can be expressed in words.



a. Bed of the river. *b.* Ancient bed of the river.

It is evident, from these facts, that the river has been withdrawn from the upper level, *b*, to the lower one, *a*.—Now, as ter aces possessing the characters of those first described, do not exist below this locality, it is very evident that the river, by having been obstructed at this point, broke through a collection of porous gravel, and formed for itself a new channel, which is thirty-five feet deeper than the one originally occupied by it. The causes of these changes will be adverted to presently.

Terraces on the Keswick.

On the Miramichi, between Cochran's and De Cantelon's Inns, the intervale begins to expand, and skirts the valley through which the river passes. At Mr. Arbo's farm, there are two terraces; the first is six, and the second sixteen feet above the intervale along the sides of the stream.—At De Cantelon's, the former bed of the river now remains dry, during the greater part of the season; a beautiful elm

is seen growing in the deserted channel. The upper terrace is eight feet above the intervale, and remains dry during the highest freshets. It produces excellent crops of grain, potatoes, &c., while the intervale, from being overflowed in the spring and autumn, only produces grass.

At Sim's Ferry, there is one terrace. Near Boistown, there are three successive steps between the river and the upland, as represented by the following wood cut.

CROSS SECTION.

The terraces on the Nashwaak are very interesting; some of them will be seen to advantage, after descending the "dug road," and from thence to the mouth of the river.—Terraces also occur on the Petticodiac, Oromocto, and almost all the rivers of the Province. There is a terraced island, a short distance above the mouth of the Shogamock.—At the Keswick, the river has changed its track, since the country was inhabited; and there are situations where these changes are going forward at the present time.

In the above instance, and many others which might be referred to, the two lower steps, or terrace, are composed of alluvium; while the upper terraces consist of beds of stratified sand and gravel. That the lower steps have been formed by the successive accumulations of alluvial matter, is evident; but this does not account for the terraces of the gravelly beds, which are of diluvial origin. These notches in the diluvial lining of the valleys, are much more ancient than the lower terraces, and appear to have been produced by causes more remote than those to which the alluvium can be referred. From all the facts taken together, it would seem that many of the valleys, where terraces are now formed, were originally partially filled with deposits of sand

and gravel, which were worn out so as to leave steps coinciding with the changes of level in the streams. The terraces in the alluvium have a more recent origin, having been produced since the rivers began to transport the materials entering into their composition.

The different levels of collections of alluvial matter, on the sides of valleys, through which rivers pass, have, from time to time, attracted the attention of geologists; but a satisfactory explanation of the means whereby they have been formed, cannot always be given, from the complicated nature of the causes whereby many of their features have been modified. These terraces, as they have been called, are common to almost all rivers; but they appear to be most numerous in Northern latitudes. I have ascended the River Oronoco, in South America, several hundred miles, and also several of the lesser streams along the coast; and although there are sometimes low terraces along their banks, those terraces do not appear to be numerous: perhaps the more frequent appearance of embankments at different levels in Northern latitudes may be explained by referring to the ice, which frequently, in the breaking up of rivers in the spring, accumulates in thick barriers across the streams, and produces great changes in the river currents.

From the inquiries of Professor Agassiz, Mr. Lyell, Dr. Buckland and others, into the facts connected with glaciers, in Switzerland, Scotland and Ireland,* it appears that many of the longitudinal mounds, and parallel ridges of sand, gravel and boulders, are to be ascribed to the operations of ice; which is supposed to have covered a great part of the Northern hemisphere, at a period immediately preceding the present. "The glaciel theory," as it is called, introduces the opinion, that between the period of the enormous animals, the bones of which are now buried in *diluvial detritus*, and the present epoch, there was a period of intense cold. The ice then formed is supposed still to remain in parts of Siberia, where it contains the bones and even the hair and flesh of those animals. Mr. Lyell, in the examination of Forfarshire, found terraces of transported *debris*, with boulders, which have been ascribed to the operations of ice, that disappeared in a change in the temperature of that part of the globe. It is probable that many of the parallel ridges of sand and gravel have been produced in a similar manner, and an enquiry into this part of the subject will claim my earliest attention.

* Proceedings of Geological Society of London.—Part II. Vol. III. No. 72.

That ice has been an important agent in the formation of parallel lines of diluvial matter in the Provinces, is very probable; but the terraces under consideration, or such as are found along the sides of present streams, and are composed of sedimentary materials, are evidently the results of changes of level in the river beds. In the valleys occupied by rivers in New Brunswick and Nova Scotia, there are two kinds of terraces; one consisting of diluvium, and the other of alluvium. The causes by which the former have been thrown up, are by no means so obvious as those which have given rise to the latter.

Since the discoveries of the before-mentioned geologists, it appears that ancient glaciers have had a powerful influence in the accumulation of those parallel mounds of erratic sand and gravel, observed in different parts of these Provinces; and likewise they may have been the means whereby boulders of granite and other rocks have been scattered over the country. But besides these mounds of sand and gravel, frequently resembling fortifications and works of human industry, there is an almost universal distribution of fine and coarse sand, pebbles, beds of clay, loam, &c.; these are distinctly stratified, having been, evidently, collected by the operations of water. The general occurrence of diluvial grooves and scratches upon the surfaces of the rocks, even in the widest and most level districts, cannot, in general, be explained unless by admitting that a great current of water has passed over the country, from the north towards the south. These diluvial marks follow almost one undeviating course, and frequently run longitudinally along the sides of the hills. It is along the flanks of the mountains where the vast beds of unstratified materials, with fragments of rocks, are seen, that the former existence of glaciers is rendered so evident. That the terraces existing along the present rivers (so far as they are composed of alluvium,) were formed by present currents, appears very obvious.

If we carefully examine the Saint John, and other rivers of New-Brunswick, we will find that their beds have been excavated and lowered by currents, and other causes, from twenty to a hundred feet. By the lowering of the bed of the Saint John, large tracts along its borders have been drained, and terraces formed. The tributaries of this river would also be lowered by any falling of the main stream, and the same results would appear along their sides. Lakes and ponds which are common along the sides of the Saint John, would, by the lowering of the river, be placed at a higher level than

its waters could maintain. The draining of these lakes and ponds would also produce terraces, and evidences are not wanting where their barriers have been forced, and their waters drained off. The gradual lowering of the main river would give these effects. But in many instances, parts of the rivers have been lowered suddenly, and, therefore, the parallel steps formed along their sides are only the simple effects of drainage.

One of the most powerful agents in changing the channels, and deepening the beds of these rivers, is the ice, during its breaking up in the spring. In the heavy freshets and floods of this season, the broken ice, for many miles, will move forward until its progress is arrested by projecting banks, narrowness or shallowness of the stream;—a barrier is thus formed across the river, and the country above is immediately inundated. These barriers, called "ice jams," are sometimes very alarming in their consequences. The ice, urged along by the current, and collected in enormous "jams," grinds against the bottom and sides of the river with a low grumbling noise; the earth trembles with the burden, and the pent up waters extend far and wide, not unfrequently sweeping away cattle, buildings, and everything within its reach; logs, trees, and the rubbish of the shores, are also borne along, and sometimes aid in forming the obstruction. The alarmed inhabitants fly to the high grounds, in canoes, and too often witness the destruction of their cattle and buildings. But at length the "jam" breaks—the barrier gives way, and the flood rushes along the valley in a mighty wave, overflowing the fertile lands, which, during the summer months, were covered with a luxuriant vegetation. At the sites where these obstructions take place, the channel of the river is frequently deepened and widened; its direction is also changed, and great alterations are made in the shoals and rapids to the distance of several miles below one of these "ice dams." Large masses of rock detached by the frost, are frequently transported down the stream to great distances; acres of intervale are torn away, and the whole aspect of the stream is greatly modified. These ice floods are common to all our rivers, and with the constant wearing down by the currents, are sufficient to account for the changes of level in the streams, and consequently the production of their terraces.

It appears certain, that the change in the site and bed of the Saint John, below Woodstock, as noticed at page 57, has been effected through the agency of one of these "ice jams." The original channel of the river being obstructed

by the ice, the whole pressure of the water was directed against a bed of sand and gravel, which finally yielded; a new channel was formed, and has been worn out no less than thirty-five feet deeper than the one where the river formerly had its course. The terraces at Brockaway's, on the Magaguadavic, appear to have been produced in a similar manner. The rivers having been bound by these powerful causes, the lakes bursting into them, and thereby being drained, will sufficiently account for the phenomena of terraces in this quarter.

PART II.

GENERAL DESCRIPTION

OF THE

GREAT COAL FIELD OF NEW-BRUNSWICK.

The geological exploration of the southern Counties of the Province having been completed, my labours were next directed to the Counties of Kent and Northumberland, and that part of the Great Coal Field which extends along Northumberland Straits and the Gulph of St. Lawrence. The object in view, was the completion of the survey as far northward as the main and south-west branch of the Miramichi and Woodstock; but I regret that the early approach of winter, and the expenditure of the annual sum granted to pay the necessary expenses, prevented me from extending the examination far beyond the Nashwaak, so that a part of the County of York still remains unexplored.

