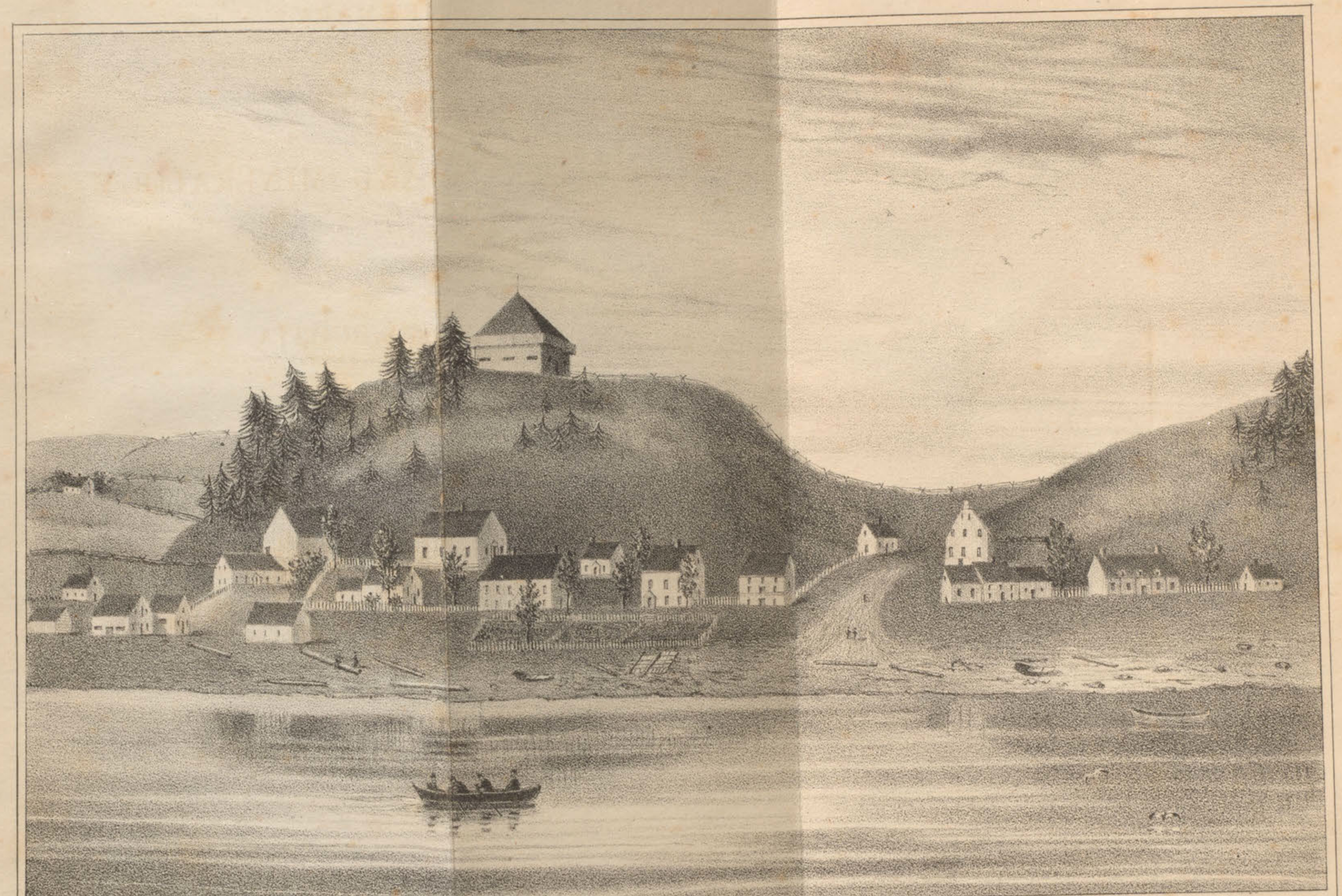

PRO ARIS ET FOCIS
Campbell,
of
St. Hilaire

The Right Honorable
Lord Sydenham
Governor General of
British America &c &c &c
With the Author's Compliments




PARRSBORO' FROM THE WATER, 1836.

REMARKS

ON THE

# GEOLOGY AND MINERALOGY

OF

# NOVA SCOTIA.


BY ABRAHAM GESNER, ESQ., SURGEON.


"THE EARTH NOT ONLY CONTAINS WITHIN HER BOSOM, SUBSTANCES THE MOST NECESSARY AND INDISPENSABLE TO SUPPLY THE WANTS OF MAN; BUT ALSO EXHIBITS IN HER VAST MUSEUM, THE MOST CERTAIN, AND IMPERISHABLE RECORDS OF HER OWN HISTORY, WRITTEN IN CHARACTERS NOT TO BE MISTAKEN BY THE MOST HUMBLE, DESTROYED BY THE MOST POWERFUL, NOR BLOTTED OUT EVEN BY TIME ITSELF."


HALIFAX, NOVA SCOTIA.

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HALIFAX, NOVA SCOTIA.
1836.

To

LORD VISCOUNT VALENTIA,

A. M., F. R. S., &c. &c. &c.

My Lord,

*AS Your Lordship's Visit to Nova Scotia, and enquiries into her Geological Structure, have aided the Cause of Science, and stimulated others in more humble stations, to enter upon pursuits of the highest importance to the Country; I beg leave to present to Your Lordship, the following Remarks on the Geology and Mineralogy of the Province.*

*And although they are but limited in regard to the interesting subjects they embrace, it is sincerely hoped that they may be acceptable to one, who delights to cultivate studies of the most useful and important character.*

*I have much reason to hesitate in laying my humble labours before an Individual, whose superior talents and knowledge, will readily discover their imperfections; but* *all my anxiety on this account is dispelled, when I consider the kindness with which permission was given, to dedicate them to Your Lordship.*

*Should this Work meet Your Lordship's approbation, it will then be sufficiently recommended, and I trust prove useful to the Public.*

*I have the honor to be*

*My Lord,*

*Your Lordship's Most Obedient,*

*Humble Servant,*

ABRAHAM GESNER.

*Parrsborough, Nova Scotia,*

1836.

# PREFACE.

IN writing a Preface, it has become customary for Authors, to declare the several different objects, that induced them to give their knowledge to the Public. Some of them have however, made many apologies for sending their ideas abroad, and a few have been impelled onward in their Literary and Scientific pursuits, by the solicitations of their contemporaries. In the present instance, a limited number of the Author's friends, have endeavoured to dissuade him from his object ; while many have been pleased to lend their cheering influence to his support. To the former it is hoped, none of the imperfections of the following pages will be ascribed ; and among all, the credit due to the few merits they contain, should be equally divided.

Under the patronage of Sir Colin Campbell, who in the Administration of the Government, and in every act of domestic kindness, has promoted the welfare of the Country, even the highest scientific and literary attainments would receive additional lustre. How much more then, will the character of the following humble work be elevated, under the auspices of His Excellency, from whom the Author has had the honor to receive numerous acts of personal kindness, and every encouragement amidst his labours.

Abounding in numerous and important minerals, that are not only indispensably necessary to supply the wants of mankind, but also those which contribute to his minor necessities, Nova Scotia will maintain a character unrivalled by any country of the same extent. So abundant are mineral substances in this Province, and comparatively so little is known of their number and extent, that in the advanced state of science and useful knowledge, any developement of their sources and modes of application, cannot be considered useless.

While the cultivation of the soil, the mechanical arts, and navigation, solely depend upon the use of metals, the discovery and manufacture of ores, will ever be objects of the greatest national importance; and the prosperity of a country must depend upon the facilities afforded for obtaining those materials, without which man would be miserable indeed. To convince ourselves of these facts, let us refer to savage nations. Even these sharpen the harder stones for various purposes. To them small pieces of iron have been invaluable, and a knowledge of minerals is among the principal of those improvements, which have elevated such nations from a state of barbarism, to one of a moral and dignified character.

Throughout that extensive chain of civilization, from the highest to the lowest grades of society, mineral and metallic substances hold an important station, whether they are employed in the plough of the farmer, the hook of the fisherman, the anchor that holds the ship, the cannon of the battery, or sparkle in the crown of the sovereign.

In the department of Mineralogy, Mohs, Hausmann, Jameson, and Cleveland, have produced regular systems, which supported by the improved state of chemistry, and the discoveries of Sir Humphrey Davy, Brande, Vanquelin, Klaproth, and other distinguished chemists, have made mankind acquainted with the elementary substances of almost all mineral compounds.

The labours of Count Sternburg, Professor Lindley, and Brongniart, have opened a new source of enquiry into antediluvian botany; while the discoveries of the celebrated Doctor Buckland and Baron Cuvier, have exhibited numerous classes of enormous animals, now inhumed in the earth. The relative ages of the different classes of rocks in England, have been clearly demonstrated in the admirable work of Conybeare and Philips, from which Dr. Ure, of Glasgow, has drawn just conclusions in reference to the former condition of the globe, and the deluge recorded by Moses. But it was the task of Mr. Lyell, to collect the scattered fragments of Geological Science, and erect a beacon to guide the wandering student in the path of philosophical truth, and to solve those difficulties theoretical writers had thrown in the naturally obscure way.

The Author of the following Remarks has been desirous to supply some of the testimony afforded among the Rocks of Nova Scotia, which support the opinions, and correspond with the discoveries of distinguished Naturalists in Europe. But more especially has his object been, to arouse the attention of the inhabitants of the Province, to a due estimation of the advantages they possess, and the resources Providence has placed within their reach.

That the Farmer may obtain a just knowledge of the soil he cultivates; the Legislator be made acquainted with the sources of public wealth and economy; that the Natural Philosopher may be assisted in his pursuits; and lastly, that the Theologian may draw from the earth the surest testimony of "Holy Writ," are certainly objects worthy of far better talents than the Author can ever possess. But if his humble labours shall be the means of leading those who are better qualified, into similar but more extensive enquiries, his object will be gained. With such motives he fears not an honest criticism; for any attempt to correct errors, which may have stolen their way upon his pages, will lead to useful examinations, and further the design of his work.

The thick forests that occupy extensive portions of the Province, and cover her mountainous ranges of land, added to other difficulties, which to the Geologist in new countries are insurmountable, have prevented the Author from pursuing his enquiries with that particular research the subject requires. He has nevertheless examined each section of the country at such places as are accessible, and endeavoured to obtain the most accurate information by actual inspection. He is aware that the appearance of many of the less important localities is changing, by the clearing of the earth's surface, and the destruction constantly advancing among the rocks. Those changes however, only affect the outward garb, while the rocks and minerals will be found at or near the places described.

In a book intended for the perusal of the general reader, it has been considered proper to affix a short Introduction to the studies of Geology and Mineralogy. Some of the matter contained in the latter has been derived from Professor Cleveland's work. The Introduction to Geology will be found to agree with the best modern systems extant. Those who would obtain a more extensive knowledge of these Sciences, must consult more elaborate treatises.

The Author has received some information from the remarks of Messrs. Jackson and Alger, of Boston, and from Mr. Haliburton's excellent History of Nova Scotia. For the correct and beautiful drawing of the Village at Partridge Island, he is indebted to Miss Jeffery. He also expresses his sincere thanks to George R. Young, Esq., and all those Gentlemen who have kindly become his Agents throughout the Provinces.

It is truly pleasing to observe, that a taste for scientific pursuits is fast gaining ground in Nova Scotia. Already several gentlemen have embarked in the study of Natural History, and it is hoped that their united efforts will not only disclose those interesting facts which serve as subjects of speculation, but such as will lead to the practical improvement of the country.

Is it not singular, that a Province containing coal, iron, copper, lead, and all those inferior minerals used in manufactories, should import her metals across the Atlantic ? Why should granite, marble, and even limestone, be conveyed to those very shores where they abound ? Is it not wonderful that a vast amount of sluggish capital should lie dormant in the hands of its possessors, when so many channels of enterprise might be opened, and the surplus earnings of the country be retained among its inhabitants ? These are questions which require answers from Legislators, while science is opening the way to those improvements, which can alone enrich the Colony, and render its inhabitants more industrious and happy.

In the description of minerals, repetitions have been avoided as far as possible. When the same mineral occurs at several different places, the most particular description has been given of it, and the locality where it occurs under its most perfect forms ; and the best specimens have been selected, when giving the details of their properties. A description of the less important associations has been omitted altogether ; for so numerous are the Mineralogical and Fossil substances in the country, that a full description of each variety, would fill a volume of no ordinary dimensions. Nor does the Author give more than a brief outline of these important branches of Natural History, so far as they are connected with Nova Scotia. So numerous are the objects of these departments, and so wide the field of their discovery, not only would it be impossible to give an account of them in a pocket volume, but require years of laborious investigation to collect, and arrange them.

The mineral springs are included in the description of the rocks where they occur. The discovery of the bones of the mammalia, in Cape Breton, and the teeth of animals belonging to that class, and bones of fish in Nova Scotia Proper, awaken in the mind new sensations. If the study of Geology be yet in its infancy in other countries, it must be almost unborn in this Province, where facts of the greatest interest to the Natural Philosopher, are almost daily developing the condition of the antediluvian world, and placing the country upon a footing highly interesting and important.

The following work has been divided into four parts, corresponding with four natural Geological divisions of the Country. Each part is subdivided and distinguished by having the name of a Township or particular locality, placed before it, and to which the Index refers. Therefore, an account of any particular place may be referred to without delay, and the eye is relieved from time to time, by the different heads under which the subjects are arranged.

The Author has endeavoured to avoid any appearance of error, but is sensible nevertheless, that the Work may contain some, in regard to the distances from one place to another. In numerous instances those distances have never been accurately measured, and he has therefore been guided by the opinion of respectable inhabitants.

It was not intended, when the Prospectus of this Work was written, to give a Geological Map of the Province, or any pictorial illustrations of its scenery ; but from the very general support the book has received, a Map has been prepared, at a considerable additional expense, which will enhance its utility. The increased price of the Volume, in consequence, will be no object, compared with the advantages to be received by this general view of the rocks and most important minerals of the country.

He might plead as an apology for some of the imperfections of the Work, that it has not been prepared with leisure and retirement. On the contrary, amidst the arduous duties of a laborious profession, and under the annoyance of perpetual interruption, most of the following pages have been written ; or during the silent hours of midnight, when the labour but not the fatigue of the day, had departed.

Some years have elapsed since he commenced an enquiry into the subjects treated of ; but not supposing that they would ever be made public, the labour of arranging a mass of detached notes, taken under a variety of circumstances, has greatly increased the task.

He knows however, the futility of these apologies, and although he feels the pecuniary loss he has sustained, by indulging in his favourite pursuits, he will be amply rewarded if his labours shall in any degree promote the study of Natural History in the Province, or prove useful to his countrymen.

ABRAHAM GESNER.

PARRSBOROUGH, July 1836.

# INTRODUCTION

TO THE

# STUDY OF GEOLOGY.

GEOLOGY is that Science which investigates the nature and properties of the various substances which compose the earth. It examines their laws, combinations, and relations, the changes they have undergone at different periods, and finally establishes a correct theory of the formation of all the materials of which the globe is constructed.

Many of the ancient philosophers doubtless, never extended their views upon this subject, beyond the general and limited account given by Moses, whose record of the creation of the world is supported by the voice of inspiration, and the strongest testimony that can be adduced to support facts believed by all christian nations. It was not necessary for the author of the Pentateuch, to record any details of the formation of the earth, but to state such important facts as would establish the faith of every Christian believer. And no reasonable mind can consider a more minute enquiry into this department of Natural History, irreverent to the Sacred Scriptures, as all such investigations must be conducted by the human mind, which with all we behold in creation, was formed by Him, " who hath made the earth by His power, and established the world by his wisdom."

With the Geological opinions of the ancient philosophers, we are unacquainted ; and those which history has recorded must be considered extremely whimsical, and blended with much error and superstition. It was not until the days of Werner, Hutton, and others, that anything like a tangible theory was adopted. Since that period, modern discoveries have placed this Science upon reasonable grounds at least, although even now the reader will perhaps be startled at some conclusions which the modern Geologist will endeavour to sustain, and some of those which recent discoveries have proved to be correct.

## GEOLOGICAL THEORIES.

It is absolutely necessary, that before any substance can be crystalized, that it first be made fluid, or suspended in some solvent; and it is generally admitted, that the agent employed in the formation of minerals, must have been either aqueous or igneous. For without the action of one of those agents, it would be impossible to account for the phenomena the mineral kingdom presents. Two systems of Geology have therefore been advanced and supported, and the disciples of each have done much good to the Science, by the facts they have produced to establish their favourite opinions. Those who believe water was the solvent employed, are called Neptunians, and those who give the preference to caloric, as the agent referred to, are denominated Vulcanists, or they are called Wernerians and Huttonians, from the theories Werner and Hutton supported.

## THEORY OF BUFFON.

This author endeavours to prove, that the earth is the ruins of a former world. He says, " The surface of this immense Globe exhibits to our observation, heights, depths, plains, seas, marshes, rivers, caverns, gulphs, volcanoes; and on a cursory view of these objects, we can discover in their disposition, neither order nor regularity. If we penetrate into the bowels of the earth, we find metals, minerals, stone, bitumen, sands, earths, waters, and matter of every kind, placed as it were by mere accident, and without any apparent design. Upon a nearer and more attentive inspection, we discover sunken mountains, caverns filled up, shattered rocks, whole countries swallowed up, new islands emerged from the ocean, heavy substances placed above light ones, hard bodies inclosed within soft bodies; in a word, we find matter in every form, dry and humid, warm and cold, solid and brittle, blended in a chaos of confusion, which can be compared to nothing but a heap of rubbish, or the ruins of a former world." He believed that great revolutions took place in the earth in the early ages, after its creation, and that the land we now inhabit was formerly covered for a long time by the sea. Hence shells and other marine fossils are now found upon the tops of the highest mountains. The vast continents of Asia, Europe, Africa, and America, were then at the bottom of an immense ocean, and covered with every thing which the present sea produces. The ebbing and flowing of the tides, and the diurnal motion of the earth, he thought were quite sufficient to account for the spheroidal shape of the earth, the formation and elevation of continents, and the phenomena of stratification this globe presents. The veins and fissures so common in rocks, were formed when the newly constructed planet was undergoing the process of drying, and therefore it cracked in the manner of clay when exposed to the sun. Some large openings were formed by the falling in of caverns in the earth, and thus the Straits of Thermopylæ, Gibraltar, the gaps in Mount

Caucasus, and the Cordilleras, were produced. It will be unnecessary to proceed any farther in the theory which this celebrated man endeavoured to establish, but one that can never be believed; as he finally informs us that the earth and all the planets in the solar system, were originally parts of the sun himself, and that they were detached from his body by the stroke of a comet! With what mighty force must that comet have been propelled! And how very singular that the pieces knocked off from the sun, are so regular in their dimensions and movements. These reflections will remind us of the state of Geological knowledge in his day; and while his name will long be remembered as a Naturalist, his opinions in regard to the Formation of the Earth, will only be quoted to amuse his successors in the Science.

## THEORY OF WERNER, OR, AQUEOUS THEORY.

At some very remote period, this globe was for a long time suspended in water, so that the tops of the highest mountains were then submersed. The water was undisturbed by rarified air, and not agitated by currents. In this vast collection of water, all the particles which now form the exterior coats of this earth, were held in solution. In this fluid was the nucleus of the earth, and crystaline deposits were made, investing the nucleus like the coats of an orange, thereby forming the Primitive Rocks of granite, gneiss, and all those which are destitute of organic remains. In this original deposit no animal or vegetable relics are to be found. Nor have any round pebbles been discovered in them; but in the first collection of earthy particles upon their surfaces, shells and fragments occasionally occur. These are therefore called Transition Rocks, in consequence of the earth having passed as it is supposed, from a chaotic to an habitable condition during their formation. At this period the ocean became filled with the finny tribes. The waters upon the earth now began to subside. They contained divided particles of the original rocks, which particles were deposited upon the nucleus, in horizontal layers. These layers contain many organic remains, and were called by Werner, Floetz, or Secondary Rocks.

During the subsidence of the waters, the primitive rocks were worn down by the violence of currents, and the particles contained in the water, were consequently deposited at a lower level than the tops of the highest mountains, which had emerged from the great deep, and could receive no further accumulation of particles from the solution.

Werner believed that through the agencies of wind, and disturbed state of the remaining ocean, violent currents were produced, which wore down and carried away large quantities of the primitive, transition, and secondary rocks in some places, and made large deposits in others, whereby inequalities of surface were produced. Hence mountains were formed, and those deep ravines which are every where exposed. As the waters continued to subside, deposits were still going forward that produced clay, gravel, and what are now termed alluvial formations. The water at last observed a proper level. Its bounds were fixed, and the surface of the earth became inhabited.

There are a variety of substances that do not appear in regular layers upon the earth, but are only met with occasionally under very irregular limits, and uncertain dimensions. Rock salt, coal, limestone, basalt, with others of that character, are thus distinguished, and were called by Werner, subordinate formations. He has also another class of rocks produced by subterraneous fires, with which his classification of strata is concluded. He has arranged all the rocks under the terms primitive, transition, secondary, alluvial, subordinate and volcanic productions.

It will doubtless be observed, that no attempt has been made to enter into the minute descriptions, and extensive details given by this celebrated Geologist: such is not the object of this work, but merely to give a general outline of a theory which has been strongly supported, and has certainly many facts favourable to conclusions to which it leads. With many positions evidently correct, it is mixed with hypothetical notions that cannot be admitted. To the Neptunian theory there are many objections, and although its general outlines may be correct, modern discoveries have decided that many of its details are altogether absurd and inconsistent. It pre-supposes the solubility of many minerals in water, a thing impossible in the present state of our knowledge. It cannot account for the inclining and vertical position of rocks; and although it may give a satisfactory explanation for the organic remains of marine productions, it affords not a shadow of reason to account for super-marine fossils.—When the whole of the earth's surface is taken into consideration, the Theory of Werner must be given up, as many of its doctrines are much at variance with plain matter of fact.

## THEORY OF HUTTON, OR, IGNEOUS THEORY.

DR. HUTTON believed that the whole surface of the earth was undergoing a gradual decay, and that the destructive process furnished the materials for the regeneration, and support of the animal and vegetable kingdoms. That the materials of former continents, were by the action of the atmosphere and water, transported and deposited in the bottom of ancient seas. The summits of the loftiest mountains yielded to currents of air, and the tempestuous action of rains. The particles disseminated by these causes were carried downward, and in their course supplied fertile vallies, and finally filled the reservoirs of the mighty deep. That by the action of subterraneous fires, the same materials were elevated to form continents and islands. Some rocks were only softened and thrown upwards, while granite and other unstratified formations, were completely melted and forced in a perpendicular direction through the incumbent strata. And by the same means, veins of ore were filled by metallic materials, thrown upwards into the strata above. The Doctor's theory intimates, that the transition and secondary rocks of Werner, were collected at the bottom of the ocean, through the medium of operations still acting upon the earth ; and that the primary rocks were formed beneath them by the action of heat. This opinion is supported by the crystaline texture, hardness and fracture they have produced, of the secondary rocks with which they have come in contact. Hence by the action of subterraneous fires, rocks have been hardened, and those changes produced that the surface of the earth now exhibits. The production of alluvium and the various kinds of soil are explained in a similar manner in both theories. Thus, by water the materials of rocks have been produced, and by fire they have been elevated and rendered solid.

This theory has received able support from the pen of Mr. Playfair, whose talents would not have been lost upon any subject, and whose style and eloquence will long be admired. But how will this theory accord with the fact, that often in stratified rocks there is a sudden change from one stratum to another. Beds of shale, coal, sandstone, &c., alternate with each other, and are sometimes found under beds of limestone. How could such a variety occur from one distinct and uniform cause ? What would have become of the pyrites contained in sulphur and in anthracite ? And what would have become of coal had intense heat been applied ? The circumstances already stated, would be more likely to result from aqueous solution.

## THEORY OF BURNET.

The theory of Burnet seems to have been similar to that of Hutton, in some particulars. The following passage is certainly very sublime, and was highly eulogized by Steele.

" Let us now " says he, " reflect on the transient glory of the earth ; how by the force of one element breaking loose upon the rest, all the beauties of nature, each work of art, and every labour of man, were reduced to nothing : all that once seemed admirable is now obliterated, all that was great and magnificent has vanished, and another form and face of things, plain, simple, and uniform, overspreads the earth. Where are now the Empires of the world ; where the Imperial cities, the pillars, trophies, and monuments of glory ? what remains, what impressions, or distinctions do you now behold ? what has become of Rome, the great city : of eternal Rome, the Empress of the world, whose foundations were so deep, whose palaces were so sumptuous ?—Her hour is come : she is wiped from the face of the earth, and buried in everlasting oblivion. But not the cities only, and the works of men's hands, but the hills, and mountains, and rocks of the earth are melted as wax before the sun, and their place is no where found ; all have vanished, and dropped away like the snow which once rested upon their summits."* This quotation accords well with one from " The art of Preserving Health" by Armstrong, who has given the following beautiful passage.

* Burnet's Theory, Vol. II. page 25.

"What does not fade; the tower that long had stood
The crash of thunder and the warring winds,
Shook by the slow but sure destroyer Time,
Now hangs in doubtful ruins o'er its base;
And flinty pyramids, and walls of brass
Descend; the Babylonian spires are sunk:
Achaia, Rome, and Egypt, moulder down.
Time shakes the stable tyranny of thrones,
And tottering Empires rush by their own weight.
This huge rotundity we tread grows old,
And all those worlds which roll around the sun—
The sun himself shall die, and ancient Night
Again involve the desolate abyss."

## MODERN GEOLOGICAL THEORY.

The Earth is a spheroidal body, the diameter from pole to pole is somewhat less than that which passes through the equator. It is composed of land and water. Surrounded by an atmosphere adapted to the animals that inhabit its surface, the earth has an annual motion producing the changes of season, and a diurnal motion which gives day and night. The sun and moon have a great influence upon the ocean, and produce tides. The surface of the dry land is beautifully diversified, with hills, and valleys, plains and hollows, rocks and earths, of various kinds. The bottom of the ocean corresponds with the earth, and is equally irregular. Islands are the tops of vast mountains, whose summits are elevated above the level of the sea. Were the sea to be lowered to any considerable distance, it would exhibit new islands and continents, similar to those now inhabited by man. On the earth there are tempestuous regions, where the elements rage at some seasons with great and irresistible fury. In some situations there are water-spouts and whirlpools; there are also volcanoes, from which fire, water, sulphur, and bitumen, are emitted, producing horror and dismay among all who behold them. Again, there are gulphs and cataracts, the hidden causes of earthquakes, and all those internal commotions which have existed since the world was created. On the other hand, there are vast regions of eternal snows, from whence mountains of ice float to warmer latitudes, dissolve and are seen no more.

The mineral kingdom is not under the influence of climate; rocks are similar in polar and equatorial regions. The volcanic fires of Iceland are equal in greatness to those near the Line, so that it may be said the solid parts of the earth, are altogether independent of the influence produced by the surrounding planets upon the softer materials of the globe. Rocks and minerals are similar in different countries.

It is well ascertained that the crust of the earth consists of a number of layers or strata, differing from each other in their structure and composition. The elementary substances of which they are composed are few in number, but variously mixed. They are in general siliceous, calcareous, or argillaceous. The different layers or classes of rocks, are placed in beautiful and regular order. Those which have been discovered at the greatest depths, are found in every instance to be the lowest in the order of super-position, and those that appear near the surface are never found beneath them. Sometimes the lowest formations appear on the surface, and often form the summits of the highest mountains. In such instances they are uncovered by those layers, which in other places are deposited upon them in the greatest regularity.

There is perhaps no situation on the earth, where all the different classes of rocks can be found existing from their lowest to their highest formations; but in different places they are all exposed ; and although some of the intervening series or strata, may be wanting to complete the order of the different layers, the next in succession fills its place, and the greatest harmony is preserved. This fact will be better explained by referring to the classification of rocks, and the relations they have to each other.

The crust of the globe presents three distinct series of substances. The first of these, and that upon which the others rest, is called the Primary or unstratified rocks. These appear to be coeval with the world, and afford a compact and substantial foundation for the less solid materials placed upon them.

The second series was evidently formed at a more recent date, and present a stratified texture. The strata are variously inclined, and always meet the primary rocks beneath. The different layers composing this series, have been denominated Secondary Rocks. These contain many organic remains, pebbles, and a great number of metallic and mineral substances, indefinitely combined.

Modern Geologists have established another series, which they have called Tertia Rocks. These appear to have been deposited after a remarkable change had taken place in the secondary strata. They are very different from the rocks beneath them, and constitute all the varieties found above the layers of chalk.

There cannot be any doubt that the Primary Rocks were formed by a process very different from that of the other series : all their characters seem to prove that they were elevated from the interior of the earth in a state of fusion, or in a fluid and elastic condition. They appear to have been raised by a great force, as the strata placed above them are singularly penetrated by their ejections from beneath. There is a great similarity between the Primary Rocks and the products of volcanoes, and the numerous observations recently made upon this subject, clearly exhibit the greatest analogy between the certain and distinguishable effects of volcanoes, and the phenomena presented by the minute disseminations of the Primary rocks that have been forced upwards into the Secondary formations.

The Secondary Rocks always lie above those called Primary. Their regular and parallel arrangement, the pieces of pre-existing rocks, the remains of organic bodies they contain, and every circumstance connected with their composition, arrangement, and situation, clearly prove that they were formed under water, by having their constituent particles thrown downwards from the surface. And it may be truly said, that "every stratum contains within its own domains records of its past history, written in characters intelligible to all nations, which no possible events can falsify or destroy." These records have enabled Geologists to arrive at some just conclusions respecting the relative ages of rocks, which possess almost all the certainty of mathematical demonstration.

In the secondary rocks are included a great variety of different beds of stone, which have been classed in the following order, descending from the chalk downwards.

The Chalk Group,
The Oolite Group,
The Red Marl Group,
The Coal Group,
The Mountain Limestone Group,
The Old Red Sandstone Group.
The Graywacke Group.

The following classification of Rocks in Great Britain is easily understood, and has been extensively applied. Such as require more minute divisions, should consult the admirable work of Conybeare and Philips, on the Geology of England and Wales.

ASCENDING.

PRIMITIVE.

1. Granite,
   - *a* Gneiss,
   - *b* Mica Slate.
2. Porphyry,
3. Serpentine,
   - *c* Steatite,
4. Marble.

SECONDARY ROCKS.

1. Clay Slate,
   - *a* Graywacke,
2. Transition Limestone,
3. Old Red Sandstone,
4. Coal,
   - *b* Argillaceous Iron-stone,
5. Red Sandstone (*New.*)
6. Limestone,
7. Chalk.

ISOLATED ROCKS.

Trap Rocks,
- *a* Greenstone,
- *b* Basalt,
- *c* Amygdaloid,
- *d* Toadstone.

The Tertiary Rocks contain a great variety of limestones, sandstones, clays, pebbles and sands, separated from each other into different groups, by distinct characters. They contain the remains of quadrupeds, birds, and near the surface the bones of mammalia. In this class of Rocks the organic remains are generally similar to those of animals now inhabiting the earth. This important discovery distinguishes its strata from those of Secondary formations, in which among all the numerous fossil remains of plants, and the animal creation, few have been found belonging to classes now existing upon this globe.

Wherefore it is believed that their inhabitants must have been destroyed previous to the consolidation of the Tertiary strata.

It is not the object of this work, to enter into the details connected with the evidences brought forward to support the modern theory of Geology. Perhaps enough has been already introduced, which if aided by common observation, will convince the reader that the Secondary and Tertiary Rocks have been deposited from some fluid in which their particles were held in solution. But in order to give some proof of the elevation of the Primary Rocks, it may be added, that "near the Island of Santorina, in the Archipelago, an Island rose from the sea 114 years before the Christian era ; in 1573 another Island arose at the same place. In 1707 a third appeared. In the year 1822, a whole line of coast, extending more than one hundred miles, arose four feet above its former level. A portion of Cutch, near the mouth of the Indus, including sixty miles of the coast, was raised sixteen feet above its original height, by an earthquake. New mountains were formed in Mexico, in the year 1759. A new Island appeared off the coast of Sicily in the year 1831." And many other occurrences of a similar kind might be cited, all of which prove, that elevations of the Rocks have taken place from time to time since the world was first created.

From the foregoing circumstances, and the numerous facts that have been observed, Geologists have arrived at the following conclusions.—That all the elementary particles of the Secondary Rocks, have been at some remote period held in solution by water, and deposited in layers as they now occur, and have embraced the animals and plants, the remains of which now appear in them. That the Primary Rocks on the other hand, have at different periods since, or during the formation of the secondary strata, been thrown upwards in a state of fusion, and thereby have penetrated the superincumbent rocks. or become elevated so as to form the summits of the highest mountains. And finally, that the Tertiary strata are of much later origin than either, as they contain the remains of animals now existing upon the earth.

It only remains to take some notice of a very singular and important class of Rocks, which occur both in Primary and Secondary countries; and are as much varied in their character and appearance, as they are in their situation. We mean the Trap Rocks of Werner, and the Whinstones of Hutton. They include all the formations called greenstone, basalt, amygdaloid and toadstone. The columnar basalt forms those celebrated and beautiful structures of the Island of Staffa, one of the Hebrides; and the Giant's Causeway, upon the coast of Antrim, Ireland. This class of rocks is now generally believed to be of volcanic origin, from its great similarity to more recent lava. Its rocks contain many varieties of crystalized minerals, and form the most stupendous cliffs of Nova Scotia.

# INTRODUCTION
TO THE
# STUDY OF MINERALOGY.

## CHAP. I.

1. MINERALOGY is the Science which obtains a correct knowledge of the properties, relations, and combinations of all mineral substances, and enables us to distinguish, arrange, and describe them.

2. Chemical Mineralogy investigates the chemical properties, and discovers the elementary parts of mineral compounds.

3. Geographical Mineralogy informs us where minerals are found, and the particular situation where they are deposited.

4. Simple minerals are composed of similar particles, and are homogeneous.

5. Compound minerals are composed of more than one simple substance, united or attached to other substances.

6. In the study of Mineralogy, it is often necessary to seek the assistance of philosophy, chemistry, and natural history, to obtain a correct knowledge of the mineral under examination.

7. In order to arrange minerals into proper classes and orders, it is necessary in the investigation of their

properties, to consider all the characters they present. Those characters are divided into physical and chemical. Each of those divisions includes a great variety of circumstances, that should be duly considered.

8. The most important of all the physical properties of minerals, is that by which those regular solid bodies are formed, called crystals.

## CHAP. II.

## CRYSTALOGRAPHY.

1. Crystalization is a very remarkable process, whereby all the simple mineral substances arrange themselves into regular and determinate bodies, surrounded by plain faces, right lines, and angles well defined.

2. From the regular forms crystals present, it is evident that the various particles of which they are composed, have also regular forms. These particles by chemical attraction and affinity, unite themselves layer upon layer, in the manner cannon shot are sometimes piled, so that a perfect form, bounded by right lines, is produced.

3. The integrant particles of every simple substance, always possess similar figures. Hence it might be supposed that any collection of such particles, would possess a similar figure: but such is not the case, for different combinations assume different forms, and different causes produce this seeming want of harmony.

4. Therefore the same mineral will often appear under very different forms. For instance, carbonate of lime, having a rhomboid for its primitive form, will exhibit a hexaedral prism, and a dodecaedron, with triangular or pentagonal faces.

5. The difference in the forms of crystals, arise from a different arrangement of their integrant particles. Thus cubic crystals of the sulphuret of iron, will some-

times so arrange themselves, as to produce a cube, an octaedron, and a solid contained under twenty triangular faces.

### Primitive Forms.

Every substance capable of crystalization, has one particular form natural to itself. This is called its primitive form. But an accumulation of particles in a decreasing ratio, may take place upon any of the sides of the primitive form, so as to produce a great variety of figures. For an example,—all the different secondary forms of the garnet are reduceable to one, by mechanical division ; and its primitive form in every instance, will be found a dodecaedron.

The following are the primitive forms of crystals, so far as they have yet been discovered.—1, The Cube ; 2, the regular Tetrahedron ; 3, the regular Octahedron ; 4, the rhombic Dodecahedron ; 5, the Octahedron with a square base ; 6, the Octahedron with a rectangular base ; 7, the Octahedron with a rhombic base ; 8, the right square Prism ; 9, the right rectangular Prism ; 10, the right rhombic Prism ; 11, the right oblique angled Prism ; 12, the oblique rhombic Prism ; 13, the doubly oblique Prism ; 14, the Rhombohedron or Rhomboid ; 15, the regular hexaedral Prism.

### Secondary Forms.

From the foregoing remarks it will appear evident, that crystals must by the laws of their formation, present a great variety. Indeed, they are discovered in almost every possible shape that regular can be made to assume. Let the primitive forms already mentioned, have successive layers of particles placed upon their faces, each layer decreasing a row of particles on one or all of the edges of the primitive form, or let decrements be made on the edges of the crystals, and some idea of the number of secondary forms can be imagined. The student in Mineralogy will derive much advantage from having pieces of wood, cut into the forms of those geometrical figures, placed before him when he is examining any regular crystal ; and he will soon discover, that a knowledge of geometry is necessary to his advancement in the Science ; for from the forms crystals present, they are distinguished from each other, and the minerals to which they belong are properly arranged.

## CHAP. III.

## EXTERNAL CHARACTERS OF MINERALS.

The external characters of minerals, are those discovered by inspection or simple experiment. They are very numerous, and require minute investigation to point out the difference that exists among them. The terms used in the description of minerals, should be well defined and correctly applied ; for it is evident that many different opinions have arisen among Mineralogists, from the uncertain meaning of words they have used, in their descriptions of the substances examined. It is not the object of this work to go into the details connected with this part of the subject. Such details are only to be found in extensive treatises on Mineralogy, and require laborious study and observation before they can be applied.

For the appropriate language now generally used to describe Minerals, we are indebted to the celebrated Werner, late Professor of Mineralogy at Freyburg, in Upper Saxony. The following arrangement of external characters has been adopted by Professor Cleveland, and includes all that is necessary to be considered.

| | |
|---|---|
| Colour, | Changeable colours, |
| Lustre, | Transparency, |

| | |
|---|---|
| Refraction, | Sound, |
| Form, | Cohesion, |
| Surface, | Hardness, |
| Touch, | Frangibility, |
| Coldness, | Structure, |
| Odor, | Fracture, |
| Taste, | Shape of fragment, |
| Adhesion to the tongue, | Tenacity, |
| Soil, | Magnetism, |
| Streak and powder, | Electricity, |
| Distinct concretions, | Phosphorescence, |
| Flexibility and elasticity, | Specific gravity. |

## CHAP. IV.

## CHEMICAL CHARACTERS OF MINERALS.

The chemical characters of minerals are highly important, as they discover the component parts of each kind, decide upon their classes, and point out the various uses to which they may be applied. It will only be necessary to describe in this place, such chemical experiments as are generally employed in the description of minerals, are easily performed, and require but a simple apparatus. For the complete analysis of a mineral, can only be successfully conducted with a perfect knowledge of chemistry, and an expensive laboratory. Hence the blowpipe and the acids form almost the whole of the chemical means, by which the metals in all their combinations, are detected.

### Fusibility of Minerals.

The blowpipe affords the greatest facilities for discovering the constituent parts of almost all minerals; and although we cannot know at what temperature fusion takes place, the various appearances metallic substances exhibit while melting, are clearly brought to view, and we have also the advantage of examining the different products of fusion. These products are often very characteristic of the mineral under examination.

In general the common blowpipe used by goldsmiths, will answer every purpose, and a little experience will enable an adept to use it in a proper manner. It may not nevertheless be improper to add, that the air should be forced through the instrument by the action of the muscles of the face and lips, and not by those of the chest. The breathing must be kept up through the nostrils, while the air is propelled through the pipe. Any kind of flame may be used in experiments with this useful instrument; but that from an oil lamp is preferable to any other. The wick should be large, and olive oil will yield the most powerful flame.

If the flame of a lamp be examined under the influence of the blowpipe, it will appear in two unequal parts. The external flame is the largest and most luminous. The internal flame is smaller, more regular, and of a blue colour. The external is the oxidating flame, and the internal the reducing flame. The greatest heat is a little within the point of the latter, where the mineral to be examined should be placed. The external flame will retain the heat and equalize its distribution. The greatest heat is obtained by blowing moderately and steadily. The piece of mineral to be examined should be a little larger than a pin's head, and supported on a piece of charcoal made from alder or pine, which is preferable to any other kind. Platina, asbestus, and glass tubes, are sometimes used for supports, but in common experiments the charcoal will answer every purpose. In using the blowpipe it is often necessary to employ re-agents, or fluxes, those most generally employed are soda, nitre, nitrate of cobalt, and borax. The effects of each should be carefully noted. The tyro in Mineralogy will derive much advantage from the perusal of a treatise on the use of the blowpipe ; and when this simple instrument is properly used, it will enable him to ascertain the distinctive characters of almost all the minerals, so that with a good manual of the science at his elbow, he can arrange and classify his specimens in a scientific manner.

### Action of Acids.

The acids generally used as tests for minerals, are the nitric, sulphuric, and muriatic, diluted with one or two parts of water. The mineral to be examined should be powdered, and placed in a concave piece of glass. A common watch crystal is well adapted for the purpose. The acid should be poured upon the mineral. And it must be carefully noticed, whether the solution is made quietly or with effervescence—whether the effervescence be quick, violent and perfect, or slow and partial. The gas also, which escapes, must be examined. In some instances a complete solution is the result, in other instances a residue is left behind.

## CHAP. V.

## DESCRIPTION OF MINERALS.

In order to describe a mineral, and determine the class, order, genus and species to which it belongs, its physical and chemical characters, must be duly considered and compared with those of a system already formed. In the first place it should be observed what is the form, regular or irregular. Obtain the primitive form if possible by mechanical division, then the hardness and specific gravity must be ascertained with the greatest possible accuracy. These characters serve as distinct data. After the examination has been thus far conducted the particular characteristic may be applied, when it will be soon discovered what characters agree or disagree, and also those that are altogether wanting. Let the substance under examination be carried through the classes of an established system, and in general it will be easily discovered to which of them it belongs. Then by proceeding to the different orders of that class, its characters will be recognised, and so on through the orders, genera and species, until the mineral is placed in its proper situation, having its properties fully determined.

In the examination of minerals, difficulties will naturally arise in consequence of the various combinations and appearances they often assume. And much labour and careful examination is often required, to determine the place a single specimen should possess under any classification, and the proper name by which it should be designated. But in proportion to such difficulties must experiments be multiplied. After all the physical characters have been duly considered, the action of the acids known, the blowpipe used, and the products of fusion carefully examined, almost always every species of the different minerals will be clearly made out, and can be placed under the classes where they belong. If all the experiments tried do not prove satisfactory, a chemical analysis must then be instituted, whereby its component parts will be known and separated. These remarks are intended for those who may not possess a proper apparatus for such an analysis, nor wish to pursue the study so far, as to examine chemically every substance taken from the earth. But the scientific Mineralogist will feel a pleasure in the investigation of every specimen the mineral kingdom affords.

## CHAP. VI.

## ARRANGEMENT OF MINERALS.

It is to be regretted that Mineralogists have used different arrangements of minerals, and several of them have applied nomenclatures agreeable to their own particular views ; hence the Science has been retarded in its progress, and much confusion produced. Professor Mohs, the successor of the celebrated Werner, has adopted an arrangement of minerals from their external characters. The species are determined by their primitive forms, cleavage, hardness, and specific gravity.—This arrangement with some alterations, has also been employed by Jameson, in the third edition of his Mineralogy. The results are these,—that ores of the same metal have been separated from each other in their classification, and some of the metals have been associated with the earths. Whereas it is obvious, that the ores of each metal should be arranged by themselves.

## TABULAR VIEW OF MINERALS,

DESCRIBED IN THIS WORK.

SPECIES SUBSPECIES *Varieties & Subvarieties.*

Sulphate of Barytes,
- lamellar
- compact

Carbonate of Lime.
- Calcareous Spar.
  - crystalized
  - laminated
- granular
- compact
  - earthy
    - Stalactite
    - Alabaster
- Brown Spar.
- Marl.
  - indurated
  - earthy

Arragonite.
- fibrous

Sulphate of Lime.
- Selenite.
  - massive
    - acicular

SPECIES SUBSPECIES *Varieties & Subvarieties.*

- Gypsum.
  - fibrous
  - granular
  - compact
  - branchy
  - snowy

Sulphate of alumine & potash

Quartz.
- common
  - limpid
  - smoky
  - yellow
  - blue
  - rose red
  - milky
  - granular
- Amethyst.
- Cat's eye.
- Chalcedony.
  - common
  - cacholong
  - carnelian
- Siliceous Sinter.

SPECIES SUBSPECIES *Varieties & Subvarieties.*

- Michaelite
- Heliotrope.
- Opal.
  - Semi-opal.
- Hornstone.
- Jasper.
  - common
  - striped
- (Agate.)

Mica.
- laminated

Leucite.

Schorl.
- common

Feldspar.
- common
- granular

Basalt.
- columnar
- tabular
- amorphous

Garnet.
- common
- manganesian

Phrenite.
- fibrous

Stilbite.

Zeolite.

Laumonite.

Analcime
- Sarcolite.

Chabasie.

Apophyllite.
- Albin.

Tremolite.
- common

Asbestus.
- common

Augite.
- common

Hornblende.

SPECIES SUBSPECIES *Varieties & Subvarieties.*

- common
  - basaltic
  - fibrous

Diallage.
- metalloidal

Talc.
- common
- indurated
- Steatite.

Chlorite.
- common

Argillaceous Slate.
- Argillite.
  - shining
  - Roofslate
- Shale.
- Aluminous Slate.

Claystone.

Clay.
- Potter's
  - Pipe Clay
  - varieg'td.
  - Loam
- Reddle

Anthracite.
- slaty

Coal.
- cannel
- slaty

Lignite.
- Jet
- brittle
- Bituminous wood

Peat.
- compact

Native Copper.

Sulphuret of Copper.

Gray Copper.
- arsenical

Red Oxide of Copper.
- capillary

| SPECIES SUBSPECIES *Varieties & Subvarieties.* | SPECIES SUBSPECIES *Varieties & Subvarieties.* |
|---|---|
| Carbonate of Copper. | Brown Oxide of Iron. |
| blue | hematitic |
| green | compact |
| | ochrey |
| Sulphate of Copper. | Argillaceous Oxide of Iron. |
| Sulphuret of Iron. | nodular |
| common | common |
| magnetic | jaspery |
| | Bog Ore |
| Magnetic Oxide of Iron. | Carbonate of Iron. |
| Specular Oxide of Iron. | Sulphate of Iron. |
| micaceous | Phosphate of Iron. |
| Red Oxide of Iron. | Sulphuret of Lead. |
| Red Hematite. | granular |
| compact | cobaltic |
| ochrey | Oxide of Manganese. |


A NEW MAP OF
NOVA SCOTIA,
Cape Breton,
Prince Edward Island,
and part of
NEW BRUNSWICK.
1836.
Sold by C.H.Belcher,
Halifax N.S.
PART OF NEW BRUNSWICK
PRINCE EDWARD ISLAND
NORTHUMBERLAND STRAIT
CAPE BRETON ISLAND
BAY OF FUNDY
MINAS BASON
WESTMORELAND
CUMBERLAND
PICTOU
SYDNEY
HALIFAX
HANTS
KINGS
ANNAPOLIS
LUNENBURG
QUEENS
SHELBURNE
ST JOHN Co
British Statute Miles

## Explanation of the Maps.

The South side of the Province, painted *brown*, is the Primary District, and is composed principally of Granite, Gneiss and Mica Slate.

The *blue* denotes the Slate District, which is composed of Slate, Greywacke, and Greywacke Slate.

The Red Sandstone District is painted *light red*.

The *crimson belts* shew important beds of Iron Ore.

The Trap Rocks are painted *green*, and the Coal *black*. See Geological Divisions.

# REMARKS

ON THE

# Geology and Mineralogy

OF

# NOVA SCOTIA.

NOVA SCOTIA presents many difficulties to the natural philosopher. With extensive tracts of country, covered with dense forests, and trackless mountains, where the moose and carriboo still enjoy quiet repose from the yell of the Indian, or sound of the woods-man's axe; the Geologist amidst his arduous labors to discover her structure, must meet with frequent disappointments in a country, that in regard to cultivation and improvement is yet in its infancy. No shafts have been opened or excavations made in the Province, except such as are confined to the raising of coal. Hence the opportunities afforded for examining the different strata of rocks upon which the soil is placed, are very limited. And as but a small proportion of the surface has been cleared of timber, the labor of examining the country, even superficially, is greatly increased. The facilities for obtaining Geological information are confined to the shores, and those places where the removal of the earth for making roads, has uncovered the rocks which lie beneath.

Almost surrounded by the sea, Nova Scotia does indeed upon her shores, not only offer the most majestic and beautiful scenery, but affords an opportunity to any enquirer, to examine immense precipices and strata of rocks, from which some just inferences may be drawn, in regard to the internal formations of the country. But in general the shores only give a knowledge of the circumference, a short distance from which in some places, other kinds of rocks are deposited. And it should be considered, that every section of the country upon the border of the sea, is very superficial, extending only from the soil to the lowest level of the water. Much information may however be obtained by examining the banks of rivers, deep ravines, and the tops of the highest mountains; although such examinations are not always attended with safety, and are never made without great labour. From these circumstances it will not be supposed, that a perfect Geological description of the country can be given, until time and cultivation shall have removed the obstacles that now lie in the way.

It should nevertheless be observed, that numerous as the difficulties in the prosecution of Geological enquiries may appear in Nova Scotia, there are some circumstances connected with the rocks themselves, which are favorable to their examination, and of much importance in the discovery of useful quarries and mines. These favourable circumstances arise from the highly inclined, and in some situations the almost vertical position of the strata of different classes of rocks. For if the different layers of each class of the secondary rocks had been horizontal, or remained in that position in which it is supposed they were originally deposited, it would have been impossible without making deep excavations, to have arrived at any knowledge of the lower classes, now in many places so thrown out of their original level, by the elevation of immense ridges, that extensive ranges are exposed, and may be examined without the labour of removing even the earth from the surface. An instance of this kind is exhibited in the clay slate of the Horton Mountains. The slate is an older formation than the new Red Sandstone, that would have covered it, had it not been turned up, so that the sandstone leans against its north side, in contact with its strata.

Again, it should be observed, that in consequence of the rapid currents upon the coasts of this Province, and the exposed situation of the country to the sea, added to the advantages gained by the great height the tide rises in the Bay of Fundy, an excellent opportunity is afforded the Mineralogist, to obtain those interesting minerals with which the country abounds. The effects of a turbulent sea, frost, and the action of the atmosphere, produce such destructive results upon the solid materials, thrown up as barriers against the encroachments of the ocean, that every succeeding season opens a new field to those interested in the discovery and collection of minerals.

But without entering into any further details of the advantages or disadvantages offered by the Province to the natural philosopher, enough has been already discovered, enough has been noticed and examined, to convince even the most sceptical, that Nova Scotia contains within her bosom, immense and inexhaustable treasures. Her resources far surpass those of the neighbouring Colonies, and in time will enrich her sons, and render a Province now by some considered of little value, a *desideratum* of less favoured countries, on account of her valuable mines. These opinions are not the result of idle speculation, or the extravagant fancies of superficial examinations; they are the sentiments of all scientific men who have visited the country, and made themselves in some degree acquainted with the numerous minerals it contains. Therefore let it never be supposed, that this Colony is doomed to the character of a worthless and barren appendage to Great Britain, for time will develope her almost hidden treasures, and prove that her soil is not only fertile, but her rocks contain an abundance of substances, which are indispensable for the necessities, luxuries, and happiness of mankind.

Let the great extent of the Coal fields of Nova Scotia; the beds of Iron Ore, Sandstone, Gypsum, Limestone; with every kind of material proper for building, both the massive cathedral and the humble cottage, be considered; the Copper and Lead, which will ere long be obtained in rich supplies, be taken into the account: and the above sentiments will be more generally believed, and this transatlantic settlement more highly valued. In confirmation of these opinions, it will be necessary to enquire into each section of Nova Scotia, produce such testimony as present discoveries will furnish, and collect such facts as are daily noticed. It is true, Nova Scotia does not enjoy the privilege of working her own mines, or the profit arising from the sale of their productions; but there is a satisfaction in knowing to what an amount we contribute to the interests of other men. No attempt will however be made to enter into this part of the subject, as it more properly belongs to the Legislator than the Mineralogist.

## GEOLOGICAL DIVISIONS.

It is necessary in pursuing an enquiry into the Formations of Nova Scotia, to divide the Province into four distinct Geological Districts. The lines which separate each division, extend from south west to north east nearly, and run in a longitudinal direction with the greatest diameter of the country. If a line be drawn from the Gut of Canso to Yarmouth, lengthwise the Province, crossing the Counties of Sydney, Halifax, Lunenburg, Queen's, and Shelburne, it will cover and run in the direction of the Primary and unstratified rocks of Nova Scotia.—Hence all the south side of the Province will be called the Primary District, for in it the Primary rocks are most abundant. On the north west side of the Primary District, and extending its whole length from Antigonishe to Cape St. Mary, there is an immense tract of country occupied by clay slate (argillite.) Hence the Middle Division of the Province will be called the Clay Slate District. Again, if a line be drawn from Annapolis to Merigomishe, and a curve made in the direction of Windsor River, all the remaining part of the Province will be called the Red Sandstone District, including the Coal Fields, through which the Cobequid chain passes. Lastly, the whole of the North Mountains, extending from Brier Island to Cape Blomidon,—the Five Islands, the Two Islands, Isle Hant, and all the Capes on the north side of the Bay of Fundy, will be called the Trap District, the rocks of which rest upon the Red Sandstone.

It must not be supposed however, that each class of rocks already named, appear always upon the lines that make those natural divisions. Such is not the fact, for they are variously indented by each other, irregularities and deviations from right lines occur probably in some places to a considerable distance ; notwithstanding in each of the divisions thus made, the Rocks from which each District is named are abundantly predominant, and occupy a large extent of country. Many advantages will arise from keeping this very general Geological description in view, for from a knowledge of these facts distinct data are offered the Geologist, that will save him much labor in following up the different associations existing among the secondary strata, and guide the miner while he is seeking for ores. For it would be as vain to search for coal on the south side of Nova Scotia, where granite prevails, as for granite among the sandstones of Cumberland, or grindstones among the trap rocks of Blomidon.

It is interesting to observe that the different Formations in Nova Scotia, correspond with those of the United States. In both countries they extend from north east to south west, nearly parallel to the Atlantic coast, having the transition and secondary rocks placed to the northward and westward of the Primary formations.—The same laws which have operated among the rocks of other countries, have their effects fully exhibited in this Province. And there are few Colonies—perhaps none of the same extent, where so great a variety in the scale of superposition, and so rich a field, is exposed to the natural philosopher, or to those who only seek the pecuniary profit of mining,—as the Province of Nova Scotia. A section of the strata extending from Halifax across the Province to Cumberland Basin, would expose a greater variety of rocks and minerals, placed in regular order, than has yet been discovered in any country of a similar magnitude. But these are facts which will be better explained, as the reader advances in the investigation of the subjects thus briefly opened.

In pursuing a description of the rocks and minerals of Nova Scotia, as far as they have yet been discovered and examined, it will perhaps be most convenient to commence with such as are considered to be of the oldest kinds, gradually advancing to those of more recent deposits; and therefore the Primary District on the south side of the Province will be first noticed.

## PRIMARY DISTRICT.

AT Canso, Granite appears in all its beauties, and forms the interior of the country to an unknown distance. The feldspar, quartz, and mica, composing this rock, exist in such quantities at this locality, that the stone in many places is admirably adapted for buildings, both on account of its resistance to the effects of the weather, and its beauty. Excellent mill-stones are made at White Point, the granite at that place being preferred to any other in the neighbourhood, for grinding all kinds of grain. In some specimens from the interior, the mica seemed wanting, so that they have the appearance of pieces of quartz rock; but the other ingredients in the composition determine its character. The mica when present, varies in colour from dark brown to black. At Country Harbour, St. Mary's River, White Islands, and several other localities along this coast, the granite is seen until within a few miles of Halifax Harbour, where the slate and quartz rock supply its place. How far it extends into the country to the northward has not yet been discovered, as there are few inducements to ascertain its boundaries. But there can be no doubt, that the Primary rock occupies a large portion of this part of the country. No indications of ores, were seen on any part of this coast, which is admirably constructed to resist the angry motions of the turbulent Atlantic. The whole of the shore is generally low, seldom rising more than five hundred feet above the level of the sea, notwithstanding the solid materials of its base form some of the highest mountains in the world. The whole of this coast as would be naturally expected, has a gloomy appearance. The shore is indented with many small harbours, rivers, and creeks, which afford shelter for fishing vessels during the summer season. In some of the valleys between the rude hills of granite, pebbles, sand, and decayed vegetable substances, form a scanty, although in some instances a productive soil.

## HALIFAX.

In proceeding along the coast, on the south side of Nova Scotia, and in a westerly direction from Canso, towards Cape Sable, a deep and narrow bay, terminated by an expanded basin, form the beautiful Harbour of Halifax, not surpassed by any in the world for convenience and safety. The rocks in the vicinity of the town of Halifax, and the surrounding country, are in general Primary. The granite generally appears on the summits of the hills, having the clay slate, and quartz rock, alternating in the valleys. The granite of the County of Halifax, contains a smaller quantity of mica, than is seen in that rock in other parts of the country. Its granular fragments are so intimately united, that they form hard and compact rock, which is seldom decomposed by the action of the weather, and therefore affords no fertility to the soil. Near the town there are two large granitic boulders, so placed as to form rocking stones. They may be rolled from side to side on their bases by light mechanical pressure, and form places of resort for the curious. One of these natural curiosities has been described by J. Leander Starr, Esquire, who with his usual neatness of style, says,—" The rock stands upon a broad flat stone, the surface of which is quite level with the ground, and it is rocked to and fro by the aid of a short wooden lever. Any stick found lying near the spot is picked up for that purpose, and it may thus be set in active motion, even by a child. Although very difficult to climb to its summit, I succeeded in doing so, and when my friend plied the lever I sensibly felt its rocking motion, as I walked about upon its surface. I examined it very minutely, and discovered the vast body to move upon a pivot of twelve by six inches, situate about the centre, and a slight rest at the north end. The quality of the rock is granite, but apparently somewhat porous." This stone is twenty feet long, fourteen feet wide, and nine feet thick. It contains two thousand five hundred and twenty solid feet, and will weigh upwards of sixty tons.

Pliny says, that " at Harpasa, a town of Asia, there was a rock of such a wonderful nature, that if touched with the finger it would shake, but could not be moved from its place by the whole force of the body." Several other rocks of this kind have been mentioned by the ancients. Some have supposed that rocking stones, or Logan stones, as they have been called, were monuments erected by the Druids, who pretended that they performed miracles by moving them by gentle means. It is not probable however, that those singular rocks in Nova Scotia, were thus placed to mislead the aborigines of the country, or to deceive the inhabitants of a more enlightened age. These blocks of granite in Nova Scotia, were evidently detached, and accidentally lodged in their present uneasy situations, by a volcanic eruption, or some violent force, which has acted upon all the rocks in their neighbourhood, and produced that disturbance, now so manifest. The quartz rock, that alternates with the clay slate, in Nova Scotia, is hard, compact, brittle and heavy. It contributes nothing to the production of soil, resists the sculptor's chisel, and occupies a portion of the country, where nothing but art and labour can produce vegetation. The beautiful farms on the peninsula of Halifax, and its vicinity, are only the monuments of industry, and the scientific agriculture of the inhabitants of the city. The quartz rock and granite, have by their naked appearance, induced many a passing traveller to condemn a fertile country, upon which Nature has bestowed her choicest gifts.