The Great Coal Field of New-Brunswick occupies a vast tract of country, of a triangular form. Commencing at Shediac, its southern side extends across a part of Westmoreland, in the Parishes of Salisbury and Moncton, and irregularly along the line separating King's and Queen's Counties, to the mouth of the Washademoak. From thence it has recently been found to reach about eight miles west-

ward of the Oromocto Lake, in the County of York. Its south-western boundary has been followed thence to the St. John, between Fredericton and the mouth of the Keswick; from this point, its north-western side remains unexplored. But from the sections made along the tributaries of the Miramichi, it is known to extend to Bathurst harbour, curving to the westward, in the Counties of York and Northumberland. It occupies the whole of the Counties of Kent and Sunbury, the chief part of Queen's, York, and Northumberland, and a portion of Westmoreland. The length of the southern side of this Coal Field is one hundred and forty-five miles. Its north-eastern side is one hundred and ten miles. The distance from the Oromocto Lake to Bathurst, following the margin of the Coal Field, is one hundred and eighty miles. I had previously estimated the area of this Coal Field at five thousand square miles; but, upon farther examination of its boundaries, it has been found to extend farther westward than was anticipated. From all the observations I have been able to make, it is now known to embrace an area of seven thousand five hundred square miles!!! If the Westmoreland Coal Field also belong to this carboniferous deposit, the whole area may be computed at eight thousand seven hundred square miles, which is equal to one third of the area of the whole Province!!! This Coal Field exceeds in its dimensions any found in Great Britain, and is one of the largest ever discovered upon the globe. The Province has been estimated to contain twenty-six thousand square miles: when it is considered that one third part of this vast tract of country contains more or less of the bituminous mineral, the quantity of coal in New-Brunswick will appear inexhaustible.

The south side of the coal district is overlaid by new red sandstone and conglomerate, to the distance of sixty miles; Southward of the Washademoak, it is met by the trap rock of King's County, and near the entrance of the river, where it communicates with the Saint John, the rocks of the coal series are found reposing upon the carboniferous limestone and old red sandstone, which cross the Saint John at Long Island, and extend in a westerly direction from thence several miles. Between the Oromocto Lake and the Saint John, the mill-stone grit of the coal field apparently meets the slates. The north-east side of the coal district extends to the Gulph of Saint Lawrence, and its sandstones and shales, sometimes associated with coal, are seen in the low cliffs along the shore. But besides the extensive area of the coal field in New Brunswick, the same district extends

into Nova Scotia, and embraces the coal mines of Pictou and Cumberland. During my examinations in these Provinces, I have explored two hundred miles of coast, in a direct line on Northumberland Straits and the Gulph; and have found that all the rocks in that distance belong to the carboniferous series, and this great coal region.

It will not be expected, in the present state of the country, that the geological boundaries of this great tract can be very accurately determined. Most frequently the lines separating different formations run through the wild forests, and uninhabited districts; where the rocks are covered with thickets and fallen trees, which greatly impede the travelling and conceal even the soil. Besides these there is a wide distribution of erratic fragments, so that it is only in the bed of some stream, in the summer season, where any opportunity is afforded for geological examination. It is, however, satisfactory to believe, that when future explorations shall be made of this coal region, the estimate now formed of its dimensions will not differ widely from that which will result from actual measurement.

Upon an average, the surface of this coal field is not elevated more than forty feet above the level of the sea.—About midway between the Gulph shore and the Saint John River, the highest ridges of land may exceed a hundred and fifty feet in altitude; they form a dividing line between the rivers emptying into the Bay of Fundy, and those that flow into the Gulph of Saint Lawrence. These ridges are the centre of a doubly inclined plane, sloping in opposite directions; they do not occupy any great extent of country, when compared with those wide and almost level tracts that border upon the Saint John and the shores of the Gulph.

The draining of the Great Coal Field is made in opposite directions, viz.: by the streams emptying into Northumberland Straits in one direction, and those that empty into the Saint John in another; of the former, Miramichi, Richibucto and Cocagne are the most important: these rivers run in a north-east direction, and, with the smaller streams, convey an immense quantity of water into the Gulph of Saint Lawrence. Of the latter, the Washademoak, Salmon River and the Nashwaak are most considerable: these rivers empty into the Saint John in a south-west direction, and their sources are scarcely separated from the before-mentioned rivers by the ridges referred to. All these streams, near their mouths, pass through the widest and deepest valleys; but at their sources, they roll along the deep grooves worn out of the

sandstone by the mechanical operations of water; and the strata appear as if they had been excavated by art for this purpose.

Viewed generally, the coal field presents an expanded low and level surface, unbroken by hills, and characterised by the absence of those bold features so common in districts more primitive in their formations. The elevated ridges are more broken and uneven than the broad tracts stretched along their bases; and they appear as if some uplifting force had been applied along the middle of the coal district, which had fractured the strata during their elevation. That this uplifting force has been applied, appears quite evident, from the existence of the trap rocks along the anticlinal axis, and parallel to the ridges; while in parts remote from them, the strata are nearly horizontal, and neither dikes nor faults are observed. From these, and many other evidences that might be adduced, it seems very evident, that after the different strata of this coal field had been laid, with all their contents, a central ridge had been elevated by a power communicated from beneath; and thus the waters of the surface are compelled to flow in opposite directions towards the sea. These conditions are not at variance with the fact, of some part of the coast having been depressed since the production of peat bogs on the coast, as that depression took place at a much later period than the elevation of the line referred to. When we see a tract of country of several thousand square miles, with the strata along its sides placed horizontally, with a somewhat elevated ridge of inclined strata running through its centre, and accompanied by trap or other volcanic rock, it is impossible to refer that elevation to any other cause than that which arises from volcanic action. Along the portage road, between the Miramichi and the Nashwaak, the evidences of volcanic operations are very clearly developed, and may be seen to great advantage towards the sources of those streams.

Viewed geographically, the coal district occupies a tract of country, of a triangular figure; one of the angles extends almost across the Province, and one of the sides reaches along the deepest part of the Gulph of Saint Lawrence. In the consideration of this Great Coal Field, almost the first idea that strikes the mind, is the probability that its site once formed the most remote part or termination of the Gulph of Saint Lawrence. On the map, it appears to be merely a continuation of the Gulph, that formed a deep and narrow bay corresponding with the boundaries of the present Gulph

in this quarter. The surface of the coal field is comparatively low and unbroken, and when seen from any eminence upon its borders, it appears almost as level as the sea; and the whole coast is not elevated more than twenty feet, and frequently not more than twelve feet above the waters of the adjoining ocean. Both sides of this coal district are met by rocks of considerable elevation; they appear like a high rugged coast extending along its sides, or they resemble the shores of a wide bay which has been filled up. The greater relative age of these rocks, their situation, altitude, and every circumstance connected with their geographical features, are such as afford favourable evidence of their having formed the coasts between which the rocks of the coal series were deposited, and beneath whose waters the coal has been submerged.

In the present state of geological science, it would, perhaps, be speculating too far, to assert that the site of the coal field was once occupied by the waters of the ocean, and that a great estuary of the sea has been filled up by strata of sandstone, shale and coal; but, when the numerous remains of plants found in the rocks, the coal, the slaty clay, and all the peculiarities of strata, are considered, it seems evident that, besides the sands and clays now found in solid rocks, this once great estuary of the sea has been filled up by those materials, and by the downfall of lofty forests and accumulations of peat, which, by a chemical agency now known to exist, have been converted into thick beds of coal. That the ancient soil has from time to time been buried beneath other *detrital* deposits and converted into solid rock, is evident, from the abundance of vegetable remains contained in it. Many of these vegetables were analagous to different species of mosses and ferns, still found flourishing upon the earth in warm and humid climates; and they were peculiarly adapted to the luxuriant vegetation from which the coal has evidently been derived.

There are abundant evidences that the coasts of Northumberland Straits and the Gulph of Saint Lawrence, have, from time to time, suffered great geological changes. The uplifting of the shore is proved by the numerous shells in the marl beds of Bathurst, now elevated a number of feet above the level of the sea, and remote from its waters. At Miramichi, the land has been depressed, within a period comparatively recent, and large peat bogs have been buried beneath the level of the ocean, and are now broken up by the fury of its waves, or buried beneath the shingle of the shore. The vegetable origin of coal has been fairly proved: and that

vast quantities of this important mineral have been derived from plants analagous to those that produced peat, seems equally certain. Nor should there be any unwillingness to admit of the existence of a sufficient quantity of this substance, even in northern latitudes, to form a thick stratum of coal. At the head of the Tantamar Marsh, in the County of Westmoreland, there is a peat bog eight miles long and three miles broad; on the surface of the coal field already described, bogs many feet in depth were found to occupy ten square miles; these, however, are but small in their dimensions, compared with the peat bogs of Ireland. The peat bogs of New-Brunswick are capable of affording (under the peculiar circumstances by which peat may be changed into a substance of a bituminous character,) a vast quantity of coal and whether the carboniferous strata, now found in the coal district, were derived from sphagneous plants or trees, it appears quite obvious that many bogs, now upon the surface of the earth, are gradually advancing to that condition, wherein they will afford solid fuel, and may contribute to supply future generations with the means of producing heat, equal to those of the present period.

The importance of the immense, but almost unexplored deposits of coal in the Province, must be obvious to all who reflect upon the subject. Being situated upon the Gulph of Saint Lawrence, they are sufficient to supply Canada, and all the demands of the extensive coasts of the Gulph. They are also capable of sustaining manufactories, rail-road communication, and steam navigation, to an extent scarcely to be contemplated in the present day. When the wood, now abundant upon the surface, has disappeared, these deposits are equal to the domestic fuel that will then be required, and they will also support a trade with other parts of the world.

When the anticipated canal to open a communication between the Bay of Fundy and the Saint Lawrence, shall be completed, the exportation of coal from this quarter to the American seaports, will be rendered easy. The actual completion of the above work, is of the first importance to the British American Colonies, and as coal possesses the power of raising and transporting itself, it may be seen how important a part the Province is calculated to take in the commerce of America. These views urge themselves more forcibly upon the mind, when it is considered that the Western States of the Republic do not possess this valuable mineral; and at those places where it does occur in the Western Territory, it is deposited far from the free channels of navigation, and

remote from those towns where it is most required. At present, almost all the coal consumed on the shores of the Saint Lawrence is imported from Great Britain, and carried for ballast in exchange for timber. But the importation of an article which is abundant in the Province, in exchange for our exports, can never promote the best interests of the country, and this kind of trade has a tendency to check all enterprise in a Colony, which Providence has endowed with ample resources.