On the new road from the town of Halifax, to the Tower at Point Pleasant, the slate is seen rising above the soil in sharp prominent ridges. Several of these have been cut through in making the turnpike. Their strata run north east and south west, and dip to the northward at an angle of nearly fifty degrees. At the Tower, it is curious to observe those places where the scanty soil has been removed, leaving the surface of the rock smooth, even, and polished, as if its inequalities had been worn down by mechanical means. Not far from the Tower, and beneath the walls of an old fort, standing upon the shore of the North West Arm, there are two large iron rings, secured in the transition slate. Similar rings are fastened in the rocks of the opposite shore. To these a large chain was formerly attached, to prevent the enemy from advancing into the safe and beautiful bay, where shipping might remain secure from any attack by sea.

Wherever the granite is not predominant, the slate, greywacke slate, and quartz rock, alternate with each other. After crossing the North West Arm, and at the King's quarries, gneiss, mica slate, and clay slate, will be found to succeed the granite occasionally. The Primary rock is however, most abundant, and forms extensive ridges, and chains of rugged hills, stretching westwardly towards Margaret's Bay. Gneiss and mica slate, are frequently placed between the granite and clay slate. In some instances the transition strata pass into each other. Several quarries of these rocks have been opened, to supply the Town with materials for building. The granite is scarcely rivalled by any hitherto discovered in other parts of the world. It enters into the strong batteries of the Citadel of Halifax. These batteries when completed, will form an admirable and strong protection against the advances of an invading enemy. At Flinn's quarries, the granite is also of an excellent quality, and may be transported without difficulty.

In no part of the Province have we seen granite of so good a quality as that at the North West Arm, where an inexhaustable store of that rock, is laid up on the shore of a safe harbour, from whence it could be readily shipped to any part of the world. And it is probable that the granite of Halifax, will not only enter more extensively into the buildings of this Colony, but soon afford an article of exportation to other countries. One species of the slate is rather peculiar, and is called by the inhabitants "iron stone." It has a crystalline structure, is very sonorous, compact, and heavy. This rock, and the slate in general, contains much iron ; sometimes thin layers are covered with the carbonate of that metal. The sulphuret of iron, in cubic crystals of a brass yellow colour, sometimes occupy the slate to considerable distance. The transition rocks here, as in many places, when they approach the granite, appear to have been exposed to intense heat, from their vitreous appearance, and the quantity of sublimed sulphur still adhering to their layers. The clay slate also, contains at numerous places the sulphuret of alumine, and potash, or common alum. This frequently forms an efflorescence, or mould, in the cavities and fissures of the rocks. Sometimes the alum and sulphuret of iron are united. Hence this species of the argillite is identical with the *alaun chiefer*, of Werner, the alum slate of Jamieson, and the aluminous slate of other authors. There can be no doubt that large quantities of good alum, might be manufactured near the Capital of the Province, and at as cheap a rate as it is now imported from Great Britain. King James I., assumed the monopoly of the manufacture of alum to himself, and prohibited its importation. In 1625, its importation was again prohibited, by a proclamation of Charles I. In the mean time, the manufacture of the salt became profitable in England. A short distance southward of Flinn's quarries, there is a large granitic boulder, resting upon one of its smallest sides, on the highest pinnacle of a barren hill, and ready to roll down a precipice into the valley beneath. Great numbers of these detached masses, may be seen along the south coast of the Province, appearing at a distance like small cottages. The rocking stones already mentioned, are curious specimens of these isolated blocks. Some have strangely supposed that these rocks have been

## DARTMOUTH.

At Dartmouth, the slate appears above the surface. It composes most of the walls in that Town, and enters largely into the lost labour of the Shubenacadie Canal; the granite having been used only in such places as required strength and durability. From Dartmouth to Schultz's Inn, the argillite and quartz rock alternate with, and frequently pass into each other. Those rocks abound along the road, which passes on the lower grounds and sides of the lakes; but the granite was found composing the higher hills eastward and westward of the Grand Lake. The quartz rock is often regularly stratified, and is easily broken into rhomboidal blocks. Extensive fires a few years since, destroyed the forests to a great distance upon the Truro road, and have rendered the appearance of the surface more barren than it was before that event; and a small undergrowth of grey birch, scattered among the withered hemlocks, produces a singular, but not an agreeable landscape. We had been informed, that copper ore had been found on the west side of the Grand Lake, but were unable to discover any traces of that metal near its confines. The micaceous oxide of iron, seen in several places, might have been mistaken for the ore of copper. On the north side of the Grand Lake, the slate is met by the red sandstone, containing beds of gypsum, and compact limestone. From the high lands eastward of Schultz's Inn, the granite extends through the Musquodoboit settlement, to Guysboro. Slate quartz rock, and greywacke, accompany the Primary formation, which often raises its mountains, far above the level of the surrounding country. It has been remarked by Messrs. Jackson and Alger, that it is singular Messrs. Smith and Brown, should have called the quartz rock, trap. With trap it can hardly be confounded. Its connexion with the slate is intimate, and the rock itself, in all its characters, are quite sufficient to fix its proper name.

## SAMBRO AND PROSPECT.

At Sambro and Prospect, the granite abounds, forming sharp ridges, and separating extensive valleys. The quartz rock appears occasionally, and the slate in many places is altogether excluded. Over a large portion of the surface, the naked rocks are exposed, with scarcely a lichen sticking to the sides of their misshapen masses, which are scattered upon the more solid foundation in great confusion. A stunted spruce occasionally appears, drawing its support, like many of the animal creation, from the death and decay of its predecessors. At Sambro and Prospect Harbours, small collections of pebbles and sand, have afforded a resting place for soil ; but a toilsome day's journey into the interior, will only present to the eye, a dreary and barren wilderness.

## MARGARET'S BAY.

At Margaret's Bay, the Primary rocks recede from the coast, and some members of the greywacke group are exhibited. Thin beds of clay, and angular fragments of the neighbouring rocks, succeed ; and upon them a soil capable of cultivation, extends some distance from the seen, outcropping beneath the beds of clay, sand, and pebbles placed above it. The scattered fragments over the soil increase the labour of cultivation ; although from the heat they retain from the rays of the sun during the day, they assist the growth of vegetables during the night.

Mahone Bay presents one of the most delightful prospects in Nova Scotia. A deep, navigable basin, in which numerous islands exhibit their evergreen summits, almost surrounded by a closely populated, and neatly cultivated country, are not often seen in that natural and delightful order which is exhibited here. In the neighbourhood of the Town of Lunenburg, and at La Have River, the beds of clay, pebbles, and sand, covered at many points with good soil, afford those rich supplies, that Nature is pleased to award the industrious and honest farmer.

The old red sandstone in this part of the country, has contributed much to the production of soil, by its easy decomposition and gradual decay. But these remarks are applied to the margins of the bays, and rivers ; for upon penetrating the almost unbroken forests to the northward, the granite again assumes its dominion, and frequently barrenness prevails.

Two singular excavations have been made by the sea, in the rocks a few miles from the Town of Lunenburg. Cavities have been worn out, called the "Ovens." Into these the waves often rush with great violence, and the air being confined, bursts out, carrying before it the spray, like that made by the spouting of some enormous whale. We were informed by a very loquacious American, that these Ovens are the nests of the "sea serpents," so often seen near Boston. Such as are interested in the natural history of these singular animals, and believe in their existence, will perhaps be rewarded by paying the "Ovens" a visit.

## LIVERPOOL.

THE coast extending from Lunenburg to Liverpool, is similar in its appearance to the shore between Sambro and Margaret's Bay, being broken and irregular. Near the Town of Liverpool, and north of Mill Village, the Primary rocks advance towards the shore, and the whole face of the country is covered with white granitic masses. Some of these are of large and regular dimensions, resembling at a distance huts, and other rude buildings. In some places the imitation is so perfect, that what is here called a clear field, might be mistaken for a deserted village. The granite is more liable to decay than in the neighbourhood of Halifax, and from its decomposition produces a soil, that although scanty, is good and productive, affording the inhabitants of the Town, fine meadow and arable grounds.

The rapid river of Liverpool, rolling over shapeless masses of the Primary rocks, is destitute of that alluvium, which in other parts of the country, has been lodged upon the banks of fertile streams, so common in King's and Cumberland counties. This circumstance arises from the unyielding nature of the materials over which the water passes, and is common to all those streams taking their rise in, and flowing over Primary formations.

There are however in the interior of this County, numerous beds of clay, sand, and pebbles, resting between mountains of the unyielding rock; some of these were evidently at some former period, covered by lakes. They are now however, capable of being cultivated, and have excited the ambition of a number of sturdy countrymen, before whom the forest bows in humble submission, and falls "to rise no more." A few inferior crystals of smoky quartz or cairn gorm, were observed among the broken granite, near Mill Village. But few specimens, however, have been discovered in this County, to reward the labour of the Mineralogist; and the rocks only seem interesting, on account of the imitative forms they present.

## SHELBURNE.

The high lands forming the interior of Halifax, Lunenburg, and Queen's Counties, extend nearly through the County of Shelburne, to its western shore. This mountainous chain has not yet been explored; but from the general appearance of the country, and its elevations, the Primary District becomes narrow, and finally terminates by dipping beneath the sea, and giving place to secondary strata. In a few instances the old red sandstone makes its appearance, although the clay slate, greywacke, and greywacke slate, are always predominant. From the detritus of these rocks, the Marshes of Argyle and Yarmouth have been collected, with all those smaller deposits of alluvium, upon the rivers and creeks penetrating the coast.

A large part of this County is covered with fens, bogs, and barren wastes, interspersed over a surface of many miles in extent. These have arisen in consequence of the indurated and unyielding nature of the rocks ; and it was observed here, that the slate is much harder, and less liable to decomposition, than that of the south mountains of Horton, which yield a fruitful soil. Those large collections of mixed pebbles, sand, and heterogeneous substances, which have in other situations filled up deep depressions in the sub-strata of rocks, are in many places wanting in Shelburne. From this circumstance the soil cannot be retained, and sterility forms a melancholy feature of a large portion of the County.

Upon the shore extending from Cape Sable to Cape Forchu, the granite appears only to a limited extent, and the clay slate alternated with quartz rock, form the greatest portion of the western extremity of the Province ; and notwithstanding the unfavourable character we have been compelled to give of Shelburne, as a farming country, it contains many fertile tracts, and upon its estuaries, collections of good alluvial soil.

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## Remarks on the Primary District, or South side of Nova Scotia.

In the examination of the rocks on the South side of the Province, and those elevated peaks and ridges, that run nearly parallel with the coast, it must not be supposed by the reader, that the granite appears so often and so abundant, as the foregoing account might seem to imply.

In many situations, that rock is so much covered with diluvial detritus, and the dense forests, that great labour would be required to discover, even a small portion of its surface; and in general it can only be discovered by the appearance of the hills viewed at a distance: for cultivation has not extended far from the margin of the sea, the interior of the country still remaining a dreary and pathless forest.

It has been observed, that the slate succeeds the granite, and lies directly upon it; this is always the case when gneiss and mica slate are not interposed. Wherever the argillite is absent, the granite is in contact with quartz rock, greywacke, or the old red sandstone, and there are extensive portions of country, where these rocks alternate with each other, without the appearance of any other kind of strata. The hills of granite may be distinguished by their rugged, sharp and prominent summits. Those elevations where the quartz rock is predominant, are round and conical, while the ridges of clay slate, give the country a furrowed appearance.

If there be any peculiarity in the granite, so often mentioned, it is the generally dark colour of the mica it contains; much of it however, corresponds with specimens from the Hartz Forest, in Germany, and St. Michael's Mount, in Cornwall. The quartz rock is similar to that occurring in some of the Islands of Scotland. The argillite occasionally contains beds of granular limestone, chlorite slate, and talc.

Perhaps in some instances, the slate should be considered Primary, particularly when it seems to pass into gneiss, and mica slate. At such localities the argillite is more compact, vitreous, and altogether destitute of organic remains. In every instance it inclines to the granite, in the same manner that it was observed at Dartmoor in Devonshire, and Land's End in Cornwall. When the vertical and broken position of the clay slate in this granitic district, is considered; the veins which penetrate the distorted superincumbent strata, and appear in many instances to have been ejected from beneath, by ridges and shapeless hills of the more ancient formation; and all those circumstances and facts manifested in other countries, in regard to the once fused state of the granite, are viewed, little doubt can be entertained, that the modern theory of Geology is, in this respect at least, more than probably true.

Some notice will be taken of the foregoing facts, when the Clay Slate District is considered, and those places described which were visited for the purpose of obtaining correct information of their structure. The pipe clay beds which occur near Chester, would afford the purest supply for the potter's wheel, and might be converted to useful purposes. The granite affords the most durable materials for public edifices, although its extreme hardness is used as an argument against its employment. It is nevertheless, not only one of the most ancient, but one of the most interesting of Nature's productions, and forms an important feature in the Geology of the country.

That portion of the Province, which has been thus briefly described, is excavated by deep hollows and ravines, which give passage to the waters of numerous rivers and creeks. Large basins of table land are formed, being partially covered with fragments of rocks, beds of clay, sand and pebbles, where the agriculturist may derive an honest support from the labours of the field. Deep depressions of the strata are filled with water; hence numerous lakes occur, and in many instances form chains, greatly adding to the facilities of conveyance, and the beauty of the country.

## CLAY SLATE DISTRICT.

IN entering upon a description of this extensive Formation in Nova Scotia, it may again be necessary to remark, that this division of rocks, lies on the north side of the Primary formation, extending like a zone from Yarmouth to the most eastern part of the Province. It occupies a large extent of country, but is often overlaid, interrupted, or alternated by other strata. In many places it rises to the surface, which it occupies extensively.—At some points it is in contact with the granite already described; at other places it is in juxtaposition with gneiss, and mica slate. In these instances it may be considered primary. At several localities it is associated with greywacke, and the old mountain limestone, and contains numerous remains of marine plants, and animals. The primary slate of Nova Scotia is similar in all its characters and properties, with that found in Great Britain, and has the same Geological relations. Specimens from Gaspereau River, in Horton, cannot be distinguished from others brought from Bangor, in Wales; and there can be no doubt, that Nova Scotia will produce every kind that has been used, for the various purposes to which it is applied. Clay Slate is easily recognised. It has a simple, homogeneous appearance ; and the common drawing slate used in schools, furnishes a good specimen of this valuable rock. The primary varieties have a more shining and vitreous appearance than the secondary.

In describing the Clay Slate District, the same order will be observed, in which different localities were visited, beginning at Yarmouth, and proceeding in an easterly direction along the chain of South Mountains that forms the rear, and uninhabited parts of several Counties.

## CLARE TOWNSHIP.

After leaving the Town of Yarmouth, and passing along the shore towards St. Mary's Bay, the slate assumes its dominion, although it is occasionally alternated with greywacke, quartz rock, and the old mountain limestone. The strata of slate are variously inclined, and in some instances much twisted, and broken ; but generally they are so placed, as to support the opinion, that the primary rocks under their southern side, have been uplifted by some violent and sudden movement, which has thrown the neighbouring slate in its present leaning, and often perpendicular position.

The quartz rock is elevated above its companions, forming ridges, and mounds. These produce the idea of huge battlements, thrown up to resist the fury of an invading enemy. In some places the slate and quartz rock are intermixed, in others, feldspar makes up a part of the aggregate ; and they form a singular compound, would be difficult to determine the dimensions of this elevated mass of porphyry, but there can be no doubt it is very extensive. The interruption of the ore is known by its occurrence on the west side of the dyke, several miles from the "Joggins."

This dyke is feldspar porphyry ; its base is compact hornblende, in which are imbedded white concretions of feldspar. The ancients considered this kind of rock very valuable, and no doubt blocks may be obtained in Nova Scotia, which will vie in beauty with those employed by them in their splendid edifices, pieces of which still remind us of the art of their sculptors.

Following the Slate District in an easterly direction from the dyke of porphyry, nothing very interesting occurs until the Bear River is seen, rushing through the different windings in its channel, produced by the more easy reduction of the rocks in some places than in others. The slate forming the banks of this river, contains near its exit into Annapolis Basin, beds of the sulphuret of iron. This iron pyrites is generally amorphous, and compact, although a few crystals, presenting the cube its primitive form, and some with the cube truncated on all its angles, were observed. In consequence of the sulphuret being exposed to the atmosphere, it is decomposed spontaneously, and the sulphate of iron (copperas) is produced, and forms an incrustation upon the rock, in many places of considerable thickness. The sulphate thus produced, is however very impure, as might naturally be expected. The sulphuret of iron occurring at Bear River, is very well adapted for the manufacture of copperas, as it decomposes rapidly when exposed to the air and moisture ;

and perhaps at some future period, when this article may be required in the manufactories of the Province, the rocks already mentioned will supply copperas, equally pure as that now imported from Great Britain and the United States.

It may not be improper to remark here, that the sulphuret of iron during its decomposition, produces a great degree of heat, and has thus been, in several instances, the cause of the spontaneous combustion of coal mines. The temperature of certain warm springs, is also supposed to arise from the same cause. We have a specimen of this mineral now upon the table, that is daily suffering from the oxygen it absorbs from the atmosphere.

The next locality of interest appears at Clements, about three miles from the mouth of Moose River. Here the great bed of iron ore has been penetrated to considerable extent, to supply a smelting furnace, erected a few years ago, within a few miles of Annapolis Town; but which has now discontinued its operations, from causes not generally known.

The bed of ore is about nine feet wide, and its contents of a good quality; but as the ore is intimately blended with the slate, which forms its walls to a considerable distance, no distinct line of separation is seen, and its measurement becomes arbitrary. The ore is the magnetic oxide of iron,—of a steel grey colour, it affects the magnetic needle, and some specimens attract iron filings. It yields in the smelting furnace about fifty per cent. of good cast iron. Although iron ore is very abundant in Nova Scotia, it does not always occur in such quantities, nor in such situations, as will offer the hopes of profit to the

Miner; but this remark will not apply to the immense bed at Clements, for being elevated to the surface of the earth, and situated in a part of the country which at present abounds in fuel to supply furnaces, its thickness and quality also considered, it would for ages supply all the inhabitants of America, with an article more useful than any other ever discovered.

It is certainly remarkable, that imbedded in the ore, and the slate with which it is in contact and intermixed, the remains and impressions of marine animals are abundant. Some of them belong to classes the most interesting to the naturalist. They are the trilobite, tellinite, terebratulite, encrinite, ammonite, and other small crustaceous animals, appearing as perfectly as if they formed a part of those animals when they were alive. Each of those fossils will be noticed in another place, and although no attempt will be made to solve the theory of their former existence, and present extraordinary situation, yet such facts as will have any bearing upon the subject, should be accurately detailed. Upon examination it will be discovered, that the internal surfaces of these fossils, profusely scattered through the ore and slate, are crusted with phosphate of iron, sometimes in crystals. These crystals have been produced by the chemical union of the phosphoric acid in the shells, with the iron. In other instances the carbonate of iron is seen, occupying the situation of the original shell. Also the sulphate of lime, produced by an affinity existing between the lime contained in the shells, and the sulphur mixed with the ore. The decomposition of the animals, and their crustaceous coverings, must have been produced by some agent more powerful than water; and all the phenomena connected with them, can perhaps only be accounted for by allowing that agent to have been heat, the operation of which will now under certain circumstances produce similar effects; and would also unite the carbonic acid gas, contained in the before mentioned animals, with the lime of their shelly coverings, thus producing the salt so easily discovered in this metallic vein.

To support the arguments in favour of the aqueous origin of the iron ore of the South Mountains, it will be immediately observed, that the marine fossil shells contained in it, are almost sufficient to demonstrate the fact.

From whence came these shells; and by what mighty convulsions and changes in this globe, have their inmates been deprived of life, and incarcerated in hard, compact, and unyielding rocks? By what momentous and violent catastrophe, have they been forced from the bottom of the ocean, (where they were evidently at some former period placed,) to the height of several hundred feet above the level of the present sea, and even to the tops of the highest mountains? It is not an uncommon circumstance in Nova Scotia, to see the honest farmer ploughing up the ground once inhabited by myriads of living marine animals, although he may not consider that he is deriving his support from the wreck of a former world. But the laborious researches of the Geologist, have explained the causes of these phenomena, which in this Province are so abundantly presented to our notice.

It is evident that the slate and ore containing the shells already mentioned, were once at the bottom of an ancient sea, occupied with numerous species of radiated, moluscous, and crustaceous animals, which then enjoyed a perfect animal existence, upon a surface placed in a horizontal position. By some mighty revolution, the ground occupied by them has been uplifted, and their native submarine possessions converted into slate, and even iron ore. It has been already observed, that the strata of slate are highly inclined, and in many situations almost vertical. Hence it is impossible that those animals could have been deposited one upon another, or thrown confusedly into an open and perpendicular chasm left void in the earth ; this would have been contrary to known laws, and is immediately disproved by the facts observed. If it be true that the primary rocks have been thrown upwards by the expansive force of heat, (a fact which modern Geologists consider fully established,) is it not probable, that the bottom of the sea, with all its corals and shells, then resting upon the melted granite, was also thrown upwards, having its strata broken, distorted, and fixed edgewise, in the manner it is now found. We would not enter upon the arguments by which such opinions are established, they are however, such as explain almost all the phenomena of the slate, and its fossil remains.

But again it may be observed, that the iron ore of Clements is magnetic. It is difficult to suppose that the heat, which rendered the bed of iron ore capable of this singular influence, was derived from that attending the formation of the trap rocks of the North Mountains ; an opinion which Messrs. Jackson and Alger consider "undeniable." Had it been received from that source, all the rocks between those mountains and the ore, would have exhibited the marks of caloric. But such is certainly not the fact; and the trap rocks are placed in a situation indicating a date much later, than even the new red sandstone upon which they rest. If it be true that the primary rocks have been formed, and elevated by heat, there will be no difficulty in accounting for the magnetic properties of the ore, as that rock is not far distant from the metallic bed.

## ANNAPOLIS.

HUGE masses of granite, are scattered upon the surface between Clements and Annapolis; they are detached pieces from the Primary District, and often of large dimensions. These masses have not been transported far from their original places of abode, as the granite alternating with the clay slate, form the high and broken hills, appearing on the south side of the beautiful sheet of water, at the head of which the Town of Annapolis is built. The granite of this place contains a large share of shining black mica, and sometimes the component parts of that rock are collected in such large crystals, as to give it the appearance of breccia. The feldspar entering into its composition is easily decomposed; hence the rock decays, crumbles down, and enriches the soil. How far the granite predominates in a south direction from Annapolis, is not known, but from the appearance of the high lands, it probably occupies the surface to a considerable distance; it is certainly inferior to the slate, placed at the base of those peaks, which compared with the argillite in its channeled appearance, affords a singular and pleasing contrast.

At Annapolis it is interesting to observe the approximation of the North and South Mountains, diverging from this place like rays from a common central point. They expand gradually, until they reach the Basin of Mines, where the former terminates in a bold and lofty promontory, and forms the side of a very extensive and fertile valley, to be noticed when the Sandstone and Trap Districts of the Country, are considered. Among the misshapen masses and blocks of granite, appearing above the soil in the neighbourhood of Annapolis Town, we obtained two magnesian garnets, one of which is regularly crystallized, under twenty-four trapezoidal faces. The earthy chlorite of Jameson, also occurs in many of the detached pieces of Primary rock ; but from their brittleness, few specimens were found worth preserving. The soil in the vicinity of the granite and slate, of this part of the County, is in general luxuriant, although in many places along the side of the Mountain, it is very scanty.

Between Annapolis and Bridgetown, the granite appears in its proper situation, and forms the abrupt and barren hills seen on the south side of the beautiful river, which winds its way through the fertile marshes of the County, urging its waters forward to an opening in the trap rocks near Digby, where they are mingled with those of the Bay of Fundy.

Let such as doubt the existence of Primary rocks in Nova Scotia, travel the road from Clements to Bridgetown, where the granite not only appears in broken and unconnected masses, but presents a chain of mountains, which almost defies fertility, and marks the horizon with lofty and irregular mounds. The slate which accompanies the granite, sometimes contains chlorite, and it was expected that greywacke would also appear upon some of these mountains ; we did not however observe any of that rock, so common in other parts of the country.

Near Paradise River, and in the neighbourhood of Bridgetown, and at a Village called Lawrence Town, immense crystals of smoky quartz have been found from time to time, scattered among the soil. Sometimes from the decomposition of the granite, the summits of beautiful crystals of this mineral, are seen imbedded on their surfaces, and may be easily extracted. These crystals are identical with those found at Cairn Gorm, in Scotland, and hence their name has been derived. In some instances the crystals appear under the primary form, and present a rhomb slightly obtuse ; but in general they are six sided prisms, terminated by six-sided pyramids, variously bevelled and truncated. Some are almost as transparent as glass, some are of a rich yellow colour, while others have that dark smoky shade, which has given rise to the appellation of smoky quartz.

Frequently the Farmers in this part of the country, when ploughing their fields, uncover these beautiful gems ; therefore it is obvious, that the rock in which they were once secured, has been broken down, and decomposed, while the crystals from their more compact texture, have resisted the action of the elements, and remain isolated, among the common pebbles of the field. This kind of quartz is employed in jewellery, and adds much to the beauty of the cabinet.

From Mr. Longley, near Paradise Bridge, we obtained parts of two large crystals. One of these is a perfect six-sided prism, having a part of its hexaedral summit still preserved. Each of the sides measures two inches crosswise, and the length to the top of the prism is seven inches. A part of the other crystal measures six inches in diameter, and is beautifully transparent, reflecting in a certain position all the colours of the rainbow. Upon the surface of a large piece of the smoky variety, prismatic crystals of schorl, run in different directions, and when viewed through the transparent mass, render its appearance singular and pleasing. These specimens are becoming scarce; their beauty has increased the demand for them of late, and few pieces can now be obtained, without paying down their full value; notwithstanding a few years ago they were piled up among the common stones of the field, from whence many have been taken and transported to the United States. From Paradise River, on the south side of the Annapolis River, the road passes through a flourishing settlement. The granite alternating with the clay slate, often appears on the side of the South Mountain, forming bold and barren prominences, frowning over the fertile valley beneath.

The above described crystals of quartz, in some degree support the opinion, that granite is of igneous origin. They are well marked by their regular forms, and could not be produced by any means we are acquainted with, but by the agency of heat. In searching for these splendid specimens, the mineralogist will do well to examine carefully, for very often fine crystals from their smoky appearance, and the soil that clings to them, may be passed by unnoticed.

## NICTAU.

PURSUING the Slate District in an easterly direction from Bridgetown, the thick forests prevent the Geologist from following the direct course of the Iron Ore, which doubtless occupies its place among the strata of slate, until it reaches Nictau, where it is again exposed on the surface, affording an extensive and rich supply ; and possessing most of the distinctive characters of the ore at Clements. The continuance of the ore is known, from pieces being found at different points between those places ; and the ferruginous soil covering its bed, may be traced a distance of several miles. Boulders of granite may also be observed on the post road, but they gradually become less frequent at Wilmot, and Aylesford. The bed of iron ore at Nictau is about six feet and a half wide. It will afford an immense quantity of metal, at less expense than it can be procured at many other places, on account of its being divided into cubical masses, and therefore easily broken up. It has but a shallow covering of soil, a large proportion of which is the carbonate of iron. The walls of slate are distinctly separated from the metallic compound, and are not so much intermixed with the iron, as those forming the sides of the bed at Clements. This ore is very similar to that already described. It is the magnetic oxide of iron, possessed of metallic lustre, is of a superior quality, and offers every inducement for working. Several years ago, a smelting furnace was erected near the spot, and excellent iron is now in use in Cornwallis, which was manufactured at that foundry. It has since been deserted, in consequence of an influence said to have been used by iron merchants in London. This ore like that at Clements, abounds in marine organic remains, and the impressions they have made in the ore and slate, are extremely beautiful and distinct. They cannot fail to give every enquiring mind some idea of the wonderful changes which have taken place upon our Planet since its original creation. Millions of shell-fish, of the moluscous and crustaceous tribes, which once enjoyed a perfect animal existence, have been swallowed up by this ore, where their remains and perfect likenesses are yet seen, in the same natural and symmetrical beauty they possessed when alive. They are almost all bivalves of the genus *anomia*, although some were obtained resembling the *nautilus disens*, and *planorbis æqualis*.

The shells at Nictau, are as abundant in the iron ore as in the slate. That compound, which yields fifty per cent. of pure metal, also contains those ancient relics. Many Geologists have supposed, that metallic veins were filled by injections of melted matter from beneath ; others, that they have received their contents from above ; but without entering into the arguments of either side, the facts as they occur in the great western iron ore bed of the Province, are such as will in some degree disprove both of those opinions. Had the ore bed at Nictau, been filled from beneath upwards, it seems almost impossible that the shells now contained in it, would enter into its contents, and be scattered promiscuously throughout its whole extent. The same observation may apply to its having been filled from above. In either instance the shells which occupy the walls on both sides of the ore, would leave their impressions, or offer basso relievo's upon it, but could not be mixed among its masses. Wherefore considering those circumstances, and the admixture of the ore with the surrounding slate, it must be believed that they are of contemporaneous origin.

The Clay Slate of Nova Scotia, in general belongs to that class, called by the older Geologists, transition rocks ; as they supposed that those strata were formed at that period, when the earth was passing from a chaotic to an habitable state. But however just such opinions may be, it is evident that the strata and ore at Nictau, were formed posterior to the creation of the primary rocks. This fact is not only proved by the shells contained in the Slate District, but also by the occurrence of pieces of granite embraced in its strata, shewing at once its later origin ; for it is plain that any substance which encloses another, must have been in action, subsequent to the origin of the thing enclosed.

The strata of slate, and the bed of iron ore, are nearly in a perpendicular direction, extending from south west to north east. It is singular that the stratum of ore makes a gentle curve to the southward, and represents a segment of an immense circle. This fact is obvious on the farm of Mr. Banks, where a channel has been formed eight feet deep, by removing the ore to supply the Annapolis foundry during its operations.

It is somewhat difficult to account for this circular direction of the ore, although it is not impossible that the eruption of a dyke of porphyry near it, may have produced this peculiar circumstance.

About a mile and a half north west from the spot where the iron ore has been exposed, the Nictau Falls come foaming down a narrow and tortuous channel, worn out of the strata of slate. Several Mills have been erected at this romantic locality, a part of the river has been turned from its original bed, and compelled to perform the labour of sawing wood, and grinding corn. The snug farms and cottages on each side of this picturesque and rapid stream, render it a pleasant and interesting spot.

Were an iron foundry erected at Nictau Falls, it is impossible that it would be unprofitable. Only a mile and a half from the ore, the rapid river would supply a power, more than sufficient to carry machinery that might be required under most extensive operations; and the mountains to the southward, would supply fuel for many ages. In many countries this valuable bed of iron would not only become a source of private wealth and speculation, but also would be considered of vital importance to the Colony, wherever it should be discovered. Near the ore of the County of Annapolis, and in a situation where fuel is abundant, a large sum of money has been expended in erecting furnaces, and all those necessary buildings connected with the manufacture of iron. Workmen were employed, the ore smelted, and found rich, and the whole establishment commenced with that energy, which seemed so desirable to a country sending abroad for ploughshares, harrow teeth, and sickles. But almost in an instant, the demon of the land spreads out his wings over the treasures of the Province—the foundry is deserted and sold, at a price too low to be named.

It will perhaps be said, that the high price of labour retards the progress of manufactories in this Province; but this cannot be the real difficulty in the present case, for labour is equally high in the United States, where manufactories are extremely profitable. All the circumstances were doubtless considered beforehand, in regard to the Annapolis foundry, for they were nicely calculated by Americans themselves. And we hesitate not to declare that the mining, and smelting of the iron ore at Clements, and Nictau, may be as profitably conducted as it can be in any other part of the world. When we lifted the ore from the bed at Nictau, with a spade imported from England, and broke some of its masses with a hammer of Swedish iron and German steel, we could not refrain from giving utterance to some unpleasant feelings, and lament over a country whose resources seem blighted and forgotten.

Upon the road which extends from Nictau to Liverpool, and crosses both the Primary and Clay Slate Districts of the Province, we observed a kind of Porphyry similar to that rock at Clements. This Porphyry forms an extensive dyke, that crosses the strata of Clay Slate, and the iron ore rather obliquely. The direction of this dyke is distinctly marked by its being a little more elevated than the neighbouring rocks, and apparently covered with a different kind of timber. This rock is of a pale blue color, its base is hornblende, containing crystals of white feldspar, and the aggregate resembles porphyry brought from Ben Nevis, one of the highest mountains of Scotland. The great growth of timber, and thick underbrush on the road, are obstacles not easily overcome, and their entangled branches prevent any extensive examinations of the rocks over which they are thickly spread. Although the hare and fox may pass along in safety, the hands and face of man can scarcely escape unhurt. Advancing upon the road to Liverpool, the slate will again be seen, alternating with the granite, in the same manner that it does at Croghan Kinshela, in Ireland. In one instance Gneiss was observed, and in another place mica slate appeared in large tabular masses, leaning against the sides of an abrupt mass of primary rock.

The clay slate is superior to the mica slate ; the granite supports extensive tracts, that only afford pasture for the moose and carriboo which have escaped the hunter's vigilance, and are often seen playing their antic pranks upon them.

Between Nictau and Liverpool, and among the detached pieces of argillite, we discovered a substance having a feeble metallic lustre, of a lead grey color, with a tarnished surface. Its streak is metallic fracture foliated, and it corresponds with the foliated copper glance of Jameson. Before the blowpipe it gives the fumes of sulphur, and yields a small globule of copper, mixed with iron, hence it may be denominated the sulphuret of copper. In what quantity it exists, is unknown, for a toilsome day's journey had produced some fatigue, and we, although reluctantly, plodded homeward from a place, which the numerous duties of life, have prevented us from visiting since. The appearance of the sulphuret of copper, was indeed unexpected, and produced at the time much interest, particularly as it is like the beautiful specimens of that mineral found in the mines of Cornwall, among the slate called by the miners *Killas*.

The relation the slate in Nova Scotia, holds to the granite, its similar direction, and the indications of copper already mentioned, compared with those circumstances, as they exist in Derbyshire, and other parts of Great Britain, will support the opinion, that the Slate District of this Province contains copper, and probably in abundance. And as tin frequently occurs in the neighbourhood of copper, it is far from being improbable, that our uninhabited mountains, and hills of slate, will at some future period, supply that quantity an increasing demand requires. But as the situations where those valuable minerals are deposited, are now covered by thick, unfrequented forests, soil, and decayed vegetable matter, and more especially as all stimulus is taken from the inhabitants to pursue useful enquiries of this kind—all the profits arising therefrom, would only fill the coffers of a few individuals who do not reside in the country, and Nova Scotia as a Colony, does not enjoy a share of the advantages to be gained ; no investigation is made farther than to advance the cause of science, while those articles which might be raised from beneath our native soil, are now imported at a great expence. In searching for copper among the slate rocks, much valuable information may be gained, by immersing clean plates of steel or old iron, in the springs, wherever they are discovered ; the air will decompose the sulphate of copper, sulphuric acid will be produced, and a new combination formed. The acid possesses a stronger affinity for iron than copper, will unite with the former, and leave the metal upon the plates.

## AYLESFORD.

In passing through Wilmot and Aylesford, in an easterly direction, the immense valley situated between the North and South Mountains, will have expanded a considerable distance. The slate formation, accompanied by the bed of iron ore, occupies the high lands southward of those Townships; and occasionally an elevation of granite lifts its head above the other hills, marking the boundary of the primary rock. From the country seat of His Lordship the Bishop of Nova Scotia, a fine view is afforded of the high lands on each side of the great valley, and the parallel ridges of slate may be contrasted with the more bold and majestic scenery of the trap rocks to the northward. Near Harris's Inn, and at numerous places in this Township, there are extensive deposits of the argillaceous oxide of iron. It occupies bogs, ponds, and swamps, varying from one to six feet in depth; and as in some situations it rests upon the shallow basins of the slate, it will now be noticed, although its consideration might have been deferred until a view is taken of the great valley of King's and Annapolis Counties.

The argillaceous oxide of iron, has by some been called "shot ore," or "bog ore." In Aylesford, its colour is a brownish yellow; it has a cellular structure, and is perforated as if it had been eaten by worms, or resembles the cinders of the blacksmith's forge. It is easily broken, and the recent fracture has a resinous lustre. The surface is friable, soils the fingers, and is ochreous—specific gravity 3.25, and according to Bergman, contains the cold short qualities of the metal. In some specimens lime, and in others the black oxide of manganese has been detected. Like this kind of ore in general, it occurs in low swampy grounds, where it is collecting daily from the stagnant water holding the oxide of iron in solution. This kind of iron ore is common in England, France, and the United States. The ore of Aylesford would probably be advantageously mixed with the ore of Nictau, and although the former yields only about thirty five per cent. of pure iron, the quality of the metal contained in each would be improved by mixing.

It is evident that the water from which the iron ore at this place, is derived, is impregnated with the oxide of iron, existing extensively in the sands of the Township, through which numerous streams are ever passing, and carrying along with them the decomposed iron sand, and finally lodging it in the lower grounds. The soil near the margin of the ponds, and swamps, is ferruginous, and not remarkable for its fertility. The argillaceous oxide might be advantageously worked; but as a richer kind of ore can be obtained in a more eligible situation, it is not probable that it will ever be required for smelting, separately from other ores of iron.

The unbroken forests crowning the summits of the South Mountains from Aylesford to Horton, prevent any inspection of their rocks for a considerable distance; but from the scenery they exhibit, and their occurrence in a direct course farther eastward from that place, their continuity cannot be doubted. A visit was made to English's Mountain, three miles south of the Annapolis road, where the slate was again observed, and found to alternate with the granite. Still farther southward the primary rock forms several abrupt and elevated ridges, terminated by steep and naked cliffs, which add much to the grandeur of the gloomy scenery of a new country. The granite of these hills is very compact and heavy, its ingredients are mixed in regular proportions, affording the kind commonly used for millstones.

A large valley occupying the space between two rounded hills of slate, which rise to the southward and westward of English's Mountain, is covered with large irregular masses of granite, piled upon each like eggs in a basket. Occasionally a sturdy spruce, and a few creeping evergreens, are seen making an effort to live in the interstices of these boulders, and the hare finds a safe retreat in the crevices produced by their disordered position. These masses have evidently been exiled from their native situations, by some sudden and violent eruption, by which also rocks of the same kind have been conveyed to those places, where they now appear in isolated blocks upon the surface.

Decomposed slate and granite mixed with sand, and rounded pebbles, cover the rocks in many places, and sometimes to a great depth in this part of the County of King's ; and the hopes of successful cultivation seemed to increase, as we proceeded in an easterly direction.

## HORTON.

At Beech Hill, a flourishing settlement about three miles southward of Kentville, the industrious inhabitants of the South Mountains, have removed some of those obstacles from the surface of the earth, which prevent many extensive examinations from being made in situations farther westward. At that place all the varieties of clay slate (argillite) may be seen. The strata are highly inclined, and in some instances almost vertical ; they run north east and south west, and display all the colours of this kind of rock. Brick red, pale red, brown, grey and several intermediate shades, are here observable in the slate. Its fracture is sometimes undulated and conchoidal, but more frequently it separates into thin plates of equal thickness throughout. Some layers are very brittle, and even friable, others are compact and will hardly yield before the knife ; again, others produce soft tables that can be easily sawed, and cut into any shape. Roof slate (*shiste ardoise* of Brongniart,) is abundant throughout the whole slate district of the Province ; but at the place just mentioned it is not only plentiful, but can be quarried at a moderate expense, and will equal in quality any obtained at Bangor in Wales. Near Kentville a slate quarry has been recently opened, and the quality of the article taken from it, appears favourable to a more extensive speculation than has yet been entered into by its proprietors.

In opening a quarry of slate, great care should be taken to avoid a situation where the sulphuret of iron appears, for that salt will hasten its destruction, and render it unfit for covering roofs. Also that kind which will absorb much water, should not be chosen, as the action of rains, and frost, will soon destroy it or render it useless for any purpose.

Beautiful specimens of marine fossil plants, have been discovered in the slate at the above quarry. One of these fossils was first discovered by William B. Webster,

M. D., of Kentville ; it belongs to the zoophyte family, and is considered to be a submarine plant of the oldest formations. It originally consisted of many delicate, divided, and jointed branches, bearing a close resemblance to some species of moss. By some unknown agency, its calcareous coat has been converted into iron pyrites, and a perfect form composed of that mineral still remains in the slate, where it resembles a light bronze painting. This fossil is a species of articulated coraline, and it nearly resembles a kind common on the shores of Nova Scotia.

Besides the coraline, sponges and other aqueous plants, are abundant in the argillite of Beech Hill. We obtained here large plates of slate, covered with the remains and prints of these marine productions, which now resemble paintings of the branches of trees, beautifully displayed in the colours of the carbonate and sulphuret of iron.

It is certainly remarkable, that in these the oldest of the secondary strata, in Nova Scotia, the organic remains belong altogether to the sea, and none of the animals and plants of the present earth can be found among them. It may also be observed by some, that these fossil plants and animals are very simple in their structure, and apparently very inferior in regard to organization, to those now living upon the earth. From these circumstances, some have supposed that there has been a gradual developement of animals and plants upon the globe, from the lowest up to the highest grades—from the zoophyte upon the rock, up to the Lord of Creation. But such reasoning must be refuted by the consideration, that the little snail clinging to the blade of grass, or crawling about with tardy pace, carries with him a machine equally as complicated as that of the human system ; and his creation would require as great an exertion of Almighty Power, as that by which man, with all his intellectual faculties, was called into existence.

Near the Gaspereau Lake, greywacke appears, forming a part of one of those elevations by which the picturesque scenery of this new settlement, is in many places so beautifully diversified. The greywacke alternates with the slate, and at some spots contains small quantities of transition limestone. About a mile from the Village of Kentville, and upon the banks of "Mill Brook," the old red sandstone crops out, and forms broad and sloping precipices, upon which, and in the neighbourhood of the Village, there are extensive deposits of diluvial detritus, consisting of beds of clay, sand, and water worn pebbles.

Near the banks of the rapid brook, and among the slate, a species of anthracite was observed. The ochrey red oxide of iron, (red ochre,) and the ochrey brown oxide of iron, (yellow ochre,) also occur in considerable veins among the slate. Each of these substances received considerable attention in King's County not long since, and a very industrious individual erected a paint mill, at considerable expense, in order to convert them into pigments. Several buildings in that portion of the country, are painted with those materials manufactured at Kentville : notwithstanding, the enterprise of the ingenious manufacturer has proved unsuccessful.

Before the visitor descends from the South Mountains near Kentville, let him take a view of the extensive valley before him. On its north side rise those mountains of basaltic columns, which with proud elevation line the coast of the Bay of Fundy, protecting the beautiful and fertile Township of Cornwallis, and all the settlements situated at their base, from the bleak north-wester, so well known, and so little admired in Nova Scotia. Let him turn his eyes towards the western horizon, and as far as vision extends, the red sandstone supports the soil of the almost level country before him, while rocks of different classes are thrown up like walls on each of its sides, affording shelter both from southern and northern gales; and lastly, let a glance be taken at the bustling little Village beneath his feet, and he will admire not only the grand and beautiful spectacle before him, but also the infant town below, prepared to afford him those refreshments his stroll will have rendered necessary. In the neighbourhood of Kentville, the new red sandstone is in contact with the old red sandstone, the members of the mountain limestone, and coal groups, being deficient. The great bed of iron, represented as occupying a place throughout the whole South Mountain range, has not yet been discovered south of that Village; but from the occurrence of detached pieces of the ore, iron pyrites, and the carbonate of iron at Beech Hill, no doubt can be entertained of its uninterrupted existence, even farther eastward than that place.

Upon the road extending from Kentville to Sherbrooke, after passing across the slate formation, and a ridge of greywacke, the granite of the Primary District again appears. At some places that rock alternates with the slate; but in general it occupies large tracts, forming a part of that elevated chain of hills, extending almost through the country, in the direction of the slate, its companion.

Upon the New Canaan road, and before the hill is ascended to that beautiful settlement, the clay slate was discovered to be in contact with the new red sandstone. This sandstone of the marly group, is the margin of that rock which underlies the soil of the beautiful and extensive valley previously noticed, and again to be considered when that formation is described. The slate continues on the road about three miles. Its strata are nearly vertical, and display all the varieties of texture and color seen at Beech Hill. About midway in New Canaan settlement, the slate is met by greywacke, and greywacke slate.

In the greywacke and greywacke slate of New Canaan, we were rather surprised to discover the remains of the encrinite, and trilobate, identical with those found in the limestone of Germany. It has been asserted by a celebrated Geologist, that this species of the encrinite only occurs in the old mountain limestone; but he would be surprised to find it in the greywacke of this country, and also in the iron ore. It is a strong argument in favour of the contemporaneous origin of slate, greywacke, and iron ore of the Province, that they contain similar organic remains throughout. Extending from one extremity of the country to the other, a certain number of strata contain the relics of animals belonging to the same epoch, and exhibiting the same characters wherever they are found.

One of the fossils mentioned is called the lilly encrinite, from its resemblance to the lilly resting upon its stalk. It is supposed that the animal resided in the base of the flower, and those portions of it which were moveable, stood stretched out like arms to seize its prey. In the greywacke at New Canaan this fossil animal appears like the lilly with its capsule and petals closed. That part resembling the flower, is beautifully figured and indented on the surface, and throughout the whole of its body. From the base of the flower proceeds the stalk, which sometimes penetrates the rock to considerable distance. This stalk is composed of circular rings placed one upon another, like the windpipe of some fowls. In one specimen those rings are perfect and regular ; in another every fourth circle is enlarged in its circumference. When a section of this singular fossil is polished, it has the appearance of the sun-fish. The serrated edges of the petals meet each other, forming a zigzag line.—After a section of the stalk has been made, it exhibits a cellular structure, and in some instances, dark rays proceed from a central circle to the circumference. The circular rings forming the stalk, give it the appearance of a necklace ; hence the fossil has been called *encrinitis moniliformis*, or necklace encrinite. The remains of this animal at New Canaan, will be distinguished by its white appearance, and the imitative figures it presents. It is often of large dimensions ; some were procured during our last visit to their stony graves, as large as watermelons, although in general they are much compressed, and have been flattened by the weight of the rock resting upon them when in a soft state.

This species of radiated animals is now altogether extinct, and many ages have passed by since a living specimen could be produced. It has never been discovered in any of the strata placed above the new red sandstone, and as it does not appear but in few of the older strata, the whole race must have enjoyed but a short existence, when every individual belonging to the family was deprived of life, and cemented in a solid mass of the greywacke; or in other instances so perfectly destroyed, as to leave no record of their existence and history.

In the same rock which embraces the encrinite, a species of the trilobate appears. This fossil most frequently exhibits an hexangular cell, once occupied by the living animal; each lobe has left two sides impressed in the rock. From the peltings of the rain, and other causes, the internal parts of the fossil have been worn, and scooped out, leaving its crustaceous covering a faithful witness of its former existence. They are not numerous, and vary in size from one to two inches in length. When a new fracture of the rock is made, two or more of their lobes are sometimes uncovered, each having a furrowed appearance. Like the encrinite, the remains of this singular animal have not been discovered in any strata newer than the old mountain limestone, therefore numberless ages must have passed away, since it became altogether extinct. The trilobate has been called the Dudley Fossil, and is found near Birmingham, and other parts of Great Britain; Germany and Sweden have also an abundance of these fossil creatures.

In some situations, myriads of these animals once enjoyed life, so that it has been presumed that their powers of multiplication have been prodigious. But few enquiries respecting the character and habits of these ancient animals, have been made, and an accurate account of them can scarcely be expected. At what period in the history of this globe were they created ? What tremendous revolution placed them in their present situation ? And by what means were they converted into compact, ponderous rock ? are questions few can answer with satisfaction to themselves, or with safety for the reputation of their common sense, to others.

The scenery in the settlement of New Canaan, is extensive and pleasing. Besides a view of the great valley seen from Beech Hill, we have here to the south west, deep ravines with steep banks, beneath which winding channels are formed, giving passage to torrents of rain, after they have descended, and washed the oval summits of the hills. It is true there are no elevations of great height in this neighbourhood, but the earth is deeply furrowed by the upturned ridges of slate, and offers a landscape, singularly diversified when contrasted with the level appearance of the Sandstone District, over which the lofty peak of the frowning Blomidon, may be seen ready to fall into the beautiful Basin curling at its base. By turning the eye southward, a long low depression will be perceived ; here the Gaspereau River, having taken its rise from a large lake, rolls on from cataract to cataract, or murmurs among the strata of slate, where it is compelled to pass.

From Kentville to the Church at Wolfville, the new red sandstone is probably in contact with the slate ; although the large collections of rounded pebbles mixed very limited inspection, to gratify our wishes. The ore is evidently discontinued at that spot where the slate is succeeded by the grey sandstone, on that part of the mountains where the road passes from Horton to Windsor, as the sandstone is of much more recent formation than the slate containing its bed. The ridge of granite at Wolfville, may perhaps be on the same line which separates the slate from the sandstone. The whole configuration of the country in this District, running with the eye along the granitic ridge, and the supposed junction of it and the sandstone, presents the idea of an ancient shore, from which the waters have retreated. Grey sandstone of different shades, occupies that part of Horton eastward of the Windsor road. Several pieces of fossil plants have been found near "Lyman's Hill." They are of the fern tribe, and similar to those of the coal fields of Cumberland.

A sudden and extensive interruption is made in the Slate District of Nova Scotia, where the Avon, with all its tributary streams, issue from the country, and pour their waters into the Basin of Mines. At Horton Bluff, Falmouth, and on the road to Chester, including in the whole a distance of twenty-five miles in a southerly direction, no slate appears, so that a deep notch or termination in its strata, is occupied by a more recent formation.

From Falmouth Bridge the Avon will be seen, extending its branches with many curves and windings, into the mountains of slate, appearing again in connection with the granite in a south west direction. From what has been already observed, it must appear probable, that the bed of iron ore, accompanying the slate formation, from Clements to Nictau, and from thence to some part of the high lands of Horton, is finally cut off somewhere in that Township. For admitting that it follows a direct course, which is evident as far as our discoveries have extended, that course is nearly north east: wherefore, the ore must necessarily terminate somewhere in the Horton Mountains, where the slate itself ceases to continue its course.

It is impossible that the ore can occupy a place throughout the whole length of the South Mountains, as far as Pictou, and according to the opinions of Jackson and Alger. For as the sandstone succeeds the slate in Lower Horton, Falmouth, and Windsor, and the latter rock is withdrawn many miles farther southward than its former range, the ore to continue its course would have to penetrate freestone, limestone, and gypsum, or dip beneath the waters of the Basin of Mines, and again rise in the slate of Pictou. But these are things impossible, although not more so than that the ore should make the necessary curve at Windsor River, diverge to the southward fifteen miles with the slate, and still have its continuance uninterrupted. Indeed the facts already known, and thus briefly stated, are almost sufficient to prove the final termination of the great western iron ore bed, somewhere in the Mountains of Horton.

The sturdy forests covering large portions of the counties of Hants, Lunenburg, and King's, where the Indian hunter alone travels the bleak and gloomy mountains—where the tracks of the moose and carriboo direct him from ravine to ravine, urging him forward to the conquests of the chace—where the hollow sound of the woodsman's axe, and his cheerful whistle, have never echoed—where the bear and wild cat stalk fearlessly, regardless of man and his destructive habits,—here the labours of the Geologist are almost useless, and from thence the naturalist longs to return to the haunts of men. Even here we discovered fine specimens of lead ore, scattered along the bottom of a rapid brook, where they had been conveyed by the violence of the stream.

## ARDOISE HILLS.

At Ardoise Hills, an opportunity is again afforded for the examination of the slate. The strata run north, 58° east, deviating a little from their general direction throughout the Province. The old route of the Windsor Road, is much more interesting than the new, as the latter has been made without consulting the wishes, either of the Geologist, or those who are fond of picturesque scenery. The new road has been made along the lower lands, so that steep hills are avoided, and a more safe, easy and comfortable communication to the Capital, is afforded. The slate of these hills has little variety. Specimens of indurated talc sometimes occur, but not often. About a mile to the westward of the old road, roof slate of a good quality might be quarried to advantage. On the most elevated summit of one of these hills, a telegraph was formerly erected; but a general and prevailing peace, and the improved state of the roads throughout the Province, have been the cause of its abandonment; and that lofty pole, which once bore signals of met by the new red sandstone, on its northern side, and that the latter rock forms both sides, and the bottom of the Basin of Mines.

Greywacke, and greywacke slate, accompany the argillite, cross the Grand Lake, and the road between Halifax and Truro, and continue eastward through the high lands of the Township of Egerton, to the hills of Antigonish, and Cape Breton. Nor does the slate terminate at that place; still farther eastward, and in contact with granite, it lifts its strata among the mountains of Newfoundland.

## PICTOU.

In the District of Pictou, and twelve miles south east from the thriving Town of New Glasgow, there is an immense bed of iron ore, at a place called McLellan's Mountain. Leaving the great coal field of Pictou, and ascending this mountain, the scenery becomes suddenly changed, where the elevated ridges of slate, and greywacke slate are travelled. Instead of the low, and rounded summits of the sandstone hills, the older formations start up before the eye; lofty ridges of slate, separated by deep ravines, are seen far south, and towards their termination.

In approaching the great Eastern Iron Ore bed of Nova Scotia, from the westward, the meagre condition of the soil will indicate a change in the underlieing rocks, and numerous strata of a fine red coloured slate, cross the road a short distance from the ore. The bed of iron is about eighteen feet wide, and is enclosed in walls of greywacke slate, with which the ore is not intermixed, in the way it was observed at Clements. The strata of slate, and greywacke slate, as well as the bed of iron ore, are highly inclined, and extend north 65 ° east. This great deposit of the iron has been opened, and a quantity of its contents removed to the Albion Mines. Its direction can be traced a considerable distance on the surface, and it may be observed extending across a small farm cleared on the spot. The ore is generally of a reddish brown colour, and when recently taken from the quarry, possesses considerable metallic lustre. Its structure is slaty, and powder red. We could not discover that it had any magnetic properties, and therefore it is different in this particular, from the ore of the western part of the Province.

This ore is a peroxide of iron, and will yield about fifty-five per cent. of pure metal. Like the ore of Clements and Nictau, it abounds in marine organic remains. The ancient shells are white in the newly raised ore, and consist principally of the carbonate of lime, occasionally united to a little of the phosphate. Upon exposure to the weather the lime becomes gradually decomposed, and beautiful impressions of the shells remain in the metallic compound. At the time of our visit, a small field of wheat had been sown directly over the bed, and the soil was made up of small pieces of ore, and the red oxide of iron. The numerous fragments of this field abound in the remains and impressions of the inhabitants of the sea, which are now placed several hundred feet above the level of the present ocean, and are yearly exposed to the movements of the plough and hoe. These remains are also abundant in the greywacke slate, and may be collected among heaps of stones piled in the field. Numerous fossil shells were observed several miles from this place, and in the greywacke slate, of which an industrious farmer had erected a wall.

That the ore and greywacke slate were formed under similar circumstances, there can be no doubt, as the organic remains in both are alike, and plainly prove, that each of those now solid substances were originally beneath the waters of some ancient ocean, once swarming with testaceous animals.

The organic remains at McLellan's Mountain, agree so perfectly with those of Clements, Nictau, and Horton, it is evident they were the inhabitants of the same period, and were annihilated by the same terrestrial revolution. Although we are not prepared to admit, that the metallic vein of Clements and Nictau extends the whole distance from those places to Pictou, there can be no doubt that the rocks, ore, and shells, at each extremity of the Province, have had one common origin, and were elevated from the sea at the same time.

The shells contained in the ore of Pictou, are the terebratulite, pectinite, cardium elongatum, and encrinite. Of the latter, several portions of the cylindrical tubes, and the flowering tops were obtained ; the former have the rings perfect, and resemble those from the Horton Mountains.

We have no desire to enter into nice theories, as it is foreign to our wishes, and the object of this work. But this enquiry may be made. If the slate district of Nova Scotia were formed at the bottom of an ancient ocean, (a fact which is plainly proved by its organic remains,) is it not possible that the different layers of slate, greywacke, &c., might have been successive deposits of sand and argillaceous particles, which formed the submarine surface ? And might not the extensive bed of iron ore have been a deposit of iron sand, of which the Isle of Sable, and Banks of Newfoundland, furnish now vast quantities ? When we consider the extensive disruptions of the primeval world, even these results appear more than probable.

It has been already stated, that a quantity of iron ore had been removed from McLellan's Mountain, to the smelting furnace at the Albion Mines ; but the reader will perhaps be much surprised, that instead of working the ore of the Province, iron in pigs, is now imported from England, and used at the Pictou foundry, and in the immediate neighbourhood of an inexhaustable store of that metal. An enquiry was made, why the ore of Nova Scotia was not used in preference to the imported metal, and we were informed, that the ore of this Province, is too rich for manufacture, and would not "run" when melted. The richness of any ore, is generally the last objection against its use, and complaints are more frequently raised against its poverty. Nor can it be possible that this is the real difficulty in the way.

It is true that the phosphate of lime, and alumine contained in the ore of Pictou, may render the process of smelting somewhat different from that of materials containing none of these substances ; but it cannot be supposed, that the scientific gentlemen of the Mining Association, are unacquainted with the chemical properties of the ore, and the proper fluxes for its reduction.

agree with the chemical effects it will produce. It is probable that the hematite at the above place, is connected with the great bed of iron ore, although we were unable to trace any such connection, as the surface in many places is closely covered with lofty trees, and thick underbrush.

Greywacke and greywacke slate appear on the south side of Antigonish, and on the shores of Chedabucto Bay. The latter occupies the east river of Merigomish, and extends to Arisaig Pier, where it is penetrated by a bed of porphyry. At Guysboro the greywacke contains veins of the specular oxyde of iron. It is also believed, that there are ores of lead on Salmon River. The Indians, it is said, formerly made their bullets of lead found among the hills of this part of the country ; and as they refuse to make their discovery known, we regret that we have been unable to extend our examinations so far as might perhaps disclose the secret.

As the old mountain limestone succeeding the slate in the District of Pictou, is connected with the great coal basin of that place, it will be considered when a description of the coal fields in general is introduced.

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## General Remarks on the Slate District of Nova Scotia.

In reviewing the preceding remarks made in regard to the Slate Formation of Nova Scotia, we are often reminded of those obstacles which, in many instances, prevented a perfect examination of its rocks, and those associations between different classes, that are not only necessary to be known, but may be usefully employed by such as may pursue the investigation of this subject to a greater extent.

Often, having been worn down by the fatigue of a toilsome day, have the expectations of the discovery of some important fact, kept our spirits alive till the setting sun has given the signal to depart. Nevertheless, from the observations already recorded, and a comparative view of the Slate District of Nova Scotia, with those of England and Wales, and without venturing to reason from analogy, it will be safe to affirm, that that portion of the Province which is occupied by the slate, contains ores of the most useful and important kinds; although their full discovery may not be made until some future period, when the fetters now binding Mineralogical enquiries in Nova Scotia, shall be taken off, and when other objects than those of a scientific nature, shall stimulate the spirit of Geological enquiry.

In every instance the slate will be found above the granite. In some situations gneiss and mica slate (which belong to primary formations,) immediately succeed the granite. In other places, greywacke is interposed between these rocks and the slate; but wherever the gneiss, mica slate, and greywacke, are absent, the argillite and granite are in immediate contact. Hence that beautiful harmony existing in the arrangement of those rocks in other countries, is preserved in the structure of this Province. In the granite, gneiss, and mica slate, not the smallest vestige of the remains of any organized substance has been discovered, and not the least doubt can remain in the mind, that they were formed, or at least their materials were created, prior to any kind of plant or terrestrial being. Although the granite is one of the oldest rocks with which we are acquainted, it must not be presumed that it is always placed at the lowest level, for facts prove the contrary. In Nova Scotia, it is seen at the tops of the highest mountains ; but wherever it appears under such circumstances, it seems to have been thrown upwards by some great force ; for the secondary rocks found in the valleys formed by the unequal eruption of the granite, are seen sticking by their sides in the greatest possible confusion. It would be absurd to argue that the slate of Nova Scotia, was formed in a manner similar to that of the granite ; the separate and distinct strata, or layers, separated by parallel lines, and the fossil animals contained in them, added to a variety of other circumstances, not necessary to be detailed, will satisfactorily prove, that it was originally a submarine deposit. Wherever the slate and other formations approach the primary rocks, their strata are turned up in an almost perpendicular position ; and as we recede from the more original structure, so the strata of the slate become more inclined, and approach that level from which they have evidently been thrown.