PHYSICAL FEATURES

OF THE

GREAT COAL FIELD OF NEW-BRUNSWICK.

It has been already remarked that one of the peculiar features of the Great Coal Field, is its small degree of elevation above the level of the sea. This character pervades the whole coast from Cape Tormentine to Bathurst, and will be recollected by all who have visited the Counties of Kent and Northumberland. The elevation along the coast does not often even exceed twelve feet; and to the distance of thirty miles in the interior, it is not more than twenty feet. The northern portions of the Counties of Sunbury, Queen's, Westmoreland, the whole of the County of Kent and northern part of the County of Northumberland, appear like a vast level plain which was formerly covered with pine, spruce, and scattered groves of beech, birch and maple: among these the fires have made dreadful ravages, and in many places the green forest has been reduced to a wild and leafless waste. There still remain, notwithstanding, in some situations remote from the navigable streams, large quantities of excellent timber, which escaped the devouring element when it swept over the bosom of this part of the country. This broad level area may be estimated at five thousand square miles, where not a rock *in situ* was observed, except such as belong to the carboniferous system. The coal has been found at numerous localities, and in situations where it can be worked to advantage.

From the yielding nature of the sandstones and shales of the Coal Field, the sea has made great inroads upon the

shore, and the coast is lined with vast shoals of sand and shingle, raised above the ocean by the fury of its waves. The sand is very readily moved, and when the shoals are not covered by beds of oysters or muscles, they are liable to change their situations during heavy gales. One of these shoals reaches along the coast some distance from the shore, and extends from the entrance of Richibucto harbour to Cape Tormentine, a distance of sixty miles. Fortunately, there is a sufficient depth of water on its surface to allow ships to pass in safety. Near the shore, there are banks of sand of smaller dimensions, many of which are dry at low water.

From the low and level nature of the country, the sea flows far up the rivers, and navigation is therefore greatly extended. The streams themselves are not broken by falls and rapids, so common on the rivers descending into the Bay of Fundy; they, therefore, allow rafts, boats and canoes to pass in safety. The harbours at the mouths of the rivers are safe during gales from every point of the compass. The scenery of every part of the country under consideration, as might be expected from its even and almost unbroken surface, is remarkably tame; and it is only where the rivers suddenly change their directions, or where their banks can be seen for some distance, that they offer any very agreeable prospect to the eye of the traveller.

The soil in general is sandy, easily cultivated, and productive; and in all the instances observed, where due attention had been given to agriculture, the earth had yielded abundantly to the labour of the farmer. Certain tracts are remarkably fertile, and produce a number of crops in succession without the aid of manure.

PEAT.

In all the lower grounds where the drainage of the surface has been prevented, and the water is confined in shallow basins, the *sphagneous* plants have taken root, and produced peat bogs, varying in size from a few rods to several square miles. In other instances, lakes have been filled up by those plants which first spread themselves over the surface of the water, and finally, by their growth and decay, fill the lakes with peat. Previous to the destruction of the beaver, by the Indians and Acadians, by building dams across the small streams, these animals formed numerous lakes and

ponds. The sites of many of these collections of water have since been filled with peat; while the ancient dams of the beaver still remain across their outlets. Sections of these bogs are sometimes made by the water during freshets, and also by the inroads of the sea along the coast, whereby they shew the changes that have taken place in the character of their vegetation. It is sometimes very curious to observe the different kind of plants, which, in these collections, have succeeded each other in their growth. The bottom of the peat basins is almost always lined with a white sand—upon this the decayed vegetable matter reposes. A few feet above the lower stratum of peat, there is a fallen and entangled layer of trees, (spruce and cedar); the trees are succeeded by a few feet of peat, and then a layer of trees appears again. In one of these bogs three strata of fallen trees were observed. Besides these, there are frequently layers of wild flags, rushes and cranberry vines. The surface is occasionally covered with a stunted growth of spruce and cedar; but most frequently the varieties of mosses are the predominant vegetables. These circumstances are readily explained. After the peat rises in the bog to a certain height, the surface becomes too dry to allow it to grow, especially in dry seasons. The bog, therefore, remains stationary until the spruce and cedar spring up: these, by increasing the weight on the top of the bog, press the peat downwards, and, by preventing the escape of water by evaporation, again render it sufficiently moist for the production of *sphagneous* plants, which soon spring up and destroy the trees; they consequently fall, and in their turn become buried. In those instances where sand, gravel and clay have, from time to time, been washed over the peat, the bogs have a striking resemblance to a coal basin, many of which have no doubt been filled by operations somewhat similar; and thus the peat of former periods in the earth's history has been made to contribute to the strength and wealth of nations, and the comfort and happiness of mankind. The peat, abundant in almost every part of the Province, is capable of supplying excellent manure, if it be properly managed in composts. Along the coasts it may be mixed with calcined oyster shells, marine plants, and the alluvium of ponds and creeks. In the interior, where those materials cannot be cheaply procured, the compost may be made of peat, barn manure, straw, and the marly red and yellow clay, frequently observed in moist grounds.

ROCKS AND MINERALS

OF THE

COAL FIELD.

Before I enter upon the local details connected with the exploration of the Great Coal Field of New-Brunswick, it may be necessary to take a general view of the characters of its rocks, and the minerals contained in them; referring, at the same time, to its mining capabilities, and the encouragement it offers for agriculture—a branch of industry to which geology affords much aid. The boundaries of the Coal Field having been given, we may now proceed to the examination of the strata, and the characters by which they may be distinguished. Almost the whole surface of the rocks is covered with *detritus*, consisting of beds of sand, gravel, boulders, &c. It is only on the coasts, sides of rivers, and lesser streams, that a view of the rocks can be obtained; and, therefore, the field of geological investigation is considerably limited.

The rocks forming the very extensive district under consideration, consist of

Conglomerate,
Sandstones,
Shales,
Clay-ironstone,
Coal, and
Trap.

The whole of these different kinds of rocks, including the coal, the trap excepted, are stratified or placed in regular layers one upon another; and they alternate one with another, without any apparent regularity. The strata also differ materially in their thickness, which varies from a few inches to ten feet. The shale in general occurs in thin strata, and sometimes embraces layers of ferruginous clay, containing nodules of clay-ironstone. The thickness of the coal strata cannot be so readily ascertained, as only the upper or thinnest beds have been exposed: such as have been found on the surface, are from six inches to two feet and a half in thickness. The strata along the coast and remote from the ridge before-mentioned, are nearly horizontal. It is true that a small degree of inclination may be observed in them at many situations, but the dip is in different directions; and, admitting that the strata were formed by the operations of water, their inclination is not greater than it would be under natural circumstances. Along the elevated grounds separating the rivers flowing into the Gulph, from those emptying into the Saint John, the dip is much greater, and indications are offered in proof of the rocks having been disturbed and lifted upwards since they were first deposited. This horizontal position of the rocks belonging to the carboniferous series, is rather peculiar to this district; for, in Nova-Scotia and in the County of Westmoreland, they are inclined from 25° to 50° from the horizon. Wherever the strata are exposed to the weather, they are much fractured. The most solid masses of sandstones are, by the expansion of water in freezing, split into thin lamina, parallel to the planes of stratification; but after the rock has been cut and hardened by the heat of the sun, it generally resists all changes of temperature and frost. The sandstones in general are of a dark grey colour, and when first taken from the quarry they are readily cut: they are composed of grains of silicious sand, firmly cemented by an argillaceous paste and the oxides of iron. In general these rocks are very micaceous, and, therefore, the soil produced by their disintegration, by containing particles of the brilliant mica, has been supposed by persons unacquainted with the subject, to contain a portion of silver. Many strata will afford superior freestones for architectural purposes, and others are used for grindstones, whetstones, &c.; but they do not equal the grits of Chignecto Bay and Westmoreland for the latter objects. The shales are far less compact, being composed of clay in an indurated state. They are very soft and yielding, and when exposed to the

air, soon crumble down into a tenacious clay. Excellent fire clay may be obtained immediately beneath each coal stratum. In every instance where the coal was seen, it was observed to be situated between strata of shale, and reposing upon fire clay. The presence of clay at those situations where the coal strata appear, seems to have been a necessary condition for its preservation, or it may have been the soil that bore those numerous plants now found changed into enduring beds of fuel.

Another class of strata contains a large quantity of the peroxide of iron; the rock is argillaceous, and embraces nodules of clay-ironstone. In breaking these nodules it is not uncommon to find crystals of galena and the delicate remains of leaves; strata of this kind have not been found numerous; they were observed on the shores of the Grand Lake, Salmon River, Miramichi and Tedish.

The coal, so far as it has been discovered, is altogether of the bituminous kind. The strata have only been examined at the surface, where, as might be expected, the coal is often impure: it, nevertheless, burns freely, and appears to be of an excellent quality.

The strata of conglomerates are associated with the sandstones, often passing into them insensibly. This rock is composed of rounded pebbles from the size of musket ball to a four-pound cannon shot, firmly cemented together: the pebbles are of quartz, granite, trap, the older slates, &c.—and with these there sometimes appear copper and iron pyrites.

Another rock found among the strata of the coal series, is trap. Almost the first appearance of this rock in the coal field, was seen on the Royal Road, and at the portage between Boiestown and the Nashwaak. It occurs in large protruding masses, evidently having been forced upwards through the strata long after they were deposited. The minerals contained in the strata of the carboniferous series, besides the coal and iron, are few and unimportant; the sulphuret of iron appears frequently, and copper pyrites rarely; carbonate of lime and sulphate of barytes also occur in small veins. Springs occasionally break out, containing the oxides of iron and sulphureted hydrogen; some of these have been already described.

A careful examination of the sandstones, shales, and ferruginous deposits of the coal field, will convince the inquirer that each of these deposits has been the result of the agency of water acting upon materials previously rendered solid. When we view the sand, pebbles, silt, and mud, widely

spread along the shore, and in the large basins adjoining the sea, we see, in an imperfect degree, the original condition of the now solid strata. Were the beds of gravel and shingle, now acted upon by the waters of the Gulph and its numerous tributary streams, rendered solid, they could scarcely be distinguished, in their lithological characters, from the sandstones and conglomerates already described. There would be a difference arising from the more modern character of the matter contained in the latter beds; but the same minerals would be present, and the mechanical arrangement of the layers would be similar. As the present collections of sand and pebbles have resulted from the breaking up of the rocks along the shores and on the surface; in the same manner the collections of argillaceous mud, in the estuaries or other basins, undisturbed by currents, would produce slate clay or shale; and where this mud was highly ferruginous, the clay-ironstone might be expected. But the whole must have been derived from a pre-existing collection of mineral matter. If we search for the rocks similar to those from which even the pebbles of conglomerate have been taken, they cannot now be found nearer than the isthmus between the River Saint Lawrence and the Gulph, an average distance of one hundred and fifty miles.

But the strata formed by the consolidation of the sand and shingle of the present shore, and its estuaries would contain the remains of shell-fish and other creatures common on the coast; even the works of art and industry would be seen with other records of the history of the customs and manners of the people who inhabit the land. In the solid strata of the coast we do indeed find innumerable records of animal and vegetable life, the most certain evidences of a fertile soil, and a warm and salubrious climate, in which there flourished a luxuriant growth of vegetables, with numerous animals belonging to the sea and land: but there is no record whatever of the existence of man, not even the print of his hand nor the mark of his foot. It was at this remote period in the history of the rocks, that the coal and iron were stored up for his use, and the necessary provision was made for him before he became an inhabitant of the earth.

It has been already remarked, that along the whole coast forming the north-east side of the coal-field, there are numerous peat bogs. Many of these bogs are elevated only a few feet above the level of the sea; and the waves are sometimes seen breaking upon them. Near the entrance of the Miramichi, and at the mouths of other rivers, large

tracts of peat have been submerged beneath the sea; in consequence of a depression of the shore, since the present order of nature was established.

Peat has been found, changed into a species of coal resembling lignite; and lignite sometimes passes into true coal. That peat is capable of being converted into coal, is, I believe, admitted by many geologists and chemists of the present day.

Having endeavoured to offer a concise explanation of the manner in which the arenaceous and argillaceous strata were formed, we may for a moment look at the consequences that would be likely to result, from the submersion of these peat bogs, beneath the waters of the Gulph; where they are soon covered by successive layers of mud, sand and calcareous deposits, containing marine shells. Under these circumstances, it is evident that the sand would be converted into sandstone, the mud into shale or slate clay, and the accumulations of the shells of oysters and other testacea, with their exuviæ, into fossiliferous limestone. The peat might be changed into coal; and the drift trees, common in each of these deposits, would correspond, in some degree, with those now found in a fossil state in the solid strata. All these circumstances correspond so nearly with those which it is certain must have taken place in the coal field, that it is exceedingly difficult to remove from the mind their identity. The operations going forward at the present time, are, perhaps, very inferior in magnitude to those which were active in the formation of the great coal-field; but their evidences are not less faithful on this account, and their testimony is such that they not only afford evidence of the vegetable origin of coal, but the manner in which it was deposited.

The peat bogs now buried beneath the waters of the Gulph of St. Lawrence, may hereafter be elevated above the sea, and afford the elements of wealth and happiness to future generations of the human race; and the deposits of bog iron ore, would afford the clay-ironstone, common in almost all coal-fields. The fossils contained in these strata, would not agree, in their characters, with those found in lower and older deposits; but the change in the character of the animal and vegetable kingdoms, would be no greater than that appearing in the formations preceding them. There are many reasons for believing that deposits of coal have taken place, from large collections of drift wood; such as are seen in the mouth of the Mississippi, and other large rivers: but it also appears obvious that coal has been produced from plants

that flourished upon the very sites where it is now found; and that successive strata have resulted from successive submergence and elevation of the tracts where the coal is now discovered. My object, in making these remarks, is not to speculate with uncertain data, but to present the facts as they occur, referring only to their most probable results.

FOSSILS OF THE COAL FIELD.

In every part of the Coal Field, the sandstones, shales, and conglomerates contain the remains and impressions of plants. Many of these were of great size, and must have flourished in a climate most congenial to their growth. Frequently only their impressions can be seen; and these, where the rock has been recently broken, are exhibited in great splendour and beauty. In ordinary cases, every vestige of the leaves themselves has disappeared; but sometimes they are seen in thin paper-like laminæ of coal, occupying the spaces where their impressions are made. The fossil trees are of different kinds, and occur under different circumstances; all of them lie prostrate in, and between the strata, so far as they have yet been observed. In some instances they have been changed into coal; in others this change has been partial; and parts of the trunks of trees are composed of sandstone, iron pyrites, sulphate of barytes, and other minerals. Large stems are found composed altogether of sandstone, apparently run in a mould like that of the iron founder—being perfect casts of their originals. In these casts, every remnant of the vegetable texture of the wood has disappeared, but their models are correct representations of their primitive features. Again, we find the original bark changed into coal, while the whole of the internal parts of the tree is now composed of sandstone. In both of these last instances, the sandstones, now representing the trunks of the trees, contain fossil branches of the same and other plants. Leaves and other parts of vegetables are frequently seen in these solid casts, lying in all directions, and often changed into coal. There cannot be much doubt that in these instances, the decay of the plant, after it was buried in the sand, resulted in a hollow mould or open space, corresponding with the trunk. Into this mould, broken fragments of other plants were lodged, until the cavity was filled, and the curious fact of fossils within fossils was the result. There are many instances where the trees appear to have been divided lengthwise, and fossils resem-

bling split billets of wood occur, one side of each piece being circular, while the other side is undefined and continuous with the surrounding rock. Similar results would arise from the fossilization of separate portions of the bark. The bark of the white birch and other trees of the Province, will remain in its original position many years after the woody parts have been decayed and removed. When such trees are decayed and covered by alluvium or sand, the bark is like a long tube, which is readily filled with surrounding matter, through fractured parts of the surface. Large stems occur among the fossils, in which the ligneous fibre remains perfect and distinct; these are composed of a singular combination of coal, sandstone, sulphuret of iron, sulphate of barytes, and sometimes of calcareous spar: they resemble rotten ash, and split lengthwise very readily. Whatever may have been the nature of other fossil plants, this variety was evidently a hard wood, and solid throughout, like the oak or ash, to which the fossil has a strong resemblance. The narrow open seams between the annular rings, or what resembles them, are often filled with crystals of sulphate of barytes or carbonate of lime. There is still another variety of large fossil trees, in which the whole of the trunk has been changed into a compact lignite; the original bark now appears in coal, and when removed from the fossil the surface of the tree resembles pealed oak. Probably this also was a solid tree. *Calamites* and smaller plants, with fragments of their stems and leaves, are scattered through the strata in all directions; being contained in the solid masses of rock and between the layers. The stems and fragments of these plants, when observed by the inhabitants, are supposed by them to be petrifactions of trees now growing in the country, and from their resemblance to decayed maple, beech, birch and pine, it is not surprising that such an opinion should be entertained.

The plants found in the rocks of the coal field, are all, without any exception, very different in their characters from those of the present period. Their general features are those of tropical productions; and they evidently flourished in a hot climate. By comparing them with vegetables growing under the line, the similarity is obvious; a winter of North America, as the climate is now fixed, would have destroyed them altogether. Nor can there be any doubt, that since those plants flourished, a great change has taken place in the temperature of the earth and atmosphere of this quarter of the globe.

PLANTS OF THE COAL FIELD.

A most interesting branch of geological inquiry is found in the study of the fossil flora of the ancient world; and a number of eminent naturalists have been from time to time engaged in this peculiar study; which has already resulted in the most interesting discoveries, and has greatly advanced the science.

It is only by comparison that I shall attempt to describe any of the plants belonging to the Coal Field of New Brunswick; as all my efforts to throw any new light upon the subject, would be unavailing, compared with those of persons who have devoted their time and talents to the study of this branch of geology. Messrs. Lindley and Hutton, M. Ad. Brongniart, and others, have described a genus of fossil tree, called *lepidodendron*. One of these trees is figured in Buckland's Geology, vol. II. plate 55. The *lepidodendra* appear to have been abundant plants of the coal period; and they grew to an enormous size. There is one described in the "Fossil Flora" of Great Britain, that occurred in the Jarrow Coal Field, which measured nearly forty feet in height, with a base of thirteen and a half feet. The separation of the leafstalks from the stems, has left scars running spirally around them. They appear to have been arborescent plants, and are not rivalled in beauty by any now growing upon the earth. Large trunks and fragments of the *lepidodendra* may be seen in the coal-fields of New Brunswick; but the best specimens could only be procured by opening mines.

Among these large fossil plants, are those called, by M. Ad. Brongniart, *sigillaria*, from the peculiar impressions seen on their surfaces. They occur in long fluted masses, marked with impressions in the most regular manner: these marks are the scars left by the leafstalks when they fell off. The trunks of these trees were of great size. One of them, seen in the shaly sandstone of the Richibucto, measured two feet four inches in diameter; and, from the dimensions of the fragments observed in other parts of the coal field, they were a lofty race of plants. At the South Joggins, in the County of Cumberland, Nova Scotia, the trunk of an enormous tree of this variety was seen a few years ago forming an angle perpendicular to the strata; but all those observed in New Brunswick are nearly horizontal. Besides these, there are large trunks and stems of plants that bear some resem-

blance to the fir tribes; to what species they should be attached is not yet satisfactorily determined.