The slate of Nova Scotia in general belongs to that class of rocks called by the older Geologists, transition ; that it is among the most ancient of the secondary strata, is evident from the following facts. It is in many instances, placed directly upon the granite, and encloses detached pieces of that rock. Its strata are broken and distorted most, in those situations where it meets its plutonic neighbour. In it organic remains first begin to appear, and its relics belong to species now altogether extinct, or have descendants resembling them only in tropical seas. And lastly, as the fossils it embraces, belong altogether to marine tribes, so far as present discoveries extend, it is not impossible that they may have existed previous to the creation of those super-marine plants and animals contained in the overlieing strata.

It is doubtless among her slate, greywacke, quartz rock, and old mountain limestone, that Nova Scotia possesses her rich and valuable ores ; and although the newer of the secondary strata contain copper, and oxides of other metals, they probably have been derived from the more important deposits of the older rocks, and will never yield that profit which may be received from the older deposits. When the situation of our lead mines is discovered, silver may be expected ; but until that metal is found, and that in considerable quantities, we must remain satisfied with the discoveries already made, and such as a liberal policy would encourage.

Before leaving the consideration of the Slate District, another important enquiry arises from the fact, that fragments of slate, rolled masses of quartz rock, and even granite, are not only found upon the surface of the new red sandstone, but enter its composition at a great depth. Now the debris of the slate and other rocks, of old classes, must have been made while the newer sandstone was becoming deposited, and consolidated ; and the shape of the fragments thus observed, demonstrate that they have been transported by the efforts of mighty currents. Again, the sandstone itself has also been under a similar influence, which must have been exerted long since the materials entering its composition had been accumulated. Hence it is equally easy to prove the occurrence of similar causes having operated upon the earth's surface, at separate and distinct periods of time. One period has produced the ingredients of the newer rocks, which in their turn have been evidently denuded by the rapidity of overwhelming floods. The effects in both cases are similar, and appear wherever the eye is turned. Is it possible that the first great catastrophe arose, when the earth emerged from beneath its waters, at its first creation, before which "darkness was upon the face of the deep"? Is it improbable that another Geological event, may have produced another class of phenomena, at that period when the "windows of heaven were opened, and the fountains of the great deep broken up"? Or, have all these changes taken place by the influence of causes now operating upon the surface of the earth? Perhaps that instead of fixing all the mutations which the earth has undergone, upon one class of causes, the whole should be taken into consideration; and the effects now exhibited upon the globe, are quite sufficient to allow each of them a due share of power. It is here natural to enquire, in what direction those currents flowed. Some have supposed, that in Nova Scotia they rushed from the southward towards the north, on account of the boulders of granite being found northward of their native beds; but this argument proves nothing, as the trap rocks of the North Mountains are often found upon the southern hills, and rocks of almost all classes, are discovered in occasional blocks all over the country. Now it is evident that all currents of water will in some degree be governed by the surface over which they pass ; hence the direction of hills and mountains, formerly existing, will prevent us at the present day from determining accurately, the course pursued by the waters that produced those effects. Again, those currents were liable to become changed during the subsidence of any flood, by the alteration constantly going forward in the channels over which they passed. But by no means however, are we to suppose, that the granitic boulders placed upon the summits of the highest hills, and particularly in the neighbourhood of Halifax, were carried thither by the above means. A flood would have had a very different effect upon them, and hurled their shapeless masses into the valleys above which they are now lodged. They have doubtless been thrown upwards, and left cresting the highest ridges, by volcanic explosions that have taken place since the general inundation of our planet.

Besides the disturbance the slate has suffered, from the eruption of the primary rocks from beneath, as it is supposed, there appear to have been other causes in action, that have had a powerful influence in breaking asunder, and carrying away large portions of its already broken strata. Large masses of that rock are often observed far from the locality where they belong, and from which they have been removed. Sometimes detached pieces of its strata are found upon the surface of the newer rocks, and promiscuously scattered over the soil covering the red marl group. In this respect they are like the boulders of granite, affording so much speculation among Geologists, but can in no way have their transportation so well explained, as by admitting fully the former occurrence of powerful currents, that carried away not only loose materials, but also tore up even the solid strata themselves. In the valleys, ravines, and basins formed by the very unequal elevation of the strata of slate, beds of clay, sand, and water-worn pebbles, were frequently observed. The clay consists of different layers, placed horizontally. The parellism of these layers, with the variety of their colours, resemble those produced by dissolving clay in water, the most ponderous and coarse particles will fall first in the solution, the lighter atoms last, so that layer after layer will appear in the bottom of the vessel containing them. Each will be composed of particles similar in their dimensions, the smaller ones succeeding the greater in every instance. Therefore it is reasonable to conclude, from a knowledge of these facts, that those beds of clay have been deposited from a flood in which they were once suspended.

It is well known, that rocks broken by mechanical means, have their edges and angles left sharp and prominent. But pieces of rocks having been exposed to the rapid currents of rivers, or the constant motion produced among them by the violence of the waves upon the sea shore, have their angles and edges broken off, and thereby become gradually rounded, bearing the appellation of water-worn pebbles. The pebbles found in the basin-shaped depressions of the slate, are of this description, and have evidently assumed their oval appearance, from attrition in water. Again, the smaller particles broken from larger fragments, would contribute greatly to the production of sand, of which there are vast accumulations. These remarks do not only apply to the District already described, but to the Province generally, where even greater proofs of a general deluge may be observed. In regard to the soil resting upon the slate in Nova Scotia, it is generally fertile : wherever the rocks yield easily to frost, rain, and the action of the atmosphere, it is very luxuriant, although not well adapted for roads and bridges, on account of its clayey nature, and easy solution in water. Like the Primary District, the argillite abounds in lakes, which often form chains to considerable extent. In the deep valleys formed by the upturned strata, the waters descending from the mountains collect, and from them cannot escape, affording a safe retreat for the salmon, gaspereau, and trout, to deposit their ova.

## RED SANDSTONE DISTRICT.

It was before observed, that if a line be drawn from Annapolis to Antigonish, and a curve made in the direction of Windsor River, all the remaining part of the Province might be called the Red Sandstone District. We shall describe this Formation, following the same course in which its examinations were made. Beginning in the western part of the Province, the sandstone first makes its appearance at the head of St. Mary's Bay, in the County of Annapolis. At that place it forms an isthmus, uniting Digby Neck with the South Mountains. A beautiful and sublime section of the sandstone, will be seen on the west side of that isthmus. The elevation of the tides, and violence of the sea, have undermined the rock, which has been broken up, and washed away, leaving an extensive and nearly perpendicular front, averaging from an hundred, to an hundred and thirty feet high. This precipice is called by the inhabitants the "sea wall," a very appropriate name; for were this barrier removed, the waters of Annapolis River and Basin, would make a more ready escape into St. Mary's Bay, than at the narrow opening called Digby Gut, through which a narrow passage has been forced, while the sea wall just mentioned remains unbroken. The sandstone is red, grey, and light blue, variously intermixed with those colours. The coloured varieties appear in the upper strata, while the layers beneath are uniformly red. The strata run in a north and south direction, falling away at a low angle. They are of different thicknesses, varying from a few inches to six feet. A few veins of reddle, or red chalk, are interposed between some of the strata, and in one instance it might properly be termed red jasper, having been apparently consolidated by heat, and capable of bearing a good polish.

The red sandstone at this place, is the beginning of an extensive formation, which reaches from Digby through the Counties of Annapolis and King's, underlieing the trap rocks of the North Mountains, throughout their whole extent; and cropping out beneath the lofty Blomidon, it forms the eastern shore of King's County, upon the Basin of Mines. In this part of the country, it forms a long narrow belt. It rests upon the slate of the South Mountains throughout its whole formation, except in a few places, where the old mountain limestone, and old red sandstone are interposed. Upon its northern margin the trap rocks have been placed, forming a resistance which secures the country from the advances of the tides and turbulent waters of the Bay of Fundy. At Blomidon, and many places along the north shores of those Counties, the sandstone is seen jutting out beneath the trap, but at so low a level in general, as to suffer but little from the waves that fall with great violence upon the coast.

The sandstone forms the bottom of a long narrow and beautiful valley, extending from Annapolis Town to the Basin of Mines. The North and South Mountains depart from each other at a small angle, as they extend easterly, and consequently the great valley between them, becomes wider in that direction. At Annapolis Town, the North and South Mountains meet each other very nearly, and seem only to be separated at that place, by the river passing between them. While at Wolfville, it will be observed how far they have receded from each other, by the breadth of the almost level land, placed between Blomidon and Horton Church.

The great valley thus produced, resembles a long entrenchment, dug out of King's and Annapolis, by the work of art, and reminds us of the bottom of some ancient river, whose waters have been withdrawn. The rocks occupying this great valley, belong to the red marl group. The slate of the southern hills, dips beneath these rocks, wherever they have been discovered to meet, thereby affording the best evidence of its greater antiquity. No beds of gypsum, or rock salt, have been discovered in the sandstone of those Counties: numerous narrow veins of the former, have however, been found in the strata beneath the trap at Blomidon, and several other situations where the rock has been exposed. In these places, snowy and fibrous gypsum frequently occur, with large and beautiful plates of selenite ; but all these varieties decline, and finally disappear, in proportion as the rock in which they are placed, approaches the slate to the southward. The sandstone is composed of siliceous particles, and oxide of iron, united by an argillaceous, and sometimes calcareous cement. It is used by the inhabitants for the purpose of building fire places, and under priming ; although no pains have been taken to open those useful quarries, which are abundant, and would supply the best materials for erecting their dwellings. In this formation numerous quarries might be opened, and in situations affording all the facilities for exporting those valuable freestones that might be raised from them. Care should be taken to excavate a rock that would resist the frost and vicissitudes of the weather, and to select an agreeable or fashionable colour, for a sufficient number of shades can be obtained, from brick red to dark brown, to accommodate such as choose to have a choice in these things. The rock is easily hewed into cubical masses, when recently quarried, but gradually becomes harder by being exposed to the heat of the sun. Like the strata at St. Mary's Bay, those forming the walls on each side of the Basin of Mines, fall away gently to the southward, notwithstanding in many places they are much broken and disturbed.

Small shining particles of mica, frequently appear in some of the uppermost layers ; these from their brilliant appearance, have led to a supposition among some of the honest farmers, that silver is at hand. But although that precious metal is certainly very scarce in the Province at present, the time may soon arrive, when it can be obtained from other countries in exchange for those very rocks, in which some suppose it is now mixed. It is curious to observe the similarity between this formation and that constituting a part of Lancashire, in England; both apparently repose upon slate, and possess similar Geological relations. The ancient castle of Hawthornden, near Edinburgh, with all its dungeons and vaults, having resisted the action of the elements, will shew the durability of our freestone, being built of similar rock. In Nova Scotia this group of strata contains few organic remains. Such as have been discovered in Horton, and Cornwallis, resemble reeds, and other plants common in low grounds; nor are they well preserved, and therefore yield few specimens of interest to the fossil botanist. The soil covering the valley already mentioned, is in general extremely fertile, producing abundantly all the plants common to this, and even warmer climates. As the North Mountains shelter it from chilly winds, and also serve as a refractor to the rays of heat emitted by the sun, it offers advantages seldom rivalled in any country. On the east, this valley is enriched by the Rivers of Horton and Cornwallis, where large collections of alluvium have been made from the decomposed sandstone and shale, ever suspended in the waters of the Basin of Mines. The red sandstone affords the dark red marsh, while the blue kind is made of decayed vegetable matter and shale, the latter being conveyed from the northern coast. Both the particles of sandstone and shale, are much affected in their transportation by prevailing winds. A northerly breeze transports the blue particles from Parrsborough shore, and an easterly gale urges forward the crumbled sandstone of Horton and Cornwallis. Hence those fertile streams not only convey the surplus waters of the country, but receive treasures of alluvium from the sea, which are always accumulating, to the great advantage of its inhabitants. To the westward the Annapolis River not only performs these common and important operations, but also affords a channel through which the produce of its fertile banks can be readily exported. We have already mentioned the irregular blocks of granite of this section of the country, and the minerals they contain. The boulders of Nova Scotia have also been noticed by Professor Buckland, in vindicating the doctrines of the Flood. The plains of the north of Europe, present the same phenomena. The level lands of the Po, and Danube, also contribute their testimony, that those isolated rocks now lodged upon the soil, have been transported from primary situations, by some propelling force, unknown upon this present world ; although it is almost certain that they are the effects of an overwhelming deluge, which at a former period produced those results now so manifest upon the earth. Not only has the granite sent its heralds abroad, large blocks of trap are also scattered over the soil of Nova Scotia, far from their original and former stations.

A large collection of sand in the Township of Aylesford, furnishes still further testimony favourable to Professor Buckland's views. Fine siliceous particles, occasionally intermixed with iron sand and scales of mica, cover the rocks of that Township, between the mountains and over a considerable space. In some places this sand is quite compact, and arranged in layers of different colours; some layers are composed of fine particles, and others of coarse materials, and even small pebbles. In general it is easily broken up, and greatly diminishes the rapidity of travelling. The inhabitants, aware of these circumstances, frequently change their route from side to side of the turnpike, as the hardness of the soil dictates, and the long parallel ridges of grass between the pathways, testify how numerous those changes have been. The effects produced by currents of water, are very manifest at that place, where many ridges and mounds of sand have been thrown up. In making the roads, advantage has been taken of these circumstances, and the bogs and swamps have been avoided. It is not possible that this sand has been produced without the breaking down of the rocks by the before mentioned causes; the similarity in its particles to those composing granite, and secondary strata, offers an argument in favour of that opinion, and the arrangement of its layers shews, that it has been moved by a current of water. In Aylesford there is also an extensive barren waste, called the "Carriboo Bog," covered in many places with peat and turf. Some have supposed this bog was formerly a lake, but the numerous elevations upon its surface do not support that opinion, and it is more probable, that a collection of unproductive sand has been made in a kind of basin, where it refuses to supply sufficient support for the towering pines now flourishing upon its border.

## WILMOT SPRING.

In the Township of Wilmot, and about three miles from Gibbon's Inn, there is a mineral spring, possessing medicinal properties of considerable importance. When the discovery was first announced to the public, numerous were the persons who being afflicted with different diseases, hastened to the waters, then supposed to be the *elixar vitæ*, and quite sufficient to remove all the ills "the flesh is heir to." The languishing and consumptive patient, he that knew the thirst of a burning fever, the gouty, and rheumatic, the scrophulous and bilious, all sought the cure thus cheaply offered to relieve them. Without reference to the nature of their diseases, and at every stage of their complaints, they hoped and vainly hoped to obtain relief. In the midst of the forest, the little Village near the pool of this modern Bethesda was all bustle and confusion, while many for the want of accommodation, were obliged to depart not healed. Few of those comforts could be procured, which the invalid requires, and those conveniences so necessary at all watering places, could not at the moment be obtained. Many and great were the cures reported to have been made by the spring. Newspapers teemed with its praises, and its virtues were said to be such as would even restore amputated limbs. But experience, that faithful schoolmaster, soon proved that its powers were not sufficient to remove all the ailments of its visitors ; hence the Wilmot Spring is already abandoned, and its name is seldom spoken. So changeable and unsteady is public opinion, the idol of the clamorous and the goddess of radicalism.

Perhaps there are no circumstances in which man is ever placed, that he is more liable to be duped and misled, than in those connected with his own bodily health. Of his own disease he supposes he knows more, but really knows less than of almost any other subject he considers. From these causes quackery has hitherto been supported, and will continue its pretending and mysterious arts, to the injury of sound knowledge and disgrace of society. Were the mineral springs of Wilmot surrounded by the gay and pleasant scenery, united with the cheerful society of the European watering places, its waters would be found at least equal to many of those celebrated resorts in other countries ; and even now the time is not far distant, when the public mind will react, and many find relief at the deserted pool.

The waters of the spring have been analysed by Dr. Webster, of Boston, and were found to contain—

Iodine,<br>
Lime,<br>
Sulphuric Acid,<br>
Magnesia.

They will doubtless be beneficial in all scrophulous and glandular diseases, and probably in the first stage of tuburcular consumption. They are gently aperient, and cannot fail to be serviceable in dyspepsia, and other diseases of the digestive organs. This might be supposed from their composition, and has been confirmed by experience.

## HORTON BLUFF.

Emerging from beneath the lofty precipice at Cape Blomidon, the new red sandstone forms the shores of the eastern side of Cornwallis, and those of Long and Boot Islands. At Horton Bluff it is met by a grey sandstone alternating with shale. On the west side, and near the mouth of Windsor River, there is a stratum of light grey sandstone, well adapted for buildings. In the detached masses of shale and sandstone frequently falling near that place, we discovered the remains and impressions of plants, some of which are like immense rushes ; others have the appearance of the iris or common blue flag. These plants have suffered great compression among the rocks, but still show the most perfect stony casts of their originals. They seem to have flourished in low grounds, and are quite different from those frequently found in other parts of the country.

In the greywacke slate of the South Mountains, fossil animals belonging to the sea, are abundant ; but not the least vestige of any plant belonging to the dry land, has yet been discovered there. On the other hand, the sandstone succeeding the slate at Horton Bluff, contains plants belonging to species like those now growing in low and swampy grounds ; hence its later formation seems well proved from this circumstance, without considering its position on the more ancient rock. It is a little singular, that even the grey sandstone between Falmouth and Horton, where it is elevated more than three hundred feet above the Bluff, has disclosed pieces of perfect fossil Coniferæ, of large size and great beauty. This plant was evidently produced upon dry soil, where it might have flourished at the same time when the aqueous plants upon the shore, were rustling upon the border of some ancient lake, each possessing the same situation their several habits required.

## WINDSOR.

The red sandstone occupies the low lands of Falmouth and Windsor, extending through Douglas, along the south shore of the Basin of Mines, and borders of the Shubenacadie river. At all those places it contains numerous and important beds of gypsum, (sulphate of lime,) and limestone, the former affording an inexhaustable source of commerce, and the latter yielding the agriculturalist an abundance of the best manure. The gypsum is largely exported to the United States: and although it affords but a small profit to the carrier at present, the time is advancing when it will become of national importance, and open a new source of Provincial wealth.

In many situations throughout this part of the country, the gypsum appears in prominent masses above the soil, forming conical elevations, which often give the surface a very picturesque appearance. In some instances it occupies uneven ridges, passing through the country to considerable extent, or with steep precipices forms the banks of rivers, from whence it is cheaply removed. On the St. Croix River, it constitutes an elevated wall, reaching several miles along the northern side of the rapid stream. Wherever it occurs the surface is irregular, or undulated ; and in those places where it forms the shore of the Basin of Mines, like the sandstone it suffers from the steady dilapidation produced by the waves, and rapid tides.

The gypsum is evidently contained in the sandstone, which throughout its whole formation belongs to the red marl group. Between the projecting masses of plaister, there are frequently cylindrical cavities, called by the miners "kettle holes." In these the bones of quadrupeds have been found. The skeleton of an Indian, and some of his rude hunting implements, were also taken from one of those pits, into which he had probably fallen, during the rapidity and heedlessness of the chace. These relics are preserved in the museum of King's College, at Windsor. The chasms and other openings in the rocks, are frequently filled with decomposed gypsum. Its colours vary from grey to dark brown ; its appearance is mealy, and when damp it soils the fingers. The soil also, in many places, is mixed with this substance, which does not in the least increase its fertility. In the interstices between the gypsum and limestone, the naturalist would doubtless find a reward for his labours. It was from one of these singular openings, that we took a large tooth of a graminivorous animal, not belonging to any species now living : but the expense of clearing away the rubbish would be considerable, and has heretofore been an objection not easily overcome with limited funds. The sulphate of lime thus briefly noticed, contains many varieties of that mineral, some of which are beautifully crystalized. It often encloses broad foliated masses of selenite. This variety yields easily to mechanical division in the direction of its lamina ; these when broken crosswise have a rhomboidal form. Its lustre is sometimes highly splendent and often pearly ; it is generally transparent, and sometimes coloured with delicate tints of red and purple. Snowy gypsum, branchy gypsum, and other varieties, frequently appear ; among them is the compact gypsum, generally called alabaster, suitable for buildings.

The extensive beds of secondary limestone alternating with, and frequently passing into gypsum, in this part of the Red Sandstone District, extend from Windsor to the east side of the Shubenacadie, and from thence in an easterly direction to Antigonish. The limestone is often separated from the gypsum by beds of marl, clay, and the decomposed rocks. It forms hills with oval summits, which are readily distinguished from the broken and irregular ridges of plaister. It contains myriads of fossil shells, which, in many instances, appear to compose the rock altogether ; from this circumstance it has been called shell limestone. These remarks not only apply to the limestone of Windsor, but also to the whole of those valuable deposits of that rock, in the red marl group of this section of Nova Scotia. Without referring to the usefulness of the limestone for building and agricultural purposes, it will appear obvious what an undiminishable source of trade is contained in the country, particularly when the comparative scarcity of gypsum in the United States, and the superior quality of that mineral in the Province, are considered.

The Americans are so well convinced of these facts, that some of their enterprising individuals have purchased an extensive quarry, and are now erecting mills to reduce it to that state in which it is used in their own country.

The group of rocks to which we have referred, are similar to those forming extensive portions of country in England, where vast collections of rock salt have been discovered. No such collections of that valuable mineral have however been found connected with the sandstone of Hants County, notwithstanding the saline properties of a spring near Windsor, afford some evidence of its existence there. Of all the shells contained in the limestone before mentioned, bivalves are by far the most numerous. Several kinds of coral have been collected, and a species of the mytilus lithophagus. The latter has given the rock the appearance of having been worm eaten. Excellent specimens of some of these fossils, are found near the Town of Windsor. In France this kind of limestone has produced some singular phenomena. In Provence, between its layers, and upwards of forty feet below the surface, pieces of columns, and stones partly wrought, were found; handles of hammers, and wooden tools, a board one inch thick and seven feet long, were also obtained, having been converted into perfect agate. Indeed, should we ever feel disposed to seek the bones of the fossil elephant, mastedon, or hyena, the chasms and fissures in this limestone would receive the earliest attention.

It has been already observed, that the encrinite of the South Mountains, has long since ceased to exist, and none of the fossils contained in the slate, have living successors in these northern latitudes. Not so with the shells of this limestone, they have yet some representatives upon our shores, bearing the distinctive characters of their ancestors.

It is certainly interesting, that in this part of the country, each class of rocks as they succeed each other, should contain fossils peculiar to themselves, and of species admirably adapted to that period of the earth's history, in which their separate strata seem to have been formed. At Kentville, the ancient articulated coraline is found compressed in the slate ; in the greywacke slate that succeeds it at New Canaan, the encrinite and trilobate are fossilated in the compact rock, but have long since disappeared in a living state from the earth ; while the beds of limestone at Windsor and Douglas, contain the relics of cockles, like those now inhabiting the shores of the Basin of Mines.

Among the limestone in this part of the Red Sandstone District, and especially in the neighbourhood of the Shubenacadie, the sulphuret of lead, and the cobaltic sulphuret of lead, one of its sub-species, are sometimes scattered in small crystals through the rock. The sulphuret is of a lead grey colour, and appears in small laminated masses, having a metallic streak and lustre. Its crystals are curiously disseminated in the limestone, but too small in quantity to offer any profit for working them as an ore of lead, although it is almost certain that an important vein of that mineral, is somewhere concealed near the Shubenacadie. The cobaltic sulphuret of lead resembles the sulphuret, both in its sitnation and external characters. It is, however, more rare, and may be distinguished by its decrepitation before the blowpipe, and the blue colour it communicates to borax.

These ores of lead may be mistaken for the micaceous oxide of iron, which also often appears in beautiful tabular crystals in the secondary limestone of the Province. But a little examination will distinguish them from the ores of iron with which they are sometimes mixed.

## MONTAGUE RIVER.

At Montague River, and not far from where that winding stream is emptied into the St. Croix, there is a very singular hill of breccia and greywacke passing into each other. Irregular fragments of feldspar and quartz, with occasional scales of mica, compose the aggregate, which at a distance resembles a coarse sandstone, or a peculiar kind of granite. The strata run north east and south west, dipping to the northward at a small angle. In its neighbourhood there is some beautiful scenery, well known at Montague House, a pleasant summer retreat. This hill was perhaps formed prior to the red sandstone, and might have raised its head above the sea, forming a small island, during the formation of the surrounding rocks.

From Montague River, through Rawdon to the Shubenacadie, the meeting of the new red sandstone and slate was observed only in a few places, as the thick forests prevent such examinations as would lead to a discovery of their junction to any great distance ; nor were we able to ascertain in the township of Rawdon, whether any of the members of the old red sandstone, mountain limestone, or coal groups, are placed between the granite and the red marl group.

## SOUTH SIDE OF THE BASIN OF MINES.

If the south side of the Basin of Mines be examined, it will be found to consist of the members of the new red sandstone, or red marl group, occupied by beds of limestone and gypsum. Between the river Avon and the Shubenacadie, those beds appear at many places. The gypsum is quarried and exported to the United States, and the limestone has been often conveyed from Tony Cape and the Black Rock, at the entrance of the Shubenacadie, across the Basin, for the purpose of making mortar; but recent examinations have discovered limestone abundant in Economy and Londonderry; and thus an article formerly procured at a great expense, can now be obtained cheaply by the inhabitants along the north side of the Basin. The specular and micaceous oxides of iron are often seen between Cheverie and Noel Bay. They are however unimportant in a Province where iron is abundant. Not so with the sulphuret of iron, which also appears along this shore, and in a sufficient quantity to supply manufactories of copperas.

The several rivers and creeks along this inland coast, afford shelter for vessels, and greatly increase the natural advantages this part of the country possesses, in regard to shipping both its agricultural and mineral productions. Probably the inhabitants of King's County, would receive their lime at less expense from Tony Cape, than from the Horton Mountains, should it be discovered there; and it is hoped that they will soon become acquainted with its fertilizing properties when used as a manure: by its use, many of their meagre and barren fields, might be converted into luxuriant meadows, and productive pastures.

## SHUBENACADIE RIVER.

From the entrance of the Shubenacadie, and directly across the country to Halifax Harbour, there is a remarkable channel formed in the sandstone, and the beds of limestone and gypsum that accompany its strata. In this channel the Shubenacadie conveys the waters of the Stewiack, St. Andrew's and Gay's Rivers, into the eastern extremity of the Basin of Mines. On the north side of the Grand Lake, the red sandstone is met by the greywacke, and slate of the transition series. These rocks also have the continuity of their strata broken, and a chain of lakes reaches along this deep and wide excavation, even to the Harbour of Halifax. Having examined the strata of greywacke, greywacke slate, and quartz rock, both on the east and west side of these lakes, their strata were found to correspond, having the same direction, dip, thickness and composition, on each side of the valley where they are placed. The same remarks may be applied to the banks of the Shubenacadie ; and it is evident that no other cause than the action of running water, has worn out the deep fosse through which that rapid river now passes.

The materials that at some former period filled the channel of the Shubenacadie, have been swept out, and now constitute those extensive sand banks and shoals, so troublesome to such as navigate the eastern extremity of the Bay of Fundy. Again, there can be no doubt, that the great opening in the Slate District, corresponding with the bed of that river, has been forced out of the solid strata by a mighty current. This seems evident from the masses of broken rocks that may be still seen northward of the slate formation, and exiled from the strata to which they belong. That this deep and expanded hollow in the country, is in reality a great "valley of denudation," we have not the least doubt; although our limits are too much confined, to bring forward all the testimony in favour of that opinion.

It was along the lakes and river, of this valley of denudation, that a Canal was proposed, and a vast sum of money expended, to open a communication from the head of the Basin of Mines to Halifax. Notwithstanding Nature had already done so much, and had given a sufficient hint to the inhabitants of the country, to complete what had been almost finished without the work of art, the undertaking as yet, has failed, but whether from the want of science or sufficient funds, we do not decide. Canals are much inferior to rail-roads, and as the latter are extended yearly, and their utility known to surpass every other kind of conveyance, it is probable that instead of the tardy process of drawing boats by animal strength, that rail-roads will ere long be seen crossing the Province, under the pressure of the locomotive engine.

The banks of the Shubenacadie present a superficial section of the rocks belonging to the red sandstone formation, and afford the Mineralogist several rare and beautiful specimens. The limestone and gypsum form beds of much importance. The former abounds in marine organic remains, corals, sponges, and a great variety of molluscous shells, of which we have collected upwards of forty different species; almost all of these are now extinct in this climate.

Along the eastern side of the river, several detached pieces of brown hematite, (hydrate of iron,) were observed. Sometimes this mineral presents beautiful imitative forms, particularly the botryoidal, and coraloidal varieties. In one instance we found the hematite associated with crystals of arragonite ; any considerable quantity of the ore was not however discovered, although a collection of it may yet be found in the neighbourhood. The red and brown oxides of iron, often appear in veins in the limestone, and would supply a sufficient quantity to justify the manufacture of the ochres for paint. But among the numerous productions of the Shubenacadie, the indications of lead are important. At one situation, and about four miles from Fort Ellis, in the bed of the river, we discovered a vein of the sulphuret of lead, an inch wide ; but the time and expense necessary for making any extensive examination of its quantity and situation, were obstacles not easily overcome. In another instance, argentiferous galena, in a small quantity, was procured from a fissure in the rock ; this ore contains a small proportion of silver, and almost the first indications of that precious metal we had observed in the country ; but the quantity of any of these interesting and valuable ores, and the situations they possess, are at present almost unknown, for we were compelled to leave the banks of that rapid stream, without being able to make the discovery future enquirers may be fortunate enough to enjoy. Sulphate of barytes, in laminated crystals, often appears connected with these ores of lead ; this circumstance is very favourable, notwithstanding the appearance of the ore in secondary formations, for the barytes is generally exhibited in rich mines.