Among the smaller plants, are those resembling ferns and equisetums, and the shale, situated both above and below the coal, contains the remains of a family of plants, called, by Lindley and Hutton, *stigmaria*. It has been remarked, by Mr. W. E. Logan, that, in South Wales, these plants are found almost exclusively in the underclay of beds of coal.* —This fact has been observed in the coal-fields of Nova Scotia and New Brunswick. When taken together, all the fossils of the coal period agree with those of Great Britain; two species of the fern tribe were, however, found near Bathurst, which are different from any I have seen figured of European species.

From the appearance of these vegetable remains, it would seem that many of them, previous to their becoming fossilized, were in a decayed state. The wood of the pine family and others, when it is rotten, breaks into cubical masses, like coal; many of the fossils have the same property, and the small fissures between each mass are frequently filled with iron, and rarely with copper pyrites, sulphate of barytes and other minerals. The living ash, beech, elm and maple, when they become decayed, exhibit the fibrous structure of the plants, and cleave in a longitudinal direction. Among the fossil plants, we find those that possess the same structure; and, therefore, it is probable that they were somewhat like them in their living state.

It must not, however, be supposed, that all these plants were in a decayed state, at the time of their fossilization; the perfection of fern and other leaves, shew that they, and the trunks to which they belonged, were changed, by being buried in sand, clay, &c. and by a petrifying process, from the living to the fossil state, without having been decayed previous to the commencement of those changes that have resulted in their conversion into solid rocks, or other mineral matter.

In reviewing these facts, as they have been thus briefly given, and the extent of the coal-field, embracing a tract of upwards of seven thousand square miles, it is difficult to avoid looking retrospectively at its ancient condition,—when its surface was covered with a lofty and luxuriant herbage, that flourished in a far milder climate than the present—when vegetation seems to have far surpassed any that has

* Proceedings of Geological Society of London, vol. iii. page 275.

succeeded it, and, compared with which, the present growth of plants appears insignificant. The vast collections of vegetable matter, now seen in strata of coal, and the numberless scattered fragments of ancient, broken and drifted trees, are evidences of the existence of mighty forests that overshadowed the primeval world. By those geological changes, so common in remote periods of the earth's history, these forests have been prostrated, and the early vegetables of the earth have been changed into beds of fuel, to afford her inhabitants the blessings of manufacture, commerce, and almost all the domestic comforts seen in their abodes. The numerous plants now represented by their mineral statues, all direct us to the grand object for which they were bid to live; and they proclaim, in the most beautiful language, the wisdom and beneficence of Him who directed them to become, in their final results, useful to mankind. However great the pleasure man derives from his inquiries into the human mind, and however advantageous it may be to follow the intricate windings of our intellectual capacities; it is from the material world that he derives the support of his mortality, and is bountifully supplied with those objects that should lead him "to wonder and adore."

In the examination of this great coal field, in regard to its geographical situation, and the relation its strata have with older deposits, we find that its several deposits rest unconformably upon other rocks of more ancient origin. The coal field has a close resemblance to a deep bay, which penetrates one hundred and fifty miles into the country. This bay has been filled by the detritus of the surrounding hills and mountains, by the operations of water, as it swept along the plains and rivers emptying into the wide estuary; and thus the strata were successively formed. The whole of the fossil plants found in the sandstones appear to have been drifted, and their fragments are scattered through them, in the manner of recent trees in the sands at the mouths and on the sides of the present streams. But in the soft shales underlying the coal, the remains of the *stigmaria* and the perfect leaves of ferns, do not afford any evidence of their transportation. It is therefore reasonable to infer, that the materials of the sandstones and the plants found in them, have been collected by the agency of water, which buried with detrital matter vast beds of peat, and numerous plants upon the sites where they flourished. The fossil trees of these sandstones differ in their positions from those of the coast of Chignecto Bay, where many of the fossils still

remain perpendicular, and afford the most certain evidences of their having grown where they now appear. In this instance it is probable that the trees and other herbage were overwhelmed by floods of water; in the other, the trees themselves were carried along by the current.

As the currents of great rivers of the present day, sweep away with them whole groves, while they also bury others, so did the ancient currents produce those effects, which still remain recorded in the solid framework of the globe. But these ancient streams have ceased to flow, and their fountains have been dried up—the vast estuary where their waters were mingled has become dry land, and the wreck of the primeval forest, with thick deposits of vegetable matter, has been converted into coal. A change has come over the scene, the climate has become more frigid; and, far above the thrifty groves of tropical vegetation, the ever-green spruce and pine bid defiance to the autumnal frosts, and refuse to fade beneath the deep mantle of snow that covers the earth during the winter months. Such are some of the effects Geology enables us to contemplate, and while it recognizes something beyond what can be distinctly seen, it increases the range of vision, and extends our knowledge of Him "by whom all things were created."

TOPOGRAPHICAL DETAILS.

Having given a general view of the Great Coal-Field of New Brunswick, and noticed its rocks and fossils, I now proceed to enter upon the details of particular localities, and to point out the most interesting and important objects of the inquiry, as they were found to exist in the district under consideration.

On a former occasion an account was given of the Westmoreland Coal-Field; and a probability was expressed, that coal might exist on some of the rivers emptying into the Straits of Northumberland. My object in revisiting Shediac, was to make some further examinations, at places where the outcroppings of coal might be expected to appear; and it is satisfactory to know, that opinions previously expressed, in regard to coal in this quarter, have proved to be correct, from subsequent discoveries.

TEDISH RIVER.

The coal field on the Gulph side of Westmoreland, was found, upon examination, to extend farther to the southward than was before anticipated; or it was found to be uncovered by the new red sandstone, to a greater extent than was ascertained during my first exploration in that quarter. The coal field may be said to reach to Great Shemogue, before its rocks are buried beneath those of the more recent red sandstone group.

A few weeks before my visit to Shediac, the settlers on the Tedish River had found some coal in a small brook; and a cart load of it had been procured and consumed in the forge of a blacksmith: it was taken from an outcropping on a branch of the River, three miles from its mouth and near

a French settlement. A brook that intersects the carboniferous strata has washed small quantities of coal from a superficial stratum, which may be seen on the farms of Peter Purrel and Paschal Le Blanc, on the new road opening between the settlement and Sackville.

The coal occurs in a thin stratum, about ten feet below the soil, and between beds of bituminous shale, met by fire clay above and below. The strata, so far as their inclination could be ascertained, dip to the north-east, at an angle of 10°; the coal is from six to eight inches in thickness; it is highly bituminous, and burns with a beautiful white flame, leaving but a small quantity of ashes. The uncleared state of this part of the country, and the detritus of red sandstone covering the rocks to the depth of several feet, are obstacles to the discovery of the outcropping of the coal. The stratum already discovered is regular and perfect, and, being accompanied by the usual shales, sandstones and fire clay, there can be little doubt that thicker deposits are situated at no great distance beneath the surface.

COUNTY OF KENT.

The geology of this County is very simple; and as almost all the rocks belong to one formation, it was by no means necessary to explore farther than there was hope of discovering coal in situations where it might be worked advantageously. The sandstones and shales, with coal, occupy the entire area of the County, except where those strata are covered by thin deposits of red sandstone.

COCAGNE.

At Cocagne Harbour, the grey sandstones appear in thin strata; about three miles from the bridge on a branch of the river, another stratum of coal was discovered by my son. The indications here were detached pieces of coal, which were scattered along the bed of the stream: the stratum whence these pieces had been removed was found in the bottom of a large brook, and beneath three feet of rapid water; under these circumstances, it was impossible to measure its depth accurately: it is estimated to be two feet in thickness; it may, nevertheless, exceed three feet in some situations. By sinking a shaft a short distance from the brook,

so as to avoid the influx of water, this coal may be opened immediately. The quality of the coal obtained from the above place was very good, notwithstanding it was taken from a superficial stratum. The sandstones and shales along the brook contain the casts and remains of several species of plants belonging to the fossil flora of the Province.

Coal has also been discovered on the Buctouche River, and there can be no doubt that it may be obtained in this district in great quantities. The whole of the uninhabited country between these rivers and the sources of the Washademoak and Salmon River, consists of sandstones, shales, and conglomerates, and coal is frequently seen along the banks of the streams.

It may be remarked here, that the means afforded for pursuing geological exploration, are only calculated to discover where coal and other minerals exist; but not to open mines. It is very evident that these coal strata are the most superficial, and therefore the least valuable deposits in the series to which they belong; and from their small degree of inclination, it may be justly inferred that the thickest and most extensive deposits are still concealed in the earth. The value of these discoveries can scarcely be estimated in the present state of the country; but when it is considered how important an article coal has become in commerce, navigation, manufactures, rail-road communication, and almost all the arts, it may be seen what the ultimate results of these investigations will be in reference to the future prosperity of the Province.

Another important consideration arises from the proximity of this coal to the proposed canal to open a communication between the Bay of Fundy and Gulph of St. Lawrence. This canal will pass over some part of the coal field, and will, I have no doubt, expose some of the coal strata. If coal did not exist on any of the shores of the Bay of Fundy, or its rivers, it might be transported through this canal, to the American market, and to every part of the south side of the Province. A direct communication from St. John to Quebec by steam is another benefit to be taken into consideration, and the advantage of having fuel situated midway between those places, is highly important. If there ever could have been a doubt of the vast advantages that would arise to New-Brunswick and Nova-Scotia, from the opening of this canal, it must vanish before a due consideration of all the facts; and the benefits offered by the completion of the undertaking, are such as call for the greatest exertion of the

friends of Colonial improvement. At present, the narrow isthmus between the head of Chignecto Bay and the Gulph of Saint Lawrence, prevents all kinds of trade between the opposite sides of the Province; therefore, the vast quantities of fish taken along the shores of the Gulph are carried to Halifax for a market. But these circumstances are unimportant, when they are compared with the trade that would flow in from all quarters through this new channel; to open and supply which, nature has offered every requisite that can be required.