Still pursuing an easterly direction, the red sandstone group continues its course to Antigonish, where it contains numerous beds of limestone, and occasionally gypsum.

## TRURO ROAD.

THE red sandstone formation reaches as far southward as the north side of the Grand Lake, upon the Truro Road. Near the Lake, and at Mr. Tremain's farm, both the gypsum and limestone beds appear similar to those already described at Windsor. Near Nine-mile River, Key's farm, Gay's River, and Stewiack, we found the limestone and gypsum abundant. At Gay's River, the plaister is dark coloured, and singularly figured with seams of jet black crystals. It is however, of a good quality, and when calcined equally as white as the paler varieties. Near Sibley's there are long parallel ridges of slate, of a good quality, and which, as before observed, appear like islands elevated above the sandstone. A large collection of yellow sand crosses the road, and the detritus of the deluge is every where manifest.

Among the limestone at Gay's River, the sulphuret of lead also appears in small narrow veins, or is seen scattered in brilliant crystals among the layers of the rock ; and it is probable, that a laborious examination of this section of the country, would be rewarded by the discovery of a valuable vein of that useful ore.

The organic remains contained in the limestone at the above places, belong to marine tribes : bivalves, the cornu ammonis, zoophytes, of different species, and sponges, are abundant. From Falmouth to Stewiack, following the course of the red marl group, eastwardly, the calcareous rocks abound in fossil shells belonging to the same families, and clearly proving that they have had one common origin.

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## General Remarks on the South Side of the Red Sandstone District.

Greywacke, and greywacke slate, appear on the South River of Antigonish ; it may also be seen at Guysboro, and forming both shores of Chedabucto Bay, where it alternates with the primary rocks. Farther northward the red marl group occupies the surface. The gypsum, limestone, and salt springs of Antigonish, determine the character of its strata, and are equally important as the collections already noticed. We regret that we have been unable to make in this portion of Nova Scotia, any extensive examinations, but doubt not that its mineral resources are great. It is hoped that a Geological survey of the country will soon be made, and a full description given, of every portion of the Province. It is however certain, that at Antigonish, as well as at Pictou, and many other places along the eastern shore, there are immense beds of rock salt, from which numerous saline springs arise. Doubtless these beds might be opened, to supply British America with an article now imported from other countries. The waters from a number of these springs have been examined, and by the great quantity of the muriate of soda (common salt) they contain, we are warranted in the opinion, that the collections impregnating them are at hand, some of which might be opened and worked, as profitably as those of Nantwich and Northwich in England.

Neither the ores of lead nor the salt, minerals of the greatest importance to the country, have been sought for any farther than as objects of natural history ; nor is there any hope of reward for such as might be willing to devote their labours to the discovery of those valuable mines contained in the country ; and should any useful discoveries have been made, what is the promised reward for perhaps years of hard labour ? If the Province of Nova Scotia received the advantages to be derived from her own mines and minerals, it is hoped there are few who would not disclose any information which might advance her welfare ; but a palsy rests upon Mineralogical discoveries, and her resources are sealed up.

Hitherto we have endeavoured to give a brief description of the minerals contained in the southern part of the Sandstone District,—taken some notice of the organic remains it embraces,—and the testimony it bears of having been buried by a general deluge. Each of these subjects teems with useful and interesting matter, and would be pursued by the details connected with them, were the limits of the description of their outline more extended.

The fertility of the soil covering this group of rocks, has been already noticed ; but before we proceed to call any attention to the general resources of the Province, it may not be considered unnecessary to give a hint to such Farmers as are located in the neighbourhood of limestone, and point out some of the advantages they possess to fertilize their meadows, and enrich their arable fields. Besides referring them to the excellent Letters of John Young, Esquire, who has written scientifically upon the subject, we would endeavour in the most plain and unaffected manner, to bring before their notice, a substance seldom used in the Province, and one which is generally abundant, wherever the lime rock appears. We mean marl, which not only fills cavities and hollows in lime strata, but also frequently occupies deep basins on the surface of the earth. The red sandstone often includes within its group, beds of indurated red, blue and white clay, argillaceous and calcareous marl. The most important of these to the agriculturalist, are the marls, occurring in many places and in several varieties. Compact limestone passes imperceptibly into marl. In Nova Scotia, the limestone enclosed in the superior strata of the red sandstone group, agrees in most of its characters with the lias limestone of Great Britain, although some of its organic remains seem to be unlike those of the calcareous formations of the Mother Country. Marl is generally composed of the carbonate of lime and clay, mixed in different proportions, although sand and other foreign ingredients are often present. Indurated marl is easily cut with a knife, its fracture is earthy, and the colours are white, brown, grey, yellow, &c. Earthy marl differs only from the indurated, by being more loose, soft and friable ; both kinds frequently pass into each other. All the varieties of marl effervesce in the acids, hence it may be easily known by placing a small quantity in contact with nitric, sulphuric or muriatic acid, or mixing it with strong vinegar.

These varieties of the carbonate of lime, are extremely useful in the improvement of soil, the fertility of which depends much upon the proportions of siliceous and argillaceous earth it contains ; therefore to employ marl judiciously, the farmer should be made acquainted with the different chemical agents entering into the composition of the soil he cultivates. The beds of marl occurring, connected with the limestone and gypsum, and extending over a considerable portion of the Province, are of great practical value, and should be employed without delay. From the limited description thus given of that useful substance, it is hoped no difficulty will be found in discovering all its varieties ; but for its particular application, some good work on agriculture should be consulted.

That part of the red sandstone formation, which lies along the north west side of the Slate District, after beginning at St. Mary's Bay, and following the course of the South Mountains, does not terminate until its layers, like those of the older formations, are buried beneath the waters of the Gulph of St. Lawrence. The gypsum and limestone, do not however, accompany the sandstone throughout its whole extent. They are altogether deficient in the great valley of Annapolis and King's Counties. After having been deposited in numerous situations at Windsor, Newport, Rawdon, Douglas, and the banks of the Shubenacadie, they decline in the neighbourhood of Pictou, where coal, a more important article, supplies the seeming deficiency.

The organic remains contained in the slate, throughout the whole range of its distorted and vertical strata, from Yarmouth on the west, to the Gut of Canso on the east, are in some degree uniform in their characters ; and evidently possessed an existence at one and the same time. However different that epoch may have been from those which have succeeded it, the same kinds of marine plants and animals appear in the slate at both extremities of its layers ; and numerous as they indeed are, they doubtless had an existence coeval with the original stratification of the slate, where they are forever rendered incapable of either multiplication or decay. They were the inhabitants of the same age, enjoyed similar bounties, the same climate, and were companions at a period when the waters of the sea were as warm as those of the present tropical oceans ; a fact easily proved by their organization, and the beauty and delicacy of their shelly coverings. The corals, coraline, sponges, and other vegetable productions of that period, although bearing a striking resemblance to those now flourishing in submarine situations, have nevertheless some peculiar characteristic features, distinguishing them from species of the same classes now inhabiting our shores, although their lineal descendants have long since passed away. Again as we ascend the scale of superposition, the limestone of the sandstone formation, contains numerous relics of productions belonging to the shores and bottom of the ocean, with species of shells and zoophytes like those still living and moving upon the coasts of this interesting country. Without seeking further testimony, these circumstances are perhaps sufficient to prove, that the red sandstone of Nova Scotia is a recent deposit, and was formed long since the strata of slate had been the graves of myriads of plants, and animals, belonging to an earlier period in the history of our planet.

The new red sandstone in Nova Scotia, never attains any considerable elevation, and the slate towering far above it, dips beneath the soft and marly covering of the country ; and also rising from beneath, forms some of our most elevated hills. Is it then impossible, that long after the slate had been thrown upwards by the expansion of the granite, the sandstone might have been formed at the bottom of a sea then covering the numberless marine plants, and animals, now folded up in its strata ? Might not the beds of limestone formerly have been coral reefs, which as the sea retreated, became more compact, and now furnish the surest evidence of their former growth ? The relics of plants and animals in each of those classes of rocks, afford the characters of an history written by time itself. Here we need not fear the partiality of the historian, nor the secrecy with which human affairs are often conducted. Here great and important events in the history of this globe, have been faithfully recorded, by once living witnesses to the momentous catastrophes that have taken place ; and their remains are yet preserved for our use, that we may be able to form higher conceptions of the sublime works of our Almighty Creator. By these imperishable records the cobweb theories of many ancient Geologists are torn asunder, while modern opinions, supported by facts alone, not only confirm the faith of their believers, but lead them to enquire into circumstances hitherto unknown.

The practical value of the gypsum must be manifest. It already forms an article of commerce, and its demand will increase yearly. Scattered along the whole coast of the south side of the Basin of Mines, upon the banks of navigable rivers and creeks, throughout an extensive portion of the country, the gypsum can be quarried and shipped at a low rate ; and from its inexhaustable treasures supply the whole world with an article, which, in many places, will render the barren sand a fruitful soil, and the parched ground a productive field. Moreover, the best kinds of freestone may be quarried in many parts of the Red Sandstone District, should it ever be required, and the snowy white alabaster, with several variegated kinds of that beautiful rock, may be procured for the designs of the sculptor, among the beds of plaister so common in the country. These at least will serve to ornament the dwellings of those who rise with the progress of civilization, and keep pace with the march of refinement.

Before this part of the subject is given up, the attention should be directed to an opinion common in the Province : namely, that gypsum is not beneficial to our soil, while in many parts of the United States it produces abundant crops. We have instigated several experiments and made many observations, to ascertain how far those opinions are correct, and give the following as the result of our enquiries. In those situations where the plaister forms the natural rock of the country, the soil to considerable extent in every direction, is deeply impregnated with the gypsum, and often in the immediate neighbourhood of the rock, the soil is so completely surcharged with the sulphate of lime, that sterility ensues, in the same manner as if the ground had been manured too highly. In the latter case however, the manure gradually decays, and the earth is finally left fruitful for a definite period. But in plaister districts, the decomposition of the rock is always going forward, and its influence is exerted from year to year. Let the sulphate of lime be applied to soils more distant from the rock, and where none of its particles enter into the mixture upon the surface, and the same effects will be produced in Nova Scotia as in other countries. Hence in many parts of the Province, plaister would be found extremely beneficial as a manure.

Wherever beds of gypsum and limestone have appeared throughout the country, collections of marl of greater or lesser dimensions, have also been noticed. Our limits will not therefore allow a particular description of each of those collections, and this brief outline has only been given to arouse the attention of the farmer, if possible, and direct him to those valuable deposits of manure, that may perchance be placed on his own lot.

A deposit of the purest white marl occurs in the Nine Mile settlement, four miles from the Shubenacadie River. It was discovered by the Revd. Robert Blackwood, who kindly forwarded specimens containing shells. This marl is of a pure white colour, and when dry falls into a light powder containing a large quantity of the carbonate of lime, and will, if skillfully used, greatly enrich the soil to which it may be applied. This marl is mentioned more particularly on account of its shells, which are in a good state of preservation, and very interesting; being similar to species found in the lias limestone, and lower members of the oolite group in England. Among them is a species of ammonite resembling the euomphalus pentangulas.

Wherever the red sandstone is not covered by more superficial deposits, or diluvium, its disintegration is continually advancing, and the superimposed soil partakes of its constituents and colour. Hence the reddish hue of the soil is a certain indication of the rock beneath. When the sandstone is contiguous to limestone, it becomes marly, or calcareous, and very muddy after light showers of rain. Beds of clay are often deposited on the members composing this group ; the soil then becomes argillacious or argillo-siliceous. In numerous instances has the decomposed gypsum entered so extensively into the superficial covering of the rocks, as to render it sterile : and not a little skill would be required to preserve such proportions of these materials as are necessary to the support of plants. In some parts of Devonshire in England, the soil is so red, that the sheep driven from them are known by the colour of their fleeces. A similar observation may be made of those animals grazing on the red soil of Nova Scotia.

A few cold and unfruitful patches, do indeed occupy the surface of the rocks under consideration ; this circumstance arises from collections of diluvial sand, and meagre clay, of which they are often composed. In such places lime, and marl, are of great value, and would quickly arouse the torpid covering of the earth, into healthy and fruitful action. These observations have been made from a number of situations where their subjects were manifest, and it is evident they may be applied far beyond what has hitherto been brought to our view ; for in the infantile state of the country, it is impossible to mark the boundaries, and the soil that covers them.

The shells appearing in these rocks, certainly differ in some particulars, from those of the lias formations of other countries, and therefore we have hesitated to apply the term lias, to the compact carbonate of lime, appearing above the red sandstone of Nova Scotia, until more accurate information can be obtained, or the character of the rock fully established, by those who are better qualified to decide upon its relative age. The beds of indurated and earthy marl, clay, &c., seem to agree with the under oolites in Great Britain, and contain the same, or similar relics of the great London and Paris basins. Among these relics we discovered a large molar tooth, belonging to the mammalia tribe, and the jaw-bone of a species of shark. These remains, few and insignificant as they may appear, open a new source of enquiry in this country: they clearly testify that even here, not only numerous tribes of shell-fish have been inhumed, but fish and land animals have been buried in the common overthrow. The diluvial deposits on the south side of the Sandstone District, are similar to those covering older formations. In some places they form collections of great depth, in others they are altogether absent.

## COAL FORMATION.

In dividing the Country into Geological Districts, it was necessary to refer to the rocks of the Province, only as they appear at the surface generally; and not to the strata often covered by more superficial deposits. The new red sandstone in Nova Scotia, covers the coal measures to a great extent; notwithstanding the breaking through, or outcropping of the sandstone, limestone, shale, and clay iron-stone, belonging to the Coal Formation. Therefore, having examined the new red sandstone formation, so far as it is unconnected with the carboniferous strata, it is now necessary to examine all the Coal fields of the Province, so far as they have yet been discovered; and at the same time take some notice of the red marl group, so frequently placed above them. Hitherto this group has been considered where it rests upon the slate, old red sandstone, and mountain limestone; therefore, when we arrive at that point, where it is separated from those rocks by a most important and valuable class of strata, it is expedient to examine those strata carefully, and point out their situations and extent, as far as possible under our present discoveries.

At Pictou, and in the County of Cumberland, the coal measures are introduced, separating the newer rocks from those of the transition series. Here the order of superposition is perfect and regular, having all its members present, occupying those situations, and producing that harmony, so clearly laid down by Geologists, and beautifully demonstrated in other countries.

The granite, gneiss, and mica slate, of the South Mountains of Nova Scotia, are succeeded by the slate, and other members of the greywacke group, reaching as far northward as the Township of Egerton, in the District of Pictou; then comes the old red sandstone, succeeded by the old mountain, or carboniferous limestone, upon which the coal measures are placed, and surmounted by the new red sandstone. But before a more particular description is given, of these highly interesting, and important parts of the country, it may be necessary to lay before the reader a brief view of the Coal Formation, as it generally appears. This may prevent injudicious speculation, in seeking for a mineral, where it can never be found, for coal ever appears in any profitable quantity, only under circumstances that never vary. Here again is another instance where Geological knowledge is invaluable. Numerous are the instances in which vast sums of money were expended in sinking shafts, and seeking for mines, where according to fixed laws, and the mandate of Nature, they could never be discovered; and men of large estates have been ruined by ignorant pretenders.

Of all the substances ever taken from the earth, coal is certainly the most useful. Its value increases with the improvements introduced almost yearly, in the power communicated to all kinds of machinery. Besides the numerous purposes to which it is generally applied, it possesses the means of raising itself from the earth, and forwarding its own transportation. Coal is power; it is the foundation of manufacturing industry, the greatest source of national wealth; and administers largely to the comforts of man. It hurls the car along the rail-road, the boat across the mighty deep; it lights the city traveller along his midnight way, and warms the shivering peasant, after his daily toil is over.

All the different kinds of coal commonly used, are found beneath the surface of the earth, alternated with strata of sandstone, a slaty clay called shale, sometimes with limestone, and clay iron-stone. These strata vary much, both in the size of their granular fragments, hardness and thickness. Associated and alternated with each other, they form beds varying from a few acres to several miles in extent, and are known under the name of Coal Measures. Any portion of country containing coal, is called a Coal Field. The different strata composing a coal field, are generally very regular throughout the same field; but different coal fields have different arrangements of their strata, each being peculiar to itself. Between these layers of sandstone, shale, &c., the coal is deposited, also varying from an inch to many feet in thickness. The number of seams of coal may be few or many, but in every instance the quantity of carboniferous matter is much less than that of the associated rocks.

The rocks which make up a Coal Formation, are the old red sandstone, the carboniferous limestone, and a coarse sandstone called the millstone grit; upon the latter rock the coal measures are generally placed. Sometimes coal is interstratified with the limestone, and millstone grit, but the above is the most usual order of its occurrence. It would be in vain to seek for coal in any of the rocks beneath the old red sandstone, or in any above the new red sandstone; as all profitable mines of this kind of coal, are confined to the series placed between those rocks.

Coal measures most frequently lie in a great trough, or basin, in the earth, rising upwards from a central point to the surface. Hence, if a section of a coal field be made, by cutting it through the middle, and removing one half, the remaining portion will present a number of coal seams, accompanied by the interstratified rocks forming portions of rings, or segments of circles. The ends of these rings or the sides of the coal basin, often rise to the surface, and are then called the outcropping. If a number of bowls be buried in the earth, placed one within the other, and separated by layers of slaty rocks, having one or more of their edges rising to the surface ; then if we suppose each of these bowls to consist of coal, a miniature coal basin is represented. In this manner most of the coal basins of Europe appear, and those of Nova Scotia are like them.

There is another kind of coal called anthracite, or stone coal, found in primary and transition rocks ; it contains no bitumen, and its history is involved in great obscurity. This species can never be profitably worked, and therefore is not an object of statistical interest.

## ORIGIN OF COAL.

Although there are arguments of some force against the vegetable origin of coal, those arguments vanish when the carboniferous strata are examined. Having entered among layers of rock, where that important article is only found in any considerable quantity, the mind is suddenly arrested with the remains of vegetable productions, which increase just in proportion as beds of coal are approached. At least three hundred species of fossil plants have been discovered in coal fields, ferns, equicetacea, araucarian pines, conifera, cacti, lofty palms, and enormous rush-like plants, are crowded together on the very border of the coal. The cortical portion of these plants, is often carbonized ; in some a part of the wood has been changed, and in other instances a gradual passage from wood to coal is manifest. All these plants, wherever they are now found among the rocks, are the growth of warm latitudes, so that a great and sudden change must have taken place in all northern climates, since their foliage covered the country where their relics are now found. Previous to the great Deluge, recorded by Moses in Sacred History, the Earth had doubtless suffered many and great changes, and perhaps from common causes, lakes, basins, and estuaries, had from time to time received successive layers of vegetable matter, swept into them by overwhelming torrents. Perhaps a layer of woody matter, was succeeded by a layer of sand, or clay, which might have produced those alternations that yet remain. In all this nothing more has taken place, than is still going forward upon the earth, and from the recent discoveries of the conversion of peat into coal, may still be advancing. The operations of causes now active upon this planet, may be sufficient to account for the collections of lignite, so common in all countries; but to our humble judgment, are not sufficient to explain all the changes which have taken place. And why need we seek to prove the formation of coal, from the vast rafts of wood yearly sinking in the embouchures of large rivers? Was there not a deluge—where is the Geologist who has hardihood enough to deny that most certain of all Geological facts? But we forbear; and without entering into the theoretical deductions relating to the origin of coal, proceed to examine its deposits in Nova Scotia, which for richness and extent, will stand high compared with the collections discovered in any country.

Before we proceed to give a more particular account of the Nova Scotia coal fields, it may be observed that the bituminous mineral is not confined to any particular County or District, but occupies a large area of the country. Not by conclusions arrived at in the closet, should the vegetable origin of coal be maintained, but by carefully examining the facts recorded by the hand of Nature, and stamped upon almost every rock within the limits of coal basins. Not by chemical experiments, instituted under liability to accident, and to be disturbed by agents perhaps unknown, even to Sir Humphrey Davy, the father of chemistry. Not by wandering among the inventions of men, need this subject be elucidated ; the appearance of whole trees, partially converted into the bituminous compound, and which still exhibit the vegetable fibre, proves more than all the nice reasonings of philosophers, and is of itself sufficient to convince any mind not hardened against the truth.

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### General View of the Independent Coal Fields of Nova Scotia.

## COBEQUID CHAIN.

From Cape Chignecto, at the entrance of Chignecto Channel, and on the northern coast of the Bay of Fundy, there is a chain of Mountains extending eastwardly through Parrsborough, Economy, and Onslow, where its extremity is divided or forked. One branch of this chain includes Mount Thom, and continues its course towards Merigomish. The other branch runs towards Tatmagouche, on the Gulf of St. Lawrence. Although these mountains attain in many places a considerable elevation, they have not been delineated on any map of the Province. The high lands in that part of the country where the road from Truro to Amherst crosses this chain, are called the Cobequid Mountains, and one of the elevations on the old road from Truro to Pictou, is denominated Mount Thom, although we were unable to discover which of the Mountains near the sources of the West River of Pictou had received that appellation. Green Hill, in the District of Pictou, enters into the branch that is stretched out towards Merigomish. Notwithstanding these elevations are distinguished by well-known names, they are only links in the extensive chain that separates the County of Cumberland from its neighbouring Districts, and is stretched across this section of the Province. Some of these mountains contain primary rocks, but in general they are composed of greywacke, and enormous ridges of porphyry. They form a line of division between the coal fields of Pictou, Pomket, Onslow, the north side of the Basin of Mines, and those of the County of Cumberland. Almost all this mountainous country is uninhabited, and from many points along its range, one unbroken forest meets the eye. Having crossed these mountains at a number of places, a brief detail of the most important of their features will be given, from which a general idea of their whole structure may be formed.

Between those ridges, and the primary chain on the been scientifically explored ; and the infant state of the Colony presents many difficulties in ascertaining their boundaries. The result of our labours will be given, limited as they are, when compared with the importance of the subject, and the wide field where they have been devoted. The practical value of this portion of Nova Scotia, is incalculable, and the great variety of organic remains contained in it, is worthy the research of a Buckland or a Cuvier.

With much labour has the Cobequid Chain of Mountains been traced from one side of the Province to the other ; and notwithstanding we might claim the original discovery of its continuation, and boundaries, and were the first to mark its outline upon the Map of the Province, no other name than that applied already to one portion of its rugged hills, has been bestowed ; and until a more appropriate shall be given, we choose to preserve the ancient designation of the natives, and therefore have called it the Cobequid Chain. This chain of mountains seems to preserve an uniform width, which seldom exceeds ten miles. In some places even that distance would much more than reach from side to side of its base. Its course is nearly east and west, until it reaches Mount Thom, where the bifurcation may be observed.

Eastward of the road between Truro and Tatmagouche, the mountains appear to consist chiefly of greywacke and greywacke slate, which are met by the coal measures of Pictou on one side, and those of Cumberland on the other. On the Cobequid Mountains, as they are called, granite, in limited masses, makes its appearance near Mr. Purdy's farm, and is seen at several places along the road. It also forms the top of the "Sugar Loaf", in the neighbourhood of West Chester. Westward there are immense ridges of porphyry, of several different kinds, some of these are beautiful when cut and polished. Appearing only at the summits of the loftiest mountains, the granite is confined to narrow limits, and is insufficient to render improper the appellation of Primary District to the south side of the country.

Northward of Economy and Parrsborough, the Cobequid chain consists chiefly of greywacke, greywacke slate, and porphyry.

Covered with a thick and pathless forest, the mountains defy the labours of the Geologist, and the minerals they contain are so perfectly concealed beneath the rubbish on the surface, that many years will elapse before the progress of cultivation will admit of their discovery. Often has an attempt been made to examine the rocks at the sources of rivers flowing between the oval crests of the hills, and almost as often has disappointment followed from rafts of trees, and windfalls, which have been plunged from the steep sides of the ravines into the narrow channels below. More than once has the carriboo been alarmed by our footsteps, and darted away with bounding speed. Not so the lazy and sulky bear—he has either stood his ground, or carelessly stalked among the underbrush upon the approach of a solitary visitor. Notwithstanding the difficulties attending Geological pursuits in all new countries, the length of the winter season, and the violent freshets common in the spring and autumn, several interesting facts have been discovered in regard to the Cobequid Chain. The granite and other primary masses of these mountains appear to have been forced upwards, through the strata of secondary rocks. This opinion seems fully established, where the strata on each side of the chain are seen leaning towards and upon the more elevated granite and porphyry. On the Cumberland side of this chain the strata lean to the southward, and dip north. On the south side the layers incline northward, dipping in the contrary direction. The rocks belonging to the coal measures also conform to this arrangement. The Cobequid Mountains appear like a long and narrow dyke, thrust upwards through the coal strata of the country; and the disturbance they have produced becomes more obvious as the tops of its highest hills are ascended. Its prominences can be seen at a considerable distance; one of them, placed a number of miles from the coast of Parrsborough, affords a well known landmark to pilots in the Basin of Mines. Several pieces of black oxide of manganese, were picked up from the bottom of the east river, in the Five Island Village. They had evidently been carried down the stream by the rapidity of the water, but with the spot from whence they came we are yet unacquainted. Sulphate of iron, arsenical pyrites, and specular iron ore, have also been found in the greywacke of Parrsborough, but each of these minerals appear in inconsiderable quantities.

The north side of Nova Scotia may be compared to a large level plain penetrated by estuaries and rivers, which like large drains convey the melted snow and rain from the higher grounds. Almost through the centre of this valley, the Cobequid chain of mountains extends across the country to the distance of more than a hundred and twenty miles, greatly increasing the beauty of the Province, and rendering its atmosphere more healthy.

## PARRSBOROUGH.

STILL pursuing the same order in our descriptions, that was observed in making the examinations from which they were drawn, the rocks connected with the Coal Formations will be viewed, beginning at Cape Chignecto, and following the north side of the Bay of Fundy, and Basin of Mines, across the country to Pictou. Near the extremity of the above Cape, the shale is covered by the trap rocks, and at the place where their junction might be expected, they are so blended together, that a compound is formed, very different from either rock, under ordinary circumstances.

The shore on the north side of Advocate Harbour, is composed of alternate strata of shale, and sandstone. The strata have suffered great disturbance, being broken and distorted wherever they appear. It nevertheless seems quite certain, that their layers dip northward. Not any of the relics of animals were observed among them; nor was a specimen found here worth carrying away. Near the house of Mr. Knowlton, the red sandstone will be observed resting upon the shale, and dipping beneath the trap of the lofty Cape D'Or. On the main land, westward of Spencer's Island, there are several strata of grey sandstone, suitable for buildings and grindstones. Near Mr. Fraser's farm, there is an unimportant bed of gypsum. At Phiney's Brook a small quantity of limestone appears upon the shore, where it seems only to occupy an isolated spot.

Near Ratchford's River the shale is black, resembling that which rests upon the main coal band, at Pictou. Sulphuret of iron in cubic crystals, often appears among the shale and sandstone, succeeding each other in regular layers, along this border of the Bay. Between the above place and Fox River, the strata are covered with a deep bed of diluvial sand and rounded pebbles, forming upon the sea coast a bank often forty feet high. This collection of diluvial detritus, is undergoing a constant and rapid destruction from the waves ever dashing upon its foundation. It was in a part of this bank, we were surprised upon the discovery of a number of human bones, which had become exposed, and were slipping downwards, towards the river. Having carefully returned them to the earth, and in a safer situation, the information of an old inhabitant gave sufficient proof, that they belonged to an unfortunate squaw, who had dressed herself in a bearskin, and during a snow storm was mistaken by her husband for a bear, and shot. This melancholy event took place many years ago, and the poor Indian remained a maniac during the rest of his life.

A vein of coal only two inches wide, has appeared on the east side of Fox River ; but no important quantity of that useful combustible, will probably ever be discovered where its measures are so much confined. Fine grained sandstone, of a superior quality for buildings, and capable of affording good grindstones, may be readily quarried between Fox Point and Diligence River. It contains numerous remains and impressions of large lanceolate leaves, which appear to have been much broken up at the time of their fossilization, and show their carbonized remnants in detached pieces among the solid rocks.

Not far westward of Diligence River there is a collection of clay iron-stone, in which we discovered a fossil tree apparently of the coniferæ tribe, converted into compact iron ore. This tree was probably about eighteen inches in diameter, and as it was placed between strata of the rocks, has been broken in many pieces, some of which have fallen from the embankment of the shore with other rubbish. The bark and considerable portions of the wood forming the original tree, have been converted into lignite, and jet. The whole of its masses seem to exhibit the harmony of that law, by which all substances during their petrifaction, assume the characters of the substances wherein they are changed from organic into inorganic matter. Thus an *Arbor Martus*, or iron tree, has been formed, and the perishable fibres of wood have been succeeded by more durable kinds of matter. On the east side of the river, the sandstone forms a high cliff, called Bull's Bluff. At this place lignites are numerous ; some of them resemble the stalks of Indian corn, others immense reeds. Large trees have apparently become flattened between the rocks, and converted into lignite. In some of these a small portion of the centre of the tree has resisted the change produced on the circumference, and has been transmuted into a sandstone, forming a longitudinal pith through the centre of the once flourishing plant. The impressions of leaves are numerous ; they appear like large species of the "Gladiolus" or common flag of the country. The Bluff furnishes specimens of jet, but little inferior to those found in

Spain. This mineral is black and blackish brown, opaque, compact, and susceptible of a high polish.

Between Black Rock and Partridge Island, the shale and alternating sandstone exhibit in their strata the effects of a powerful force that has acted from below upwards. At each extremity of West Bay, the layers are nearly perpendicular, while in the centre they are horizontal undulated, or run in zigzag lines along the coast, where they form a bold precipice, almost equalling in grandeur the sublime scenery of the trap rocks. At Partridge Island the upturned strata are a little retired from the shore. Upon their most prominent ridge stands the blockhouse, while between it and the basin a narrow space is sufficiently level to afford an easy communication with the harbour, and to accommodate the inhabitants of the beautiful village standing upon its border. Near this romantic spot there is an extraordinary locality. The remains and impressions of large flags, and other aqueous plants, are found in strata of blue shale. Several other small vegetables have been observed imbedded in this rock ; and their appearance indicates that they were the growth of low and moist grounds. Immediately alongside of the strata containing these antediluvian records, and in immediate contact with their branches and leaves, the rock is filled with myriads of fossil shells, which have been obtained in great perfection and beauty.

These shells belong to a species of the mytilus edulis, or common fresh water muscle ; none of their kind ever inhabited the saline waters of the ocean, and their home was at the bottom of some lake, pool, or rivulet, whose waters flowed from higher grounds. Here the productions of the soil, and the testaceous inhabitants of the water, have been buried side by side. Here the animal and vegetable creations have been laid up together in the vast cabinet of Nature ; here is testimony of the most extraordinary kind, proving the changes which have taken place upon the earth, since it rose from the dark and mighty deep. And great must the overthrow have been, when the inhabitants of the peaceful lake or brook, and the plants which blossomed upon its margin, were doomed to be imprisoned in the solid rock, where their remains still appear, forming the monuments of their former vitality, and the awful shock that hurled them upwards above the level of the waters. Had the phenomena which accompanied the events recorded at this place, been inscribed by the hand of man, many would ridicule them as idle phantoms : but as the most faithful Historian has placed the objects of the narrative before our eyes, we should begin to know how limited our knowledge is of what is past.

A bed of coarse breccia forms the east side of the mouth of Partridge Island River ; the grey sandstone and black shale, in perpendicular strata, compose the shore as far eastward as Clarke's Head, where it is succeeded by a bed of diluvium ; and afterwards by the new red sandstone, which is finally overlaid by a mass of trap, to be mentioned hereafter. At this locality all the rocks have been under the influence of heat during the formation of the greenstone in the neighbourhood ; and there are few places in the Province, where so great a variety of minerals has been produced. The sulphur has been united with the iron, and large plates of shale are covered with a brilliant efflorescence of the sulphate of that metal, forming very singular specimens. The sulphate and carbonate of lime, are mixed, and contain within narrow fissures, groups of crystals, called hog tooth spar. Frequently the mixed rocks have their surfaces studded with delicate crystals of analcime. Sandstone, shale, trap, gypsum, and limestone, seem to have been thrown together and heated intensely. Hence many masses of rock defy classification, and must be consigned to that very convenient term in Mineralogy, called "compounds." A few yards in front of a low cliff, a solitary pillar of rock, about seventy feet high, adds much to the beauty of the shore. In this rock several interesting specimens may be obtained. They are the tremolite, augite, micaceous oxide, and sulphuret of iron. The tremolite is distinctly crystalised in prisms: sometimes these prisms are oblique and terminated by diedral summits. The augite is of a dark green colour: when the crystals are found regular, they are generally six-sided prisms, occasionally terminated with beveled tops. Small cavities in the pillar are often lined with delicate crystals of this mineral, and sometimes contain all the above substances congregated together. The micaceous oxide will be known by its tabular crystals and pigeon-blue colour: and the sulphuret of iron exhibits its usual brassy appearance.

From Swan Creek to Moose River, the red sandstone crowned with trap, predominates. These rocks will be particularly described when treating of the Trap District. Alternate layers of sand-stone, iron-stone, and shale, constitute the shore at the entrance, and form walls on the sides of Moose River. Here the coal and its series, extends along the coast of Mines Basin some distance, and would lead any miner to suppose that veins of that most useful mineral were cropping out before him. No coal has however been discovered at this river, although it is highly probable it will be found when the surface becomes cleared of the thick forests now growing upon it. Another indication of coal at this place, is the number of fossil plants, and impressions of leaves contained in the strata, which dip in a north easterly direction. Near the entrance of the above river, we discovered an immense fossil tree, which is not only remarkable on account of its great magnitude, but also for the great perfection of its branches and leaves. The shale and sandstone are gradually broken up, and removed by the operation of the elements upon their brittle and crumbling strata ; hence this enormous tree, now a solid stone, once buried deeply in the earth, became exposed, and large sections of its trunk are now seen projecting from the base of an almost perpendicular cliff. One portion of the trunk, supposed to be its largest part, measures nearly three feet in diameter. Another section, of dimensions gradually becoming less, penetrates the rocks to an unknown distance : from the size of those blocks, and the supposed class to which the tree belonged, it must have been a lofty plant. It has not, however, like some others that will be noticed hereafter, maintained its original perpendicular position. Its glory is fallen, and probably during the rush of some fearful torrent, has been uprooted and covered by the materials now forming its grave. This fossil, in its appearance, has a general agreement with the

*Lepi do dendron Aculatum* of Sternburg, an arborescent plant, having some analogy to the cocoa-nut tree of the tropics. We have finally succeeded in tracing this tree to its branches and leaves, which are perfect models of the original. Among the shale and near the trunk of the above fossil, we also discovered numerous impressions of leaves, apparently belonging to different species of grasses ; and the remains of the aquicetacea are abundant. Beautiful impressions of the leaves of the *Sphenopteris Trifoliata* are seen when opening the slaty rock, appearing as natural as if they were just taken from the herbarium of a botanist. But among the numerous vegetable organic remains found at the above locality, none are more interesting than a kind of fruit resembling grapes, which are so naturally preserved among the stony foliage of this singular spot, that no doubt remains of their original character. A whole strata of black shale, containing a large quantity of carboniferous matter, is almost wholly composed of grasses, branches, and leaves of trees.

May we not be allowed to pause for a moment in these enquiries, and reflect upon the phenomena before us. That the freshwater shells and aqueous plants at Crane's Point, and the majestic tree at Moose River, with all the lesser plants, that were once mantled in green beneath its branches, were the productions of the same age, there can be no doubt. All these relics are enclosed in the same class of rocks, and furnish the best testimony of their coeval existence. But how are they changed ; the muscle has now become a solid stone, and the towering palm an unbending and massive column. Perhaps, in considering the original habits of the plants just described, we must as Count Sternburg observes, "transport our thoughts to an epoch, when the vast tracts now occupied by more recent marine deposits, were still beneath their parent ocean, from which scattered groups of primitive islands alone emerged, covered by the vegetation of which, these relics are still preserved. The rivers, which in such a condition of things, would have existed only as torrents, would frequently tear up this vegetation, and deposit it along the bottom of the adjacent basins." But we will shortly have occasion to shew, that a whole forest of fossil plants in Nova Scotia, retains in a great measure the upright position, so necessary to its former existence; and produce substantial proof that in one instance at least, trees now remain in the same position and place they occupied during their growth.

In the rocks to which we refer, there are no remains of land animals. This indeed is a remarkable circumstance, and has produced a belief in some, that long before these animals were created, the seas were inhabited, the earth covered with herbage, and prepared to receive those creatures which were destined to feed upon the tender plant, and find a shelter beneath the branches of the lofty palm. Might not many of the changes which have taken place upon the earth, have been produced between that period when the globe was first created, and the Noachian deluge? And might not many of those effects, the causes of which are now almost inexplicable, have been produced at that momentous period, when the "windows of heaven were opened," and "the fountains of the great deep broken up?" From what we have endeavoured to examine, and our feeble penetration into these dark problems, we are compelled to believe, that in no way can these phenomena be so satisfactorily accounted for and explained, as by admitting the brief account of the creation of the world, in the first Chapter of Genesis ; and that there is no necessity for making the world appear older than its date given by Moses. Fortunately however, diversified as the opinions of modern Geologists may be, there are few who do not add much testimony to corroborate the statements of that inspired historian.

Before the plants to which we refer, could have become petrified or converted into stone, it was necessary that they should have been submersed beneath the waters of a lake or ocean, at the bottom of which layers of sand and argillaceous particles, accumulate in successive deposits, according to the course of the currents, and the rocks from which their materials were derived. And is it not probable that the bottom of the sea where these collections of vegetable matter have been made, and covered by successive layers of sand and clay, has been uplifted by some volcanic force ? The sand and clay have been rendered solid, and still preserve their stratification : the plants have been decomposed, and their places filled up by the surrounding materials, presenting those facts so common in secondary deposits.

The causes of similar phenomena are now in progress upon the earth. Instances might be quoted where vast rafts of timber finally sink at the mouths of rivers, and in estuaries where there are enormous accumulations of vegetable matter. Such occurrences are common on the Mississippi, and other large rivers, and why should they not have taken place on the antediluvian world ?

These effects may be altogether independent of the great general deluge. The detritus of that overwhelming flood is indeed placed above the rocks containing those vegetable remains, and is common in all parts of the world.

The volcanic fires of the earth are gradually becoming extinct. They were evidently far more vehement in former ages than in the present day. Therefore we have sufficient reasons to believe, that from the creation of the world to the deluge, great changes must have taken place upon the earth's surface. Who can clearly decide, that the flaming sword which forever shut out our first parents from Eden's delightful garden, was not a livid torrent of flame, issuing from the ground polluted by sin? Near Moose River, there are huge masses of trap rocks, and there is every evidence afforded, that in that neighbourhood at least, the earth's internal fires have broken forth.

From Moose River to the settlement at Five Islands, the red sandstone occupies the embankment of the shore, and is covered at some places with a diluvial deposit from ten to thirty feet deep. A small headland called "Blue Sac," is composed of breccia, and seems to be the margin of the trap formation. At the above settlement, the red sandstone, covered by diluvium, composes the low grounds. The mountainous chain already noticed, here begins to recede from the shore. Over its perpendicular strata of greywacke, the North River falls in a splendid cataract, and offers to the eye a waving rainbow, playing in its beautiful colours over the frothy pool into which the broken torrent descends. The waters of this fall pass over a precipice about fifty feet high. In the spring and autumn, when the contents of the river is increased, it produces a hollow sound, which may be heard at the distance of several miles. Were it placed in a more exposed and populous part of the country, it would afford a celebrated resort for the lovers of romantic scenes. From the bank of Bass River, a small stream running through the settlement, a salt spring rises from the red sandstone beneath. These waters have never been analysed ; but they probably contain only the muriate of soda, (common salt.) It is reported by the inhabitants of the Village, that they possess medicinal virtues ; but it is probable, that a strong solution of Liverpool salt, in clean water, would be equally efficacious in healing them of their diseases. Although a bed of rock salt may be near the spot from which this spring issues, it could not be worked without a great expense, as it is probably situated on a narrow point of land and nearly surrounded by the sea at high water.

## ECONOMY.

The new red sandstone forms the shore of this Township, and often rises to considerable height. Its layers are nearly horizontal in some places, while at others they dip to the southward, at a small angle. Excellent quarries of freestone might be opened along this coast, and durable materials for building be procured at a low rate, although great care should be taken to select strata that will resist the weather. Near the principal source of the Economy River, there is another splendid water-fall, and the contents of the rapid stream is hurled over the strata forming the south side of the Cobequid other marine inhabitants. Among the former we discovered the *Nautilus Truncatus*, *Productus Scoticus*, and belemites. The limestone is one of the largest of the most recent deposits, in the country. It approaches the oolite series, of which there are no extensive formations in Nova Scotia, so far as we have surveyed it. Nor can a pound of chalk be found in British America, belonging to its rocks ; hence those more recent depositions have never been made in this quarter of the earth.

The discovery of the carbonate of lime in the above Township, is very valuable. A few years ago the inhabitants were obliged to cross the Basin, to obtain the rock that has since been found abundant on several of their farms. Beds of clay of a superior quality, are common between the upper members of the red marl group, and the limestone. Many of these would afford the best materials for potteries, and for the manufacture of some kinds of china. These argillaceous beds are often covered with sand and water-worn pebbles to a considerable depth. Notwithstanding they often rise to the surface, where they can be readily opened.

## LONDONDERRY.

A SIMILAR series of formations to that just described, continues its course eastward. We did not observe any gypsum along the shore of this Township, and the limestone is less common on the margin of the Basin at this place, than it is farther eastward. The mountainous chain northward of the great road, and the rocks belonglonging to coal series, by running farther from the coast than at Parrsborough, have a low and fertile plain at their bases, and the oval prominences so characteristic of the red sandstone, may be observed in every quarter of this fertile district.

At the mouth of Portapique River, and on the farm of Mr. William Davison, two small salt springs break from the bank, which at their site is thickly covered with diluvial gravel. The water of these springs is highly impregnated with common salt. Three pounds of good salt were obtained, by evaporating ten gallons of water in the ordinary way.

On the banks of the Portapique, pieces of coal have been discovered. A small quantity of the micaceous oxide of iron, was however, the only reward for a hard day's labour among the rocks overhanging its sides.

Several beds of limestone are exposed on De Burt River. A little to the westward of the bridges crossing that stream, and on the farm of Mr. Morrison, the rock abounds in shells of various kinds. We have been unable to decide upon all their different species, any farther than that they generally agree with those of the lias formation in England. The rock in which they are now secured, is of a reddish colour, and apparently mixed with the marly sandstone lying beneath it. It affords good lime when calcined, and is easily quarried. A bed of dark coloured slaty limestone occurs in immediate contact with the above rock, on its west side, and was evidently formed under different circumstances. Three species of shells appear in this calcareous deposit; they are all bivalves, and are not found in the red limestone. These bivalves are so different from any of the species we have seen figured or described, that it has not been determined to what family they belong. Indeed, if the reader would wish to try his skill in fossil conchology, the rocks near the entrance of DeBurt River, will afford abundant materials for his exercise. A bed of gypsum also appears at the above place ; but as that mineral can be more conveniently shipped from the other side of the Basin, it is of little value.

On some of the preceding pages, the fresh water shells, and the fossil plants, incarcerated in the shale of Parrsborough, have been very concisely described, and a few hints given of their probable history. But here, in rocks of later origin—in those which are placed far above that shale in the order of succession,—the testaceous inhabitants of the sea are cemented together, almost defying conjecture itself. But if we enquire into the condition of all the secondary strata, and believe that while one portion of the habitable earth has been engulphed in the waters of a primeval ocean, and the bed of the ancient sea uplifted far above the waters that covered it : If we believe that these changes may have been effected, perhaps several times, upon the same portion of the earth's surface, there will then be no difficulty in finding causes equal to the effects produced. We had been informed by a respectable individual, that some kind of ore was common in the fields near this river, and found upon examination, that pieces of hematite were scattered over the surface, and often became exposed during the ploughing of the soil. This species of iron ore is often beautifully crystalised, and assumes several imitative figures. Its occurrence on the surface of new rocks, and intermixture with the soil, are also patches of brown and white sand, produced from the same cause, and are common wherever the eye is turned over the Province. Limestone forms a portion of Dickson's Hill, four miles north east of the Village of Truro, and the fertile surface of the country extending eastwardly through a number of flourishing settlements, whose inhabitants have been taught by experience to cultivate the red soil in preference to any other.

Ten miles northward of the beautiful Village of Truro, and near the road to Tatmagouch, an outcropping of two veins of coal has been discovered on the banks of a brook that cuts the strata, almost at right angles. The layers of coal cross the brook, and have been worked from twenty to an hundred yards in each direction, on a level with the stream passing across them. They are separated from each other about two furlongs. The largest vein is twenty and the other twelve inches in thickness—dip southward, one foot in three. The coal burns freely, although not highly charged with bitumen. We examined these mines accompanied by an intelligent old miner, who had laboured almost night and day during the winters of 1834 and 1835, in a narrow dark opening in the earth, where a necessity for standing in a bent position, has forced a habit upon the poor miner he is unable to overcome. The walls of the small coal seam are altogether composed of fossil trees of enormous growth. In entering the dark chasm on the west side of the brook, it reminded us of creeping into a large raft of timber, having its interstices filled with coal. Such as have any scruples respecting the vegetable origin of coal, should visit this locality, where all the plants found in the rocks, are partially converted into this useful combustible. Some large reeds or calamites, and numerous trees, the growth of this world in a former state, have only their cortical covering carbonized. In other instances the coal surrounds the plant, and is several inches in thickness ; while in the centre of large masses, taken from the workable part of the vein, longitudinal and furrowed pieces of slaty claystone are collected, representing most perfectly, the pith of the plants to which they belonged. These piths were placed too far from the carbonizing power, and instead of being transformed into coal, were by another process, made to bear the characters of the surrounding shale. A number of solid evidences of the conversion of wood into coal are now upon our shelves, and furnish testimony not easily overcome, by such as would defend opinions opposed to these facts. Whether those plants have been thus changed, by the medium of water or heat, or whether both of those agents have been in operation during their curious transmutation, it is somewhat difficult to decide. Notwithstanding, that hypothesis which admits heat to have been the object employed, seems most preferable.

The practical value of the Onslow coal mine, is at present of but little importance, and perhaps little is comparatively known of its extent. On the DeBurt and Chiganois River, and at the Onslow coal mines, the effects of running water are very plainly exhibited. At those places the coal measures have been denuded from fifty to two hundred feet, and deep channels formed a number of miles in length through the solid rocks. These facts are very manifest : the strata on each side of those rivers, and on the brook of Onslow coal field, correspond exactly in every particular, and the most imperfect examinations shew, that those deep notches through which the water now passes, have been worn out since the rocks were consolidated and placed in their present situation. They also give an useful hint when a general view of the surface is taken, furnishing indisputable evidence, that deep valleys in which rivers now pass, have been formed by the steady action of the watery element.

About nine miles eastward of the Village of Truro, and on the road to Pictou, the red sandstone meets and overlies the coal measures. In passing along this road, a change will be observed to take place in the colour and quality of the soil. On the marly sandstone the soil is red and light, over the coal measures it is grey and stubborn. The situation of the former rock is known by low and rounded eminences, while the latter constitutes narrow ridges of considerable altitude. From some of these elevations a part of the Cobequid Chain may be seen, covered with thick forests, and reaching towards Tatmagouch. They produce a gloom upon the mind, and recall it to reflect upon those days when the whole Province was a thick forest, inhabited only by the native savage.

On the banks of the Salmon River, at the farm of Mr. Archibald, there is an outcropping of carboniferous limestone, and there are indications of coal near his house. A short distance from the limestone there is a salt spring, that although it appears so near the coal series, evidently rises from a collection of salt in the red marl group placed above it. The limestone is black, and as far as we have examined it contains no organic remains.

From Salmon River Bridge towards the West River of Pictou, but a small quantity of diluvium was seen, although boulders of granite and blocks of porphyry are common on the road side. From the bridge to Pictou, the road passes over rocks connected with coal measures, and it is curious to observe in rainy weather, how much more muddy the turnpike becomes over the shale and slate clay, than above the strata of coarse grey sandstone.

Having, during a visit to this part of the Province, passed along the new road, and sides of several proud elevations, an enquiry was made for the celebrated "Mount Thom"; and not a little surprise was felt, when it was discovered that this appellation was applied to all the hills in the neighbourhood. Knowing that Germans are fond of low and moist situations, we could not fail to observe here the local feelings of the Highlanders, who choose another extreme, and climb the summits of the highest hills they can discover, when fixing their residence.

## PICTOU.

On the north side of the west river of Pictou, and not far from the Kempt Bridge, there is a vein of coal about six inches wide. The rapid stream has worn away the sandstone, and a perfect section of the rocks is produced. This coal is accompanied with lignites, and immense jointed reeds, which appear in great numbers throughout this populous and extensive District. It has been remarked, that at the eastern extremity of Nova Scotia proper, the different classes of rocks succeed each other in regular order, and all the secondary formations are deposited one upon or against the other, according to the most perfect Geological arrangement. The granite of the southern hills is succeeded by the slate of the Townships of Egerton, Maxwelton, and Antigonish. Then comes the old red sandstone, seen at Fraser's Brook. The old mountain limestone appears at numerous situations. Upon this rock the coal measures rest, having the new red or saliferous sandstone above them on the surface. Here the regular succession of strata is so perfect, that the modern arrangement of the secondary rocks is found to be correct by ocular demonstration.

The old red sandstone is coarse and granular ; its colour varies from a dark red to a light grey. This formation does not appear to be extensive, having only been observed at two different localities in the vicinity of the coal.

The old mountain or carboniferous limestone, outcrops at numerous places, and occupies a considerable space beneath the superficies of the country. It points out most accurately, the margin of the great coal basin of Pictou, so that its extent may be very accurately measured. Beginning at Merigomish, it continues westward, crossing the East, Middle, and West Rivers of Pictou, and following a curvilinear course, appears at Carriboo Harbour and at Pictou Island. Thus the limestone underlieing the coal of this District, encircles an area of more than a hundred square miles.

On the banks of a rapid stream called McLellan's Brook, the limestone is cavernous, and numerous deep interstices are left void between the amorphous masses of rock. One of these openings forms the entrance to the "cave." This cave is about one hundred feet in length, and on an average six feet wide. Its door is at the foot of a hill, where by stooping the visitor may enter "the dark retreat." A small quantity of pure water runs along the floor of the vault, and the rude masonry of the walls is only equalled by the fearful projecting masses, ever ready to fall from the roof above. Even this damp and gloomy cavern had an inhabitant but a few years since. An old gentleman of eccentric habits, tired of the busy scenes above ground, removed downward among the rocks, where his friends were ever welcome to his scanty accommodations. He is now again removed ; not to the earth, for his residence was in it ; but to a narrower prison, from whence he will not soon return. With the aid of a light, we succeeded in procuring a few stalactites from a remote corner of the "cave" ; but the frequent visits of the lovers of novelty, had removed most of the acicular masses from its roof and walls.

The mountain limestone of Merigomish, contains several species of fossil shells ; among them are ammonites and terebratulites. Encrinites are common in the calcareous rocks of Pictou Island, and the remains of extinct species of shell fish, are common in the limestone placed beneath the great coal basin of Pictou.

The coal measures of this District, consist of a series of layers or strata, composed of sandstone, clay iron stone, shale, bituminous shale, and coal, alternating frequently and indefinitely, but not different in any important particular from those strata, as they appear in coal measures in general. Ten strata of coal have been penetrated at the Albion Mines. They are from one to three yards in gerous, until effectual measures were taken to remove or decompose it, and the mouth of the dismal pit could be stopped. Here then is an instance of the cracking of the solid earth, on which we walk without apprehension, and scarcely believing the mighty revolutions nature has unfolded to our senses.

A large dyke cuts off a portion of the coal field, about two miles north-east of the mines. There is also an extensive fault reaching from Fraser's Mountain, in an east and west direction, to the distance of upwards of twelve miles. The surface of the earth over this fault is broken and uneven, and points out the course and boundary of the disturbance which has taken place beneath. Other marks of the influence of powerful causes are manifest in this coal field; but they are of less importance to the practical miner than those above mentioned.

Calamites, large cactites, the remains and impressions of several ancient trees, have been procured in the sandstone and shale of the colliery, and among the rocks of this coal field; but they are less common than similar plants in the field of Cumberland and Onslow. In Pictou all the antediluvian herbage seems to have been converted into coal, whereas at the above places only a part of them have been thus changed, and therefore have left perfect stony casts of their original stems and foliage.—About a mile northward of the town of Pictou, and on the south bank of a large brook, good specimens of calamites, and their leaves, were obtained. The impression of a large cactus was also observed near the "Mills." We were accompanied to this place by several scientific gentlemen of the town, who kindly presented all the fossils procured by them during the excursion ; nor were we less pleased to observe, that a taste for literary and scientific pursuits, is daily increasing in this valuable section of the Province. Already the Pictou Academy, under the talented management of Doctor McCulloch and his sons, has accumulated a number of interesting Mineralogical and Geological specimens, and other objects of natural history.

The new red sandstone covers the Pictou coal field, and skirts the coast towards the Gut of Canso. It is also spread out over a considerable part of the County of Cumberland, forming the surface of the lowest and most level lands. At the base of a hill in the neighbourhood of "Mount Thom," and also a short distance from the Kempt Bridge, it sends forth salt springs. At the latter place salt was manufactured a few years ago by a company formed in England, but as they were unsuccessful in discovering the bed of salt, from whence the springs flowed, the enterprise was abandoned. Perhaps their object would have been gained, had they selected a spot where the coal strata were placed at a greater distance from the saliferous sandstone ; for it is evident, that the rock is more superficial in the neighbourhood of coal, than in situations more remote from the carboniferous strata ; and thick beds of clay often direct the water from the mineral by which it may be impregnated. Salt springs are very numerous in the eastern section of the Province ; their number multiplied too rapidly in our travels to allow a description of them all. It was nevertheless observed, that wherever they appear the gypsum declines, and where the gypsum is plenty, there is seldom any appearance of salt.

About eight miles north of the Town of Pictou, and on the banks of the Carriboo River, there is a bed of copper ore. The strata at this place run in an east and west direction, dipping to the northward at an angle of about fifteen degrees. The copper ore occurs about two miles from the mouth of the river, in strata of sandstone and conglomerate, which form steep banks on each side of its winding channel. A remarkable circumstance connected with this copper, is the great abundance of lignites with which it is enveloped and intermixed. Large trees have been converted into coal, but still retain their natural form and external appearance, and in some instances the vegetable fibre of the wood, impressions of the leaves, bark, and all those figures so common on the surface of the living plant. Sometimes the whole tree appears to have been transformed into lignite. In other instances, only a partial change has been effected, and the ancient herbage of a productive climate is now half stone, and half coal. It is true that lignite and coal are dissimilar in some particulars, notwithstanding it has never been proved that both of those substances have not been produced by similar causes. Among the lignites good specimens of jet are common ; these are susceptible of a good polish, and equal in beauty to any brought from Wittemburg, in Saxony, or from Whitby, in England.

In breaking open masses of these once majestic trees, now transmuted into jet and bituminous lignite, the green carbonate of copper often appears, forming a beautiful efflorescence in their delicate crevices. The blue carbonate, and red oxide of copper, also appear occasionally, both in the lignite, and sandstone embracing the metal. The copper ore is deposited in narrow veins, from one to four inches in thickness, and alternating with the lignite and sandstone. The ore exhibits a variety of appearances, from its admixture with the rock and carbonized wood. Compact masses of the specific gravity 5.5, are identical with the *fahlerz* of the Germans, and may properly be called grey copper ore. Its colour is greyish black—fracture conchoidal—lustre metallic. By exposure to the air, the surface becomes tarnished, and renders its appearance unfavourable ; it is nevertheless a rich ore, and very interesting, both to the Geologist and Miner. The politeness of Messrs. Ross and Primrose, afforded us an opportunity of examining a quantity of this ore, which had been collected and stored for exportation. Among several varieties procured from this collection, were pieces composed of the green carbonate of copper, almost in a pure state. Copper ore has also been discovered at Toney's River, and the East and West Rivers of Pictou, but in quantities too small to admit of profitable mining. When the circumstances under which the above ore appears are considered, its association with vegetable remains, its situation in secondary strata, it can hardly be supposed that any very important quantity of copper will ever be found near this place. It is among the more ancient formations of granite, greywacke, and slate, that more valuable deposits will be discovered. While the small and occasional collections contained in the coal series, are only indications of those rich stores the country evidently contains.

The sandstone of the coal measures often contains valuable beds of freestone, which in the District of Pictou supply materials for building, millstones and grindstones ; the latter are however much inferior to the blue grits of Cumberland.

The red sandstone that has been represented as covering the great coal basin of Pictou, is a more shallow deposit of that rock than that of other Counties. In Pictou it is often associated with beds of conglomerate, which may be seen in almost every section of the eastern division of Nova Scotia, while in King's and Hants Counties it is comparatively of rare occurrence.

From a small eminence a short distance eastward of the Town of Pictou, long ridges of slate and greywacke may be seen rising southward of the coal boundary. In a northerly direction, a part of the Cobequid Chain may be observed, and although this district does not possess the sublime scenery of the trap formations, it is nevertheless very pleasing from the highland villages spread over the face of the country.

The shores of the harbour and rivers of Pictou, abound in projecting masses of sandstone and conglomerate ; these towards the surface seem to pass insensibly into a soft red sandstone, which from its ready disintegration, yields a rich and fertile soil. The higher lands slope gradually down to the sea, that is yearly extending the limits of its confines, by wearing down the unresisting rocks of the shore. Enclosed in long glades of interval, the rivers of this district have their more elevated borders ornamented with cultivated fields and rich meadows : and no extraordinary discernment need be exercised in discovering, that Pictou must be considered a most important part of Nova Scotia.

Four shafts are now open into the great coal bed of the Albion Mines, these being worked by steam engines, raise an immense quantity of coal. At none of the mines visited in England, was there seen so great a quantity of that mineral ready for exportation by any comparison, as was observed at those of Pictou. From the mouths of the pits the coal is conveyed on a railroad to New Glasgow, where vessels of a hundred and fifty tons are loaded in a few hours. On the river below, an excellent steamboat is constantly plying. On her passage down the river, she is followed by a chain of large lighters, deeply laden with the contents of the mine, to complete the cargoes of the larger ships at the mouth of the East River. On her voyage up the stream and over a distance of four miles, tied to some lofty craft, she paddles her winding course, thus performing a double office, and completing that series of operations by which vessels are now loaded at the port with every facility. Under the immediate direction of Mr. Smith, a gentleman of science, and to whose politeness we are indebted for much information, the whole of these operations are conducted, with credit to himself and the Mining Association.

At Pomket Harbour, a small vein of coal has been discovered. It is only about eight inches wide, and dips to the northward at a small angle. Pieces of coal and the remains of vegetables, have also been found on the North River of Antigonish, but no workable quantity has yet been exposed.

Leaving the District of Pictou and all its natural advantages, both in regard to soil and important minerals, the sandstone, clay iron stone, shale, and limestone, in indefinite alternations and qualities, form the whole coast to the Bay de Verte. They were examined at Toney's River, Tatmagouch, Wallace, and Shenemicaq, and were found having the new red or saliferous sandstone superimposed. There are indications of coal at numerous places along the coast, which abounds in vast quantities of the best building-stone, and grindstone quarries of as good materials as those of the Joggins, on the Coast of Cumberland. Organic remains are also abundant in the rocks, the limestone containing those of marine tribes, and the coal series myriads of fossil plants. Among the latter are trees of great dimensions, but similar to those appearing on the Chignecto Bay and Cumberland Basin. But as all these belong to the same deposits, it will be unnecessary to enter into any details of their characters, until we arrive at the Joggin shore, where they appear in still greater perfection and beauty. Numerous places in this part of the country have been examined, and in every instance the rocks appear to have been deposited in one vast basin, which was once covered with a most luxuriant tropical herbage. Even the common stones of the field partake of the character of the more substantial strata. The impressions of reeds and ferns, the cylindrical petrifactions of calamites, and other culmiferous plants, which occupy all the rocks on the northern side of the County of Cumberland, show that this great basin was at some former period covered with primeval plants, under a climate similar to that of the present tropics.