At the mouth of the Cocagne and Buctouche Rivers, there are fine flourishing settlements; the soil, in general, is light and sandy; but, under proper tillage, produces good crops. At the sources of those streams, there are large peat bogs and "carriboo plains," where the soil is unfit for cultivation.

RICHIBUCTO.

The sandstones and shales of the coal-field are seen along the shore and upon the road between Buctouche and Richibucto, and also along all the streams emptying into the Gulph in this quarter. The sandstone, in general, is a fine grey rock, composed chiefly of silicious particles, feldspar, and mica, cemented by the peroxide of iron and argillaceous matter. The strata near the surface, or where they have been exposed to the weather, frost, &c., are much fractured and split into thin lamina: their dip is very variable, and will seldom exceed 10°. Both the courses and inclination of the beds are such as might be expected where displacement subsequent to accumulation has not taken place.

A peculiar kind of stratification may sometimes be seen on the banks of rivers: it arises from the different degrees of inclination of strata evidently of the same age and produced by the same causes. The following cut will afford an idea of what is intended to be conveyed.

It would appear, in these instances, that the lower strata had been depressed, and, afterwards, the more horizontal beds were laid upon them unconformably.

At many places, the rocks will afford excellent freestones, grindstones and whetstones; but no quarries have yet been opened, and the properties of the sandstones remain untried.

Reposing directly upon these strata, there is frequently a thin deposit of new red sandstone, with strata varying from ten feet to a few inches in thickness. These beds consist of a light red sandstone, and thin strata of arenaceous and marly clay; above them, and where they are absent, there are deposits of detrital sand, clay and pebbles, derived from the rocks beneath. In these there is a perfect degree of stratification, one of the most certain evidences of their having been formed by the agency of water. Immediately beneath, the subsoil beds of red and yellow clay occur from one to four feet in thickness. Both the soil and subsoil are of a reddish colour, having been produced by the mixture of the red rock with those of the darker coloured sandstones beneath. Taken altogether, the mixed soils are light, sandy and productive. The whole district under consideration is well adapted to agriculture, and offers an ample illustration of the capabilities of the Province, both in regard to husbandry and mining.

The alluvial deposits skirting the rivers are greatly modified in their agricultural character, by the forces of currents. The marshes of the Gulph shore, where the currents are feeble, are scanty and meagre. Along the shores of the Bay of Fundy, where the tide rises from forty to sixty feet, the alluvium of the marshes, from the rapidity of the currents, accumulates quickly; while on the northern shores of New Brunswick, where the tide does not rise more than six feet, alluvial accessions to the land are but slowly made.—The nature of the rocks over which these currents pass, determines the character of the alluvium; and thus the properties of the marshes derived from the sandstones are less fertile than those from the marly strata of the Bay of Fundy.

RICHIBUCTO.

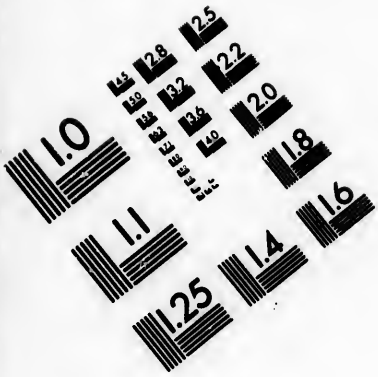
The Richibucto River, from its mouth to the residence of John Ford, Esquire, a distance of twenty-five miles, will average a quarter of a mile in breadth, and is navigable for

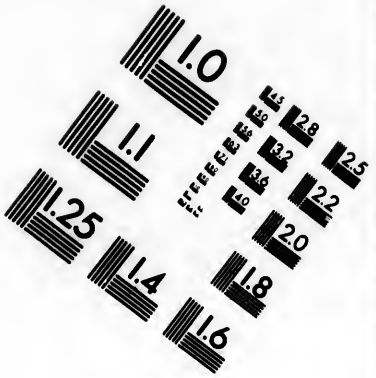
large vessels twenty miles above the town of Liverpool.—Notwithstanding the lands along the sides of this fine river are of a good quality, they are but thinly inhabited. The harbour is safe and convenient, and large quantities of timber are yearly shipped from it to the Mother Country.—Most of the excellent pine that formerly grew in the vicinity of this stream has been removed, or destroyed by ravaging fires.

The rocks through which the Richibucto pas... om its sources to its mouth, are all sandstones, shales, ... glomerates of the carboniferous series. The strata, in gene- ral, are horizontal; and wherever any dip was discovered, it was towards the northward. The surface of the earth is occupied by four feet of broken sandstones and erratic blocks: upon these the soil reposes. Excellent freestones may be quarried from the bank of the river. The outside of the strata should be removed before a quarry is opened, as the frost has shattered the strata to the depth of several feet. All the layers, containing iron pyrites or deep yellow stains, should be rejected, and only the fine-grained compact grey rock should be employed in buildings: this kind will become very hard by being exposed to the sun, and will resist the changes of weather. We ascended the river a few miles above the junction of its branches, the wilderness country southward having been previously examined. The Molus and Bass Rivers, branches flowing in from the westward, also pass over the before-mentioned rocks. It had been supposed that a valuable ore was to be found in the bed of the latter stream, but the only mineral seen here was the sulphuret of iron; which, from its brilliant metallic lustre, is calculated to mislead persons unacquainted with the subject. At the termination of the tide flow, the main river sends off a tributary called the south-west branch; near the mouth of this stream is the establishment of John Ford, Esquire, who has erected flour and grist mills, and greatly contributed to the settlement of this part of the country. To this gentleman we are indebted for his hospitality and aid in ascending the stream.

COAL.

About three miles above this place, and on the south branch of the stream, coal was discovered about twenty years ago. It also appears farther up the river and at Big Brook, one of its branches. At the former locality, it appears in a





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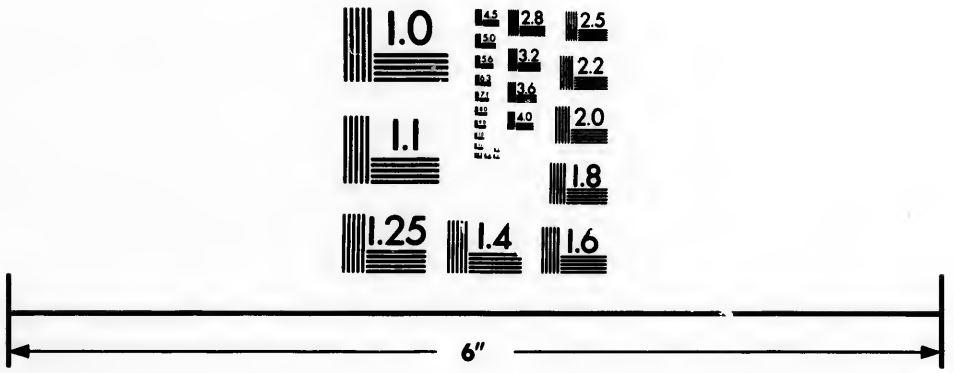

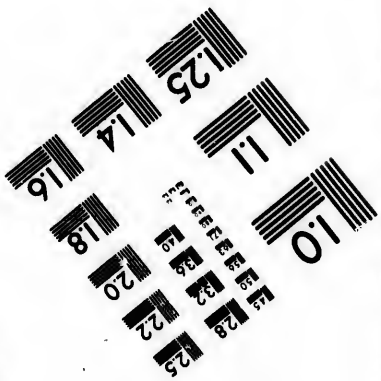

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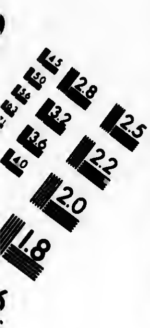


steep cliff eighty feet high, and forty feet above the level of the stream; it is contained between strata of bituminous shale. Thick strata of coarse grey sandstone meet the shale above and below; the shales, including the coal, being about thirty feet in thickness. The upper part of the cliff and its base along the river, are shaded by a lofty growth of hemlock, spruce and pine. The coal is about two feet in thickness, and of an excellent quality. It is probable that there is another stratum of coal near the base of the cliff, but the *debris* and rubbish skirting the front of the bold escarpment, rendered our labours to discover the second stratum unsuccessful. The strata dip north-west 10°; this is also the general dip of all the beds in this quarter. The coal appearing farther up the stream and at Big Brook, is evidently continuous from this cliff. From the small degree of inclination in the strata, it is probable that only the most superficial bed of coal has been discovered. By sinking a shaft near the head of the navigation, it is probable that the coal might be found at an inconsiderable depth below the surface; thence it could be shipped down the Richibucto.

Immediately at the base of the steep precipice beforementioned, there is a mineral spring issuing from beneath the coal. This stream sends forth a strong effluvium of sulphureted hydrogen; and its peculiar odour is perceptible to the distance of several hundred yards. Bubbles of gas are constantly rising to the surface, and from the application of a lighted match some of them took fire and burned for a few moments with a pale blue flame. The water has a nauseous and sulphurous taste; and when taken, even in moderate quantities, it produces purging. It has been found useful in the cure of certain cutaneous diseases, and is still the resort of wild animals. The following is the medium result of several trials made in its analysis:

In one pint

Carbonic acid—*cubic inches*	0.7
Sulphureted hydrogen—*cubic inches*	2.5
Sulph. of soda—*grains*	3.5
Peroxide of iron—*grains*	2.0
Silicia—*grains*	0.5

It is evident that this spring possesses medicinal properties of considerable power; but its secluded situation will render it almost useless, until the country around shall be inhabited.

The casts and remains of plants appear in considerable numbers in the sandstones of the Richibucto. About a mile and a half above the town of Liverpool, on the west side of the river, and on the Indian grant, they are common. These fossils have been mistaken by the inhabitants for petrified pine and maple, and other kinds of recent wood; but they are all the productions of a much warmer climate than any in North America at the present period, and unlike any of the plants growing in New-Brunswick. The strata frequently contain globular masses of sandstone and ironstone as large as cannon balls; these are sometimes liberated from the rock by the action of the water and frost. They consist of successive layers formed around a central nucleus, and were probably produced by the rolling along of hardened masses over the sand and mud, of which the strata were originally formed.

BOG IRON ORE.

My attention was directed, by the Hon. John W. Weldon, to a deposit of bog iron ore, situated about half a mile westward of the town of Liverpool. The bog has been partially opened in making a new road, and a small quantity of the ore has been exposed. This variety of iron ore exists in many of the low swampy grounds in this part of the Province, and might be employed in the manufacture of cast iron; its quantity is constantly increasing from being transported from the soil by water flowing over the surface.

It has been already stated that an extensive bar of sand has been thrown up along this coast. At the mouth of the Richibucto, there is a bar across the river, about five miles in length. It has been cut through, by the current, at its main channel, and also by a small passage on the eastern side of the harbour. This bar will average fifty rods in width, and its central portion is attached to a beautiful island covered with red pine. The sand is first thrown up to high water mark by the waves, it is then blown into mounds by the wind, and frequently resembles the out-works of fortifications.

KOUCHIBOUGUASIS.

This is a small river between the Richibucto and Kouchibouguac, which, contrary to the meaning of the Indian

name it has received, is smaller than the former stream. The river passes along a channel worn out of the sandstone. Small seams of coal also appear on this stream. The soil is more light and sandy here than it is farther eastward; it is, nevertheless, capable of being successfully cultivated.

KOUCHIBOUGUAC.

Northward of the before-mentioned river about fifteen miles, is the Kouchibouguac. Like the Richibucto, these streams open into harbours formed by sand bars at their mouths. The surface of the country is more uneven here, than in the neighbourhood of the Richibucto. Excellent freestones and grindstones may be quarried along the sides of these streams. The rock is a compact grey micaceous sandstone, containing, in many places, the fossils of the coal field in great abundance. The remains of some of these plants will be seen near the bridge and mills on the main road leading to Miramichi. There are but few good farms in this direction. As lumbering has heretofore been the principal employment of the inhabitants, the capabilities of the soil are scarcely known. The same rocks prevail along the whole shore to Point Escuminac, where a large area of land is scarcely elevated above the level of the sea. It was not deemed necessary to explore these rivers to their sources, as the country through which they pass is composed altogether of rocks belonging to the same class, and contains only the minerals already noticed.

Coal and iron are the only important minerals in the County of Kent; these, with the soil, are sufficient to give profitable employment to a large population, independent of timber and the fisheries.

COUNTY OF NORTHUMBERLAND.

Between the beforementioned rivers and the Miramichi there are several small streams. The largest of these are Bay des Vents, Black and Nepan Rivers; these streams also pass along channels worn out of the sandstone by the operations of their waters. In some places they are skirted with narrow belts of intervale and tracts of productive red soil: there are, however, patches of white and yellow sand, covered with laurel and peat. In approaching Miramichi

from the southward, the soil becomes more argillaceous, and often resembles alluvium. Eastward of the Nepan River, a few scattered boulders begin to appear, and near Chatham they are quite numerous; they are of granite, syenite, and trap, and identical with those rocks where they are found *in situ* on the north side of the Gulph of Saint Lawrence, whence they have evidently been transported; but, whether by ice, or by water under a former condition of the country, it is difficult to decide. There are many good farms in this quarter, but large tracts, capable of affording a due reward to industry, are unoccupied; the settlements being confined to the sea shores and the banks of the rivers.

Northumberland is one of the largest Counties of the Province, and, when considered in reference to its soil, minerals, fisheries, and timber, it is a district of much importance to New Brunswick. The Miramichi, a large and beautiful river, passes directly through this County; while its branches, extending in all directions, afford great facilities of transportation from the interior. This river is nearly two hundred miles in length. Having descended with considerable rapidity from its principal sources, it becomes navigable for large vessels; and finally opens into a spacious bay. The banks of the river are settled to the distance of a hundred miles; the mouths of the principal branches are also thinly inhabited; but, remote from the streams, the country is in its original wilderness state, and thousands of acres of land, capable of cultivation, are covered by dense forests. Upon the main river and many of its branches there are some excellent intervales; even these, in many situations, remain uncleared. From fifteen to twenty miles above the mouth of the river there are three towns, with a number of handsome villages adjoining. Chatham, Newcastle, and Douglas Town, are places of great trade in timber, ships, and fish, and the country has improved rapidly, notwithstanding a most calamitous fire that destroyed two of its towns and a number of villages only a few years ago. Large sums of money have been expended in the erection of steam and water-mills, for the manufacture of lumber; and a spirit of enterprize has prevailed that is unrivalled in any part of America. Agriculture and mining have, however, been almost altogether neglected, and it is only of late that any advances have been made in those important branches of industry. These few hints are thrown out for the information of persons abroad, into whose hands this Report may fall; and although they may not be con-

sidered to be of a geological nature, they form an important outline of the inquiry under consideration.

The whole of the shore, from Point Escuminac to the town of Chatham, is composed of the sandstones and conglomerates of the coal field. The rocks are elevated but a few feet above high water mark, and the fine settlements along the shore are almost level with the waters of the Gulph. The islands of Miramichi Bay are composed chiefly of sand, which has been thrown up by the waves and currents.

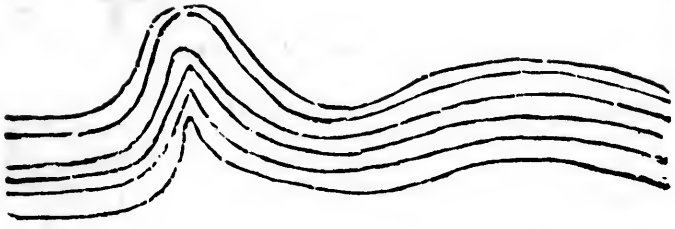
The most remarkable features of this part of the County are the evidences of a depression of the coast having taken place, within a comparatively recent period. In the vicinity of Bay des Vents, and Lower Bay des Vents, extensive peat bogs are seen at low water, reaching outwards under the sea, being buried beneath its waves. I examined this peat carefully, and found it to be of super-marine growth; how far these bogs extend beneath the Bay, and have been covered by beds of sand and gravel, cannot be readily ascertained; there is reason to believe, however, that an extensive area of low land has been submerged, and the higher portions of it are now scarcely above the tide level. These facts appear more extraordinary when compared with those which shew that the coast near Bathurst has been elevated; but they are the result of geological changes and catastrophes, to which the earth has been subject ever since it was created, and became a revolving mass in the heavens.

Between Newcastle and Black River, on both sides of the main stream, the sandstones appear in cliffs from fifteen to thirty feet in height; and the strata are nearly horizontal. The upper layers of the rock having been acted upon by the frost, are much fractured, and frequently split into thin lamina. Near the water level they have suffered less, and they often appear in broad compact masses, capable of affording good freestones of large dimension. The water is constantly wearing away the yielding rock, and singular grottos, with deep notches, have been worn out along the level of the Bay. Excellent freestones may be procured from these strata. The new Bank at Newcastle, and a number of buildings at Chatham and Douglas Town are built of these rocks. The freestones are readily quarried and cut; and buildings composed of them have a venerable European appearance. Messrs. Gilmour and Rankin and the Hon. Joseph Cunard have employed them in the erection of their excellent mills. These freestones form a valu-

able part of the natural resources of the County; they are abundant, and may be transported at a low rate. The brown and yellow varieties of this rock should not be employed in architecture, as they will not resist the weather: the compact grey kinds are very durable.

Interstratified with these sandstones, soft shale, and fire clay, sometimes occur at the bases of the cliffs. In all these the fossil plants belonging to the coal period are common. Large trees have been changed into coal, lignite, iron pyrites, and sandstone. These trees are situated parallel to the strata, and sometimes form an irregular layer between them. Most frequently they extend in an east and west direction, and by being more readily acted upon than the sandstone itself, they have been worn out, and deep holes are left in the cliffs. Very often the whole tree has been changed into sandstone, except the bark, which, being converted into coal, encircles the fossil, as it did when both were in a living state. Ferns and coniferous plants are numerous; but none of the *cactacea* were observed. Wherever these fossils are found, the rock is of a brownish red colour, from the presence of the peroxide of iron.

About five miles below Chatham, there is every indication of the existence of workable beds of coal: a small but perfect stratum of the bituminous mineral appears in the cliff, and on the property of Mr. Willison; fine specimens of coal were found here, and accompany this Report. The abundance of fossils, the presence of shale and fire-clay, always accompanying coal in these Provinces, and every other condition of the rocks, render it almost certain that coal may be obtained here at no great depth from the surface. Near the mouth of the Nepan River, a conglomerate composed of small pebbles was observed reposing upon the sandstone. This conglomerate contains pebbles of the sulphurets of iron and copper. The casts of plants and their leaves are also seen here. The rocks in this quarter are covered with beds of sand, gravel, and sometimes clay, to the depth of ten feet, and erratic boulders are found upon the surface. The strata in general are horizontal; but there are instances where they are singularly contorted. The following is a representation of curved strata on the Miramichi.



It appears that these strata, while they were in a soft state, were exposed to some force that moved them from their original horizontal situation.

The same sandstones and freestones, sometimes containing fossil plants, are seen at Newcastle, Chatham, Douglas Town, and on both sides of the river, as it flows from the southwest. A large fossil tree was discovered by the workmen of Thomas H. Peters, Esquire, in the digging of a cellar. The texture of the wood still remains perfect, and portions of the original plant are beautifully crystallized.

The tide in the Miramichi rises four and a half feet at common tides. The river affords a most safe and commodious harbour, averaging a mile in breadth. Although there are many pretty views on the sides of this noble stream, the scenery in general is tame, and without that bold outline that contributes so much to the beauty of more elevated districts.

I had received information of minerals having been discovered at several localities farther up the river; but those minerals, upon examination, proved to be unimportant. The coal evidently deposited in this part of the Province, is the most valuable of all its mineral resources. From the great fires that have overrun the County of Northumberland, timber will soon become scarce, and the facilities of obtaining coal in the ballast of lumber ships, will cease to exist; the coal of this County will then be duly valued, and the peat, in an advanced state of agriculture, will be extensively employed in fertilizing the soil.

At the Ferry, over the North-west branch of the river, about two miles above Newcastle, the sandstones contain iron pyrites in nodules and irregular masses; near this spot I observed an ancient Indian manufactory of arrow-heads; several spear-shaped pieces of flint and jasper were found among the broken fragments buried in the soil. These sharp

pieces of the hard stones were employed by the Indians in killing their game, and in warfare, before the Europeans had ever visited these shores.

Directly at the bifurcation of the river, there is a beautiful spot, called Beaubair's Island, from Monsieur Pierre Beaubair, a person of considerable importance among the early French settlers on the river. The island was the site of a French fort, the remains of which are still to be seen; and pieces of muskets and other instruments of warfare have been found around its sides. This part of the island has long since been covered with a growth of forest trees.—Beaubair's Point, at the junction of the two branches of the river, was once the site of a French town and a large chapel; human bones are almost yearly washed from the graveyard by the encroachments of the stream. Both the island and the point are places of considerable note in the early history of New Brunswick; they now present little of interest, beyond what arises from their antiquity, and the recollections they bring of the early struggles for power in a new country.

From some specimens received from the North-west branch of the Miramichi, it appears evident that the westernmost part of the County is rich in minerals; the exploration of that district was necessarily deferred until the next season. Several kinds of mineral substances from the tributaries of the South-west branch were examined, but they are common to the sandstones, and do not differ from those already described.

About three miles above McKie's Inn and eleven miles from Newcastle, on the south-west branch, coal appears in the south bank of the river; it is but an inconsiderable stratum, belonging to one of the superficial beds already alluded to. The river at this place is a quarter of a mile in breadth, and rolls along in great grandeur and beauty. From the confluence of the south-west and north-west branches to Cochran's Inn, the distance is about twenty miles; the soil in this distance is a light yellow and white sand, sometimes mixed with clay: it is easily worked, and, under proper cultivation, produces good crops.

Coal has been found on the Renous and Bartholomew's Rivers. These minor branches of the Miramichi were too low to allow canoes to pass at the time of my exploration in this quarter. Above the mouth of the former stream the intervale increases in quantity, and the soil near Dr. Canteline's, fifty miles from Newcastle, is more argillaceous.

About one hundred and ten miles from the coast, the south-west branch of the Miramichi makes a sudden turn to the north-west, and receives the Taxes River and other streams. At this place, a few years ago, a village was commenced, mills erected, and some land improved, by Mr. Thomas Boies; the village, now called Boies Town, is situated on the main road between Miramichi and Fredericton, and at that point where the road communicates between the South-west branch and the Nashwaak, a tributary of the Saint John.

At this place a narrow seam of coal appears near the mills: grindstones and freestones may be quarried at numerous places on the banks of the river. The Miramichi, to this distance, passes through the rocks of the Great Coal Field of New Brunswick, already described. The terraces on this river have been noticed at page 58. The river is lined with thriving settlements; but, half a mile in the rear of these, the soil has never been cultivated, and thousands after thousands of acres of fertile land, with tracts of intervale on their brooks, remain in all their primitive wildness. When the advantages offered by the river, the quality of many large tracts of soil, coal, timber, &c. are all considered, it is surprising that this part of the Province should not have been settled long since. It is probably because the resources of the country have not been explored, and are unknown to emigrants, that they remove to foreign countries, while British soil remains neglected.

My principal object for following the main south-west branch of the Miramichi to the portage, and thence down the Nashwaak to the Saint John, was to complete another section of the coal field, which has been laid down on the geological map of the Province as far west as those rivers. It may be remarked here, that when the general features and characters of the coal formation have been accurately ascertained, it is only necessary to explore rigidly such parts as offer any hopes of reward, but in districts where there are indications of ores, a most careful search is necessary. Should it be remarked that our visit to this part of the country was short, compared with the importance of the district, an apology is offered above, and in the expenses, that in travelling on the north side of the Province were nearly two-fold greater than in the southern counties.

About four miles southward of Boiestown, a ridge of greenstone trap has apparently been forced through the rocks of the coal measures. I had been informed that a great

quantity of iron ore had been discovered upon the portage road; but it is probable that the ponderous trap has been mistaken for iron, of which I could find no indications at that place. The soil in the neighbourhood of Boiestown is light and sandy; upon the trap rock it is greatly improved, and has supported a lofty growth of beech, birch and maple.

NASHWAAK.

The Nashwaak takes its rise near one of the sources of the south-west branch of the Miramichi, and after having passed through an extensive grant of land belonging to the New-Brunswick Land Company, it empties into the Saint John, opposite Fredericton. This river runs through a fine tract of intervale, and the number of terraces upon its banks are evidences of the changes of level the stream has, from time to time, undergone. These terraces have been noticed in another part of this report. All the lower part of this river passes through the sandstones and shales of the coal field; these rocks are seen on both sides of the beautiful valley, and often rise abruptly from its sides. In these sandstones and shales, the remains of plants are abundant, and may be seen in the cliffs, or the strata broken up in making the roads. Towards the sources of the Peniac, Little River and Newcastle Creek, there is a large tract of good tillage land, with some intervale. This uninhabited district is also within the coal field, and the coal is frequently seen in the beds of the streams. Freestones and grindstones are also abundant in this quarter, and are known to be of an excellent quality.

Extending from the County of Northumberland in a south-west direction to within ten miles of the Saint John, a tract of land containing five hundred and fifty thousand acres, has been granted, by Royal Charter, to the New-Brunswick Land Company. This tract crosses the south-west Miramichi, Taxe[illegible]ashwaak, Keswick, and Mactaquack Rivers. Its most southerly part is situated upon the primary rocks of the range described in the first part of this report, and the whole of its eastern side is upon the coal field. The soil in general is good, and there are considerable areas of a superior quality. Notwithstanding the Company have been unable to settle this immense tract to the extent they have desired, the situation for a colony of emigrants has been judiciously chosen, and is capable of being made a fine agricultur-

al district. The foundations of two small towns have been laid. Stanley on the Nashwaak, and Campbelltown on the Miramichi, are beginning to flourish. Roads have been opened in all directions, and every encouragement is offered the industrious settler, who, from the above improvements, will find but few difficulties to encounter in establishing himself upon the soil.

The coal crops out on the Tay Creek and Nashwaak, and if properly opened and worked, would lay the foundation of extensive manufactories. It might also be transported to Saint John and be employed in the steam boats on the main river, where at present foreign fuel is chiefly used. The whole of this extensive establishment is under the control of Lieutenant Colonel Hayne, the Company's Agent, the kindness and urbanity of whom will be gratifying to all who may avail themselves of the advantages these lands offer for successful cultivation. I regret that I have been unable, during the past season, to make a particular examination of the whole of this part of the County of York: it will, however, claim my earliest attention.

During my exploration in the northern counties of the Province, an excursion was made to Bathurst. By the aid of Thomas M. Deblois and William Stephens, Esquires, Doctor Bishop, and other gentlemen of that place, many interesting facts were collected in regard to the geology of the County of Gloucester. This County and Restigouche, however, remain unexplored.

A visit was made to the mining establishment of an English company at Bathurst, conducted by Mr. Stevens, a most enterprising individual. The first efforts of the company were directed to the mining of copper ore, veins of which are evidently contained in the slates of Tete-a-gouche River. At present the mining of manganese is carried to some extent, and powerful machinery has been erected with sufficient water-power, which will be directed to cleaning the ore, and other operations. The mine of manganese is situated eight miles from the town of Bathurst. The ore occurs in veins and disseminated masses in clay-slate. Fifty tons were ready to be shipped at the time of my visit. The sterling price of the ore is stated to be £10 per ton.

This is evidently a mining district, and one of great importance to the country. I have also analysed two kinds of marl found in the County of Gloucester. They are superior in quality, and will soon be applied to agricultural purposes.

In concluding the present work, it may not be unnecessary to remark, that the country explored during the past season had never before been examined, in regard to its mineral wealth; and frequently where valuable ores had been supposed by some of the inhabitants to exist, those substances were found to be worthless in an economical point of view. In several instances the proprietors of lands have been urgent for me to spend much time and labour, where, from the nature of the rocks, it could not be expected that any thing of value could be discovered. The excellent ore of manganese now worked by the Gloucester Mining Association, when first discovered, was supposed to be antimony; and other instances might be mentioned where similar mistakes have occurred. It is also to be regretted that attempts have recently been made in the Province to secure leases of mines, for the sole objects of speculation, and not for their actual working; but such things are common to all new discoveries, and can only be removed by time and experience.

It will, nevertheless, be seen from what has been already performed, that New-Brunswick not only possesses a fertile soil, but is abundantly stored with valuable minerals, and those elements that are capable of elevating the character of the country, and of supplying the means of strength and greatness. The Province also affords a wide field of research to the scientific inquirer, and abounds in the evidences of those great changes geology contemplates. In every quarter the wisdom and goodness of the Creator, in providing for the wants of man, may be seen, and the beauty and harmony of His works are displayed to every unprejudiced eye.

I have the honor to be,

Your Excellency's most obedient

And very humble Servant,

ABRAHAM GESNER,

PROVINCIAL GEOLOGIST.

Saint John, N. B., 1st January, 1842.