## CUMBERLAND.

SALT SPRINGS are common in the new red sandstone along the coast of Northumberland Strait. At the River Philip, a large quantity of salt was formerly manufactured, by evaporating the waters of a briny pool. One of the springs at that place yields a larger quantity of muriate of soda than almost any other in the country, and would supply, under proper management, more salt than would be required by the British North American colonies ; nor can it be possible that the crystaline deposit from which these waters flow, is beyond the reach of the Miner's skill. The infancy of the colony is a trite apology for not entering into useful speculations, but it seems impossible that any country can arrive at manhood, when little pains are taken to develope its growth.

Leaving the Cobequid Chain, and proceeding towards Amherst, in numerous situations the coarse sandstone of the coal measures is uncovered by the saliferous rock, and conglomerate is seen upon the surface. These circumstances are very obvious at the River Philip, Black River, and on the roads leading to the eastern shore. Collections of fine sand, beds of clay, and marly clay, are common. Freestone of an excellent quality and of various kinds, is abundant : some strata are soft and yielding, and therefore are easily worked, the stone becoming gradually harder by being exposed to the heat of the sun. The impressions of large reeds and other jointed plants, are common in all the sandstones belonging to the coal series of this part of the Province, although they are less distinct and beautiful than at other places where the rock is composed of finer materials.

Between Parrsborough and Cumberland, a deep notch in the Cobequid Chain, affords a passage for the Partridge Island River, emptying southward into the Basin of Mines, and the River Hebert, opening into the Cumberland Basin. These Rivers meet at Half-way River, where a small lake occupies a space between their sources. The greywacke of the mountains, is here met by the sandstones of the Cumberland coal basin, which are occasionally overlaid by the conglomerate, or new red sandstone. Near this lake, and at the inn of Alexander Fullerton, there is a great collection of clay iron-stone, forming a steep bank on the north side of the river.

From Maccan in an easterly direction towards the River Philip, a long belt of country is occupied by members of the red marl group. In this group, and about six miles from Furlong's Bridge, another salt spring has been discovered upon the same tract where that of the River Philip breaks out. These springs are certain evidences of immense quantities of salt, deposited beneath the rocks of this part of Cumberland. No less than four springs, highly impregnated, have been already discovered within the circumference of a few miles, and every proof is thus afforded, of the vast accumulations of that mineral somewhere near them.

At Spring Hill, an eminence five miles eastward of Maccan River, an outcropping of coal was discovered but a short time since. In the bottom of a small brook, running through a wild forest of beech and maple, a poor farmer has been digging coal, one of the greatest treasures of the earth. As the pit he had excavated was full of water during our visit to the spot, it was impossible to obtain much information respecting the quantity and position of the Maccan coal. It appears however, to dip to the northward, and the largest vein is about ten feet wide. The coal is reported to be of a good quality, notwithstanding the quantity of sand mixed with it, through the carelessness of the miner. Two other small veins appear, a short distance farther south : these, and the ten feet layer, are enclosed in strata of coarse sandstone, resembling that rock as it appears at Pictou. The impression of a large cactus, was the only relic of ancient vegetation observed, and the rocks are so deeply covered with the rubbish of the surface, that the visitor will return from the wilderness disappointed in the collection of fossils, and fatigued by a journey over an uneven surface.

The distance between the Maccan coal at its outcropping, and the navigable part of the river, is a difficulty few in the present day will be willing to contend with, notwithstanding the country is very level, and a rail road might be laid at a moderate expense, to meet the river at a point from which either steamboats or small craft might depart in safety. There are indications of coal near Pugsley's Inn, on the Maccan River ; and perhaps this article of commerce may be obtained in a situation more favourable to its exportation. Quarries of sandstone are numerous between Maccan and Nepan. At the latter place the coal measures are covered by the red marl group, including limestone and gypsum. Collections of red, yellow, and white sand, beds of plastic clay, and small pebbles, often repose upon the rocks in this part of Cumberland ; they are unfavourable to the production of good soil, and frequently render the surface sterile. Turf and peat bogs are common in such situations, and will supply that peculiar kind of fuel used by the lower classes in Ireland.

## NEPAN RIVER.

On the south side of Nepan River, there is an extensive formation of limestone, running in an east and west direction. It crosses the Maccan and Hebert Rivers, and extends eastwardly, to an unknown distance. Several species of fossil shells, and other marine organic remains, were discovered in the quarries a short distance from Nepan Bridge. They belong to classes contained in the magnesian limestone of Great Britain, and therefore clearly shew, that this limestone is not the carboniferous or old mountain, as has been supposed by Messrs. Smith and Brown. The connection this limestone formation holds with the new red sandstone and gypsum, at the above place, is another circumstance not to be overlooked in determining its relative age. It is curious to observe here the numher of pits and hollows, which contrasted with the accompanying mounds, form a peculiar feature in calcareous districts. Some of the shells, although imprisoned and forming a part of the solid rock, where for many centuries their inhabitants have ceased to exist, still appear beautifully marked with the delicate stria of the bivalves. Species of the encrinite, trilobate, &c., are the principal inhabitants of the carboniferous limestone of the Province; but not one of these extinct animals are found in the limestone referred to, and a more modern race of testaceous animals have been its inhabitants. The shells contained in the limestone of Nepan, are far above the rocks of the coal measures. They lie upon strata in which a great variety of plants have been buried. The layers of sandstone, occupying the fossil valley of the Joggins, are beneath the calcareous deposit ; a fact that none can deny who will take the pains to examine. It is then evident, that a large portion of this County, has been engulphed in the ocean of a former state of the globe. It is also obvious that it was covered by the sea after the growth of a luxuriant herbage, for perfect stony casts of the original trees still remain, and even leaves are preserved. Wherefore, although these phenomena may confound the tyro in Geology, it is plain that the fossil valley has been submersed, and during its submarine visit the limestone and shells were deposited upon its surface, where they still remain. But the great valley of fossil trees has returned from beneath the waters of the sea, and is now dry earth. The molluscous animals of the limestone, have in their turn been exiled from their native element. These are facts requiring no ingenious arguments to establish their belief ; but of the nature of the revolutions which produced these remarkable changes, we are compelled to acknowledge our ignorance. On the surface of the limestone, the detritus of the deluge forms a distinct covering ; and according to the opinion of some Geologists, should not be considered in any way connected with the changes which have taken place in the strata beneath. But we would remark, that although the beds of rounded pebbles and sand, clearly demonstrate the effects of a flood, they can have no reference to the great Geological catastrophe which ushered in that awful event. The depression of whole continents, the raising of the ocean's level bed, the distortion of strata previously horizontal, the elevation of mountains, and all those violent operations, whereby the whole surface of this planet has been rent asunder, might have been the prelude to that overwhelming deluge, while the diluvial debris resulted from the action of torrents, after the crust of the globe had been thus broken up.

On the north side of Nepan River, gypsum is abundant. It also appears in other parts of the county, but in the same manner, and of the same quality of the plaister in other parts of the country. The sandstones of the coal measures, with their red marly coverings, continue into the Province of New Brunswick, where they are met by the high lands of Shepody Mountains. The great collection of alluvium on the rivers of Cumberland, has enriched its industrious inhabitants. A number of beautiful and extensive views are presented to the eye, from spots where the neat villages of the sister Province are seen in the distance, and the cultivated fields and green marshes of Amherst are spread out over the pleasing landscape. But the visitor longs for a hill in this low and level district—for some proud eminence where the eye can wander over this interesting portion of the country.

The extensive alluvial deposits, forming wide borders on the rivers of Cumberland, have been principally derived from the broken down sandstone and shale of the coal measures. Every succeeding tide brings its treasures of fine particles, until creeks are filled up, and the rivers confined to narrow limits. So rapid and great has this collection been, that even miles from the sea trees have been dug up, having been covered a number of feet by the detritus from Cumberland Basin. This diluvium yields a soil inferior to that formed at Windsor, Horton, and Cornwallis. This circumstance arises from the more fertile qualities of the debris made from the red marly sandstone in the Basin of Mines, than can be derived from the decomposed sandstone, or blue grits of Cumberland.

## RIVER HEBERT.

At Minudie, near the entrance of the River Hebert, and a short distance from the store of Mr. Simmonds, a small vein of copper ore, half an inch wide, appears in the red sandstone, on the margin of the river. Several pits were dug by a Mr. Backwell, a gentleman employed by the Mining Association some years ago, in order to discover a profitable quantity of this metal. It is almost unnecessary to state, that his digging was unsuccessful, as it always will be, when conducted without some knowledge of the strata excavated ; for it is almost impossible that any considerable quantity of copper should be found in the marly covering of the Cumberland coal field, notwithstanding several veins in the sandstone, at the locality referred to, are coloured green by the carbonate of that metal mixed in them.

The sandstones of the Joggins coal basin, cross the river in an easterly direction, and are identical in thickness and quality, to those appearing westward on the coast of Chignecto Bay. Several valuable grindstone quarries have been opened on the banks of the river, and yield their proprietors most liberal profits. One of the veins of coal of this basin has been discovered where it crosses the Hebert near the bridge. At this place it has been opened, and a small quantity mined to supply blacksmiths in the neighbourhood, and the inhabitants of the Village of Amherst.

## SOUTH JOGGINS.

The coal basin of the Joggins not only extends eastward from the shore of Chignecto, to a distance almost unknown, but also being placed beneath the Bay, reaches into the Province of New Brunswick, including in its dimensions Cape Mereguin, Grindstone Island, North Joggins, and the lower lands at the base of Shepody Mountains. The strata of sandstone and shale, on each side of Chignecto Bay, are perfectly alike, containing the same fossils, having the same dip, direction, &c., and so perfectly correspond, that no doubt can remain in the mind that they belong to one and the same formation, were produced by the same causes, and have undergone the same changes and revolutions, alike singular and extraordinary.

The broad and deep opening of Cumberland Bay, the estuary called Cumberland Basin, and the channels of the several rivers emptying into them, and which are widely blocked up with collections of alluvium, have been worn out, excavated and formed, long since the Joggins coal basin was constructed and filled.

There must have been a period when this basin was perfect, when the site now occupied by Chignecto Bay, Cumberland Basin and its rivers, was far above the level of the present ocean, when the dry land was spread out from Apple River to Cape Carnage. But how is the landscape changed ; the site of the Bay, once covered with lofty trees, is now often studded with the white sails of coasters, its waters are inhabited with numerous kinds of fish, and dash upon the shores they have formed for themselves, with unremitting violence. The action of running water has here produced two very contrary effects : first, it has worn down, and carried away by its erosive force, the materials which formerly filled the bays, basins, and estuaries of the country ; and as those channels became widened and more expanded, as the waters themselves obtained a more easy exit, so they have brought back the debris they had produced, and deposited it along the sides of broad channels, required at some former period to allow their escape. The fragments carried downward by the torrents of rivers, have again been restored by the influx of the sea, which still continues yearly to increase alluvial collections, by bringing up the rocks disintegrated by its steady influence. Such are some of the changes produced by water in motion, and such are the effects obvious in many parts of Nova Scotia. These effects are by no means to be confounded with those produced at an earlier period in the earth's history ; they belong to the present period, and may be viewed wherever the eye is directed.

The coal measures having thus been most extensively denuded, have their strata almost yearly broken up by the turbulent sea and the frost, and now present a beautiful section of their several layers, extending from Minudie to Cape Chignecto, a distance of nearly thirty miles. These effects are greatly augmented by the rapidity and height of the tide, which rises about fifty feet at its ordinary influx. The coast from the South Joggins to Apple River, is generally low, meeting the sea with a perpendicular cliff, averaging from fifty to an hundred feet high, and skirted at low water with a beach composed of broken sandstone and fossil trees, through which the inclining strata often project in dangerous reefs and shoals.

From the South Joggins to the above river, this shore is almost uninhabited ; notwithstanding, a great number of men are employed in quarrying grindstones at Ragged Reef during the summer season. They retreat on the approach of winter, as the soil offers few inducements for the clearing of farms.

Between the Bank Quarry at the South Joggins, and Ragged Reef, there are eight veins of coal, included in a distance of about six furlongs, and averaging from six inches to three feet and a half in thickness. The strata of sandstone, shale, and coal, dip to the southward, at an angle of thirty-five degrees, and are perfectly exposed, from the top of the cliff until they disappear beneath the sea. The strata are extremely regular, parallel and equal, affording a section of a coal basin, not surpassed by any in the world, while the sloping layers of the rock, and serpentine waving of the cliff, render the scenery extremely interesting. Several of these veins of coal could be profitably worked, and will produce good bituminous fuel. At the " King's Vein," (so called from having been excavated by some soldiers formerly stationed at Fort Cumberland,) we found three Cornish miners, who had made an opening in the side of the precipice, and were supporting themselves and their families by their original occupation.

When the quality of the Cumberland coal is considered, and its geographical situation properly viewed, it is remarkable that those who claim an extraordinary right to the Mines and Minerals of Nova Scotia, should neglect a situation offering so many advantages. Almost all the coal raised from the mines at Pictou and Sydney, is transported to the United States, where its demand is steadily increasing. But vessels loading at those places, must almost circumnavigate the Province, before they can obtain their cargoes. On the other hand, if they were supplied at Cumberland, the length of the voyage would be greatly diminished, and consequently the coal would command a higher price at the pit's mouth. It is however very probable, that the Mining Association having expended large sums of money at the coal mines of the eastern parts of the Province, would rather discourage the coal trade from Cumberland, than abandon their former labours. And while competition is prevented, and the inhabitants of Nova Scotia are only permitted to gaze upon the treasures of their country, without being permitted even, to dig a bushel of coals from beneath the soil, so long in all probability will the mines of Cumberland remain closed, although steamboats propelled by fuel brought from England, shall almost daily pass over their strata.

Having briefly adverted to the coal of Cumberland, we proceed to the consideration of strata yielding great profits to their proprietors, and of the greatest importance to the country. Among the various kinds of sandstone belonging to the carboniferous deposit, there are numerous strata of that peculiar kind used for grindstones, and of a quality superior to any other ever discovered. These sandstones are composed of minute grains of quartz, sometimes transparent and colourless, but more frequently stained red, green, blue and brown, united by an argillaceous cement. These grains of quartz, sometimes mixed with particles of mica, and feldspar, form a compact rock, capable of being split into tabular masses of large dimensions. Sometimes by the presence of a little of the oxide of iron, the rock has a tinge of a blue colour; from strata of this kind the "blue grits" are derived. From the most compact and finer kinds of these varieties, the grindstones are made, and already form an article of commerce, of much greater importance than is generally considered. At the Bank Quarry, owned by Mr. Simmonds, a very industrious individual, the gravel and upper stratum is first removed, then the rock beneath is broken into large masses by blasts of gunpowder. After having been split into pieces of smaller dimensions, with iron wedges, it is conveyed to the stonecutters, who with a pair of compasses describe the circle, and with amazing facility cut the eye, and complete the whole process in a shorter space of time than would be required to form a piece of wood of similar size into the figure of a grindstone. One man will cut fifteen and even twenty of the common grindstones in a day, after the rock has been quarried properly and placed at his hand. The smaller grindstones are most valuable, and those of the quarry just mentioned, are preferred by purchasers in the United States to any other. The value of a finished stone at the quarry, is from two shillings and sixpence to three shillings; hence it is easy to perceive the great profit arising from this source, as they are often sold in that country as high as ten shillings per stone. Much larger grindstones are quarried and floated between large boats, from the reefs covered by the tide at high water; some of these are six feet in diameter, and twelve inches thick. They are used by the Americans in grinding and polishing the metals.

Grindstones are also quarried at Ragged Reef, and other places along the coast. On the opposite shore there are several excellent quarries, so that New Brunswick also, can supply a most useful article in almost all manufactories. So rare and valuable are these rocks, that they are now largely exported to Boston and other American ports, and from thence have been reshipped to different nations in Europe. It is to be regretted that any of these quarries should ever become the subjects of monopoly. His Excellency Sir Colin Campbell, with his usual interest in the welfare of the Province, is however, endeavouring to secure to the country such as are yet ungranted, and those rights the Crown has reserved in former gifts. Some idea of the value of Nova Scotia as a Mining District, might be formed from a knowledge of the fact, that the inhabitants of the Northern States find it advantageous to procure coal from this Province; and as steam navigation and rail-road enterprise increase, so must the demand for our fuel be raised. Also in proportion as their population, trade and manufactories multiply, so will the demand for our coal, grindstones and gypsum, expand. Nevertheless, if the monopolizing influence of our fellow subjects, be allowed the power it has so long enjoyed, the inhabitants of this country may weep over the folly or avarice of other men, but can never enjoy the common bounties granted to them by an impartial Providence.

## FOSSILS OF CUMBERLAND COAL BASIN.

Having thus briefly detailed circumstances intimately linked with the practical importance of the County of Cumberland, so far as they relate to Provincial and individual wealth, we proceed to lay before the reader such interesting facts as have been collected, and such as will delight the Natural Philosopher, however elevated his attainments may be in these scientific enquiries. Often have we gazed in astonishment upon the precipices of the Joggins shore, and beheld the beach on which the broken trunks and limbs of ancient trees are scattered in great profusion—the place where the delicate herbage of a former world is now transmuted into stone.

The Cumberland coal field may justly be called a vast fossil valley, where plants from the lowly iris, up to the majestic palm, have been buried by some great and sudden change on the surface of our planet. The area included within the limits of this singular event, is by no means narrow or confined to the petrifaction of a few lignites : it reaches at least fifteen miles along the shore, and more than twenty into the interior of the country. The banks of rivers and creeks, the sides of ravines and cliffs, have been examined, and the same fossils are every where exposed, over several miles on the surface : and even among the common rocks of the field, the remains and impressions of antediluvian plants are yearly overturned by the movements of the plough and hoe. These facts should be remembered, as they plainly shew that no common causes could have produced effects so wide in their operations, and powerful in their results.

Between the Bank Quarry and the coal veins, there are sections of two large fossil trees, standing perpendicular by the side of the cliff, and penetrating the strata in their way upwards: but as the precipice is constantly yielding before the action of the elements, its strata have fallen, and in their descent carried downwards large portions of these trees, which may now be seen among the numerous relics of the shore. The roots of the largest tree may be observed as they enter the rocks, and a sudden swell is spread out at the base, reminding the visitor of the cocoa-nut tree of the West Indies. Mr. Brewster, in the Edinburgh Phil. Trans. for 1821, has figured a stem with roots, found at Niteshill. Count Sternburg has also figured a magnificent specimen of this species of tree, which is called *Lepiododendron Aculatum*: neither of those specimens however, equal these of the South Joggins in their size, for the tree to which we now refer, is upwards of three feet and a half in diameter; and although only about fifteen feet of its stem remains, it must have been more than a hundred feet high. Trunks and branches of other plants, are abundant; their stems are frequently perpendicular in the rocks, except near the coal veins, where they lie parallel to the strata, a fact of considerable importance.

A few miles southward of the "King's Vein," we discovered an immense fossil *Lepiododendron Aculatum*; the violence of the sea had removed the adjacent shale, and sandstone, and the majestic plant remains erect, by the side of a vertical cliff. This tree stands perpendicular, passing through and crossing the strata, according to the angle of their dip. Its roots are seen branching out, and penetrating the rock beneath. At the base it measures two feet eleven inches, and forty feet of its trunk were exposed at the time of our last visit to the spot. Sections of a still larger growth may be seen along this unfrequented shore, and pieces of smaller dimensions may be observed, from fifty to an hundred feet up the embankment.

Frequently the bark of these trees is converted into coal, constituting the true lignite ; in other instances the bark, with the tree itself, is changed into compact sandstone. Great care should be taken in removing pieces of the former, as sometimes a whole tree, having its cortical portion carbonized, will slip through the bark, and come headlong to the beach. In this way we were in danger of being killed from the unexpected launch of a huge fossil.

Since a recent visit to the Joggins, our agent in fossil affairs, a sturdy miner, has informed us that a portion of the cliff has lately fallen, and exposed another tree of great size. But few days have elapsed since we found a gigantic plant imbedded in the sandstone at low water mark, opposite the Bank Quarry : it had been exposed by blasting the rock for grindstones, and the miners suffered some loss and disappointment, in consequence of its passage through a profitable layer of stone. At this place, a *cactus*, beautifully figured on the surface, and measuring fifteen feet in length, had been broken by the workmen, and rolled off the reef. Such are some of the ponderous fossils of this valley, to which months might be devoted in collecting and describing the remains of a former world, and where more fossils of large dimensions, more perfect in their preservation, and interesting in their postures, occur perhaps, than in any other part of the world, so far as they have been discovered.

Some of the trees of this valley, seem to belong to the palmaceous order, and to anomalous species, connecting the palm to coniferous tribes. *Arundinaceous* plants are abundant ; among them are calamites, a generic term used by Sternburg and Sclotheim. These are jointed stems, longitudinally striated : in some of these fossils the joints are long, in others short ; frequently they resemble bamboo very closely, and hence have been called bambusites, although Count Sternburg observes,—“ elles se distinguent des bambousiers en ce que les divisions n' en sont point marquées par des nœuds saillans, mais par des contures ; elles sont en outre rayées plus distinctment.”

The *variolaria* of Sternburg are common ; they have the depressed areola, with a rising in the middle having a central speck ; these are called variolate, from the surface appearing as if covered with pits of the small pox. Different species of this plant are easily procured. The *variolaria* are almost always found between the layers of sandstone and shale, considerably flattened, and with a longitudinal groove along their under side. Steinhauer considered that this groove represented the pith, which was not so easily decomposed as the other woody parts of the plant. With him we are unable to agree in this particular, for besides the longitudinal groove, so well described by him, and appearing in numerous specimens, the pith or heart of the plant is beautifully preserved, enclosed in a tube running through the fossil so clearly and naturally, as to leave no doubt of its original nature. We placed a specimen of this kind in the Mechanics' Institute, at Halifax, an establishment of much importance to the country, and many large specimens with the pith entire, are now upon our shelves.

Another class of fossils common on this shore, is easily recognised by their fluted appearance. The flutings are farther apart than those of the calamites, and the plant has no joints. This class is called *Syringodendra*, by Sternburg. Several species have been found in the strata of Cumberland ; among them is that called *Palmitus Sulcatus* by Schlotheim.

Trunks and branches transversely striated—the *Phytolothus transversus* of Steinhauer—sometimes appear ; although they are more rare than the preceding plants. Enormous cactites may be picked up among the broken strata, near the coal veins. Large oval masses, resembling the thick fleshy stems of the tropical cactites, are abundant ; but it is difficult to decide how far they are represented by species now inhabiting the earth.

But besides the foregoing classes and their several species, we have here a lofty and majestic fossil, lifting its head far above the humbler plants. This giant of the petrified forest, nearly resembles the palm tree of the tropics ; it consists of a large straight trunk, without limbs, except at its summit, where the leaf and branch were united. The leaves resemble those of the living palm, and must have been of great length, as some of them can be traced continuously through the shaly rock, to the distance of forty feet. The cortical covering of these trees has been converted into coal, which readily separates from the trunk, leaving a smooth surface. Several kinds of leaves have been found, but in the present state of our knowledge, and being unable to obtain the most recent works on fossil flora, we find it difficult to decide to what species they belonged. Conybeare and Philips have observed, that one class of these impressions has been compared by different authors to Hippuris equisetum, Asperula, Galium, Rubia, Moluga, and Casnarina ; a list quite sufficient to shew their entire uncertainty of the subject.

From what we have examined, more than one half of the plants petrified in this great fossil valley, belong to species resembling filices, (ferns.) One kind belongs to the equisetacea, (horsetail.) There are reeds, canes, conifera, (fir tribe,) Araucarian pines, tree ferns, cactites, palms, and rush-like plants, twenty feet high. There are leaves of the *Sphenopteris trifoliata* ; others are pectinate, flabilliform, bissinate, and ensiform. The intention of this work will not allow an elaborate description of the above fossil plants ; but from the foregoing facts some general idea may be formed, how great the vegetative power must have been during that period, when their branches and leaves overshadowed the antediluvian soil.

Doubtless there was a period in the history of this terrestrial planet, when all these plants spread forth their vigorous leaves ; when the lofty palm with its umbrageous foliage, hovered over the leafy cactus ; when the jointed and bending calamite, waved in the primoidal breeze, casting its moving shadow upon the waters of some ancient lake or basin. In the examination of these relics, belonging to one of the kingdoms of living nature, the mind is transported back to an era for ever gone, and the soul is aroused in its deepest recesses, by a faint ray of light, seeming to issue from the primeval world. But in vain will that world have perished ; in vain will its ponderous relics, thus preserved for our instruction and admonition, be unfolded to our senses, if they fail to awaken their oculate witnesses to a view of the beginning and end of all sublunary things, and lead them to admire the great Author of all terrestrial beings.

All the plants thus concisely noticed, and now converted into solid stone, flourished in a climate as warm as that of the present tropics ; every fact connected with their classes, structure, foliage and size, demonstrates that they are natives of a moist soil and heated atmosphere. Descending among these enormous fossil vegetables, the mind is immediately arrested with their similarity to living plants now growing in South America and the West India Islands. The botanist may search in vain for their successors in these northern latitudes : none of their analogies are now growing in this frigid region. Since their mighty vegetation covered the earth, since their delicate leaves and blossoms had been expanded, their vast sources of multiplication unlocked, and their odoriferous exhalations emitted in a benign atmosphere, the climate has been changed, and they have been sealed up in the dark cemeteries of the dead. And although our name may perchance be enrolled among those who are called catastrophists, and do not allow enough latitude for the operations now going forward upon the earth ; we know that some vast change has taken place in the climate, some mighty revolution in the rocks has been effected ; and moreover we are compelled to believe, that the change has been as sudden as great, the disruption as powerful as it appears extraordinary. Let him who doubts the correctness of these opinions, examine the herbage upon the Joggins cliff; here the birch, maple and spruce, in dwarfish thickets, with small creeping evergreens, mantle the earth. But if he descend among the strata beneath, the majestic palm tree, the gigantic cactus, and several species of succulent vegetables, are placed before him, and the stony foliage of another climate, more mild, humid and salubrious, lies buried in the earth beneath his feet.

In order to account for the great collection of tropical plants now found in northern latitudes, some Geologists have informed us, that they drifted there during the Noachian deluge. But is it possible that delicate branches and leaves, should suffer a transportation of two thousand miles, and even much more, be exposed to a powerful current, the agitations of the ocean, the chemical action of the saline fluid, and still be preserved in all their original beauty? Could the fossil flora and tender pericarps, endure a voyage so hazardous to their structure? Most certainly not. Others have supposed that the poles of the earth have been changed, whereby the ancient tropics have been conveyed to the present poles, and the ancient poles to the present tropics. These opinions must also fall, and the idle theories they have introduced, be abandoned; for the plants belonging to the coal fields are all tropical, whether they be found in Greenland, or directly under the Line. Therefore a warm climate must have pervaded the whole universe during the coal period. But without bringing before the reader all the evidence refuting such opinions, let the matter be referred to the testimony afforded on the coast of Chignecto Bay. Here immense fossil trees are seen standing perpendicular, penetrating the strata in their way upwards, and unaffected by the inclination of the several layers through which they pass. Here also the roots of the plants are seen branching outwards, and entering the rocks beneath in the most natural order. Therefore the best evidence is afforded, that they flourished upon the spot where they are now located, and stand in the same situations as when their spreading boughs afforded a cool retreat from the scorching rays of the sun.

We have already observed, that the great fossil valley has been submersed beneath the waters of the ocean. This is evident from the calcareous deposit placed above it at River Hebert, Nepan, &c. This calcareous deposit contains an abundance of marine shells, therefore all doubt on the subject is removed. That the Cumberland coal basin has been beneath the waters of a primeval ocean, there can be no doubt ; round masses of quartz, sandstone, and even porphyry, frequently appear in the middle of its strata. Sometimes these bolls are troublesome to grindstone-cutters, who call them "bull's eyes." They are frequently as large as a four pound cannon shot, and render the slabs where they are deposited, unfit for use.

From the facts already described, perhaps the following theorem may be derived ;—that the Cumberland coal field was at some very remote period covered with a very luxuriant tropical herbage ; during the growth of enormous plants upon its bosom, it was by some Geological catastrophe buried beneath the waters of the ocean. In this state of things, the sea would naturally convey and deposit upon it, layers of sand and clay, ultimately forming strata of sandstone and shale. In those situations where there was a hollow or a hill, those materials would be carried over the summit of the latter, forming regular sloping strata down its side, leaving the trees in their original upright position. In this way only can we account for their frequent upright posture; for had the strata containing the trees, been formed horizontally, the fossils would cross them at right angles, however much they might have been elevated by some eruptive force from beneath. This opinion seems to be supported by the fact, that it is only in a few situations, where the upright position of these enormous fossils is preserved; often they lie at different angles with the strata, and more frequently between them. After the elapse of an unknown period, after the basin was filled, the inhabitants of the sea took up their residence upon its surface, the calcareous rocks of Nepan were laid, and finally, through some volcanic agency, the limestone was elevated from the deep, and the shore of the Joggins raised above the level of the present sea. The "beds of coal were produced by vast quantities of plants, carried down from the land, and accumulated at the bottom of the sea; the numerous alternations, amounting to many hundreds sometimes, of sandstone, shale, and beds of coal, proving a long period of the process of deposition." Admitting these opinions to be correct, it is easy to account for the coal and fossils, now lying beneath the present sea, and the shells appearing so far above them.

Perhaps many would enquire at what time since the creation of this earth, did these mighty revolutions and changes occur? But although the science of Geology is supplied with the best evidence of certain events having occurred, and of distant periods when by the fiat of the Almighty, numerous classes of animals and plants were called into existence, or were annihilated by His supreme mandate, he is lost in his account of time, and cannot discover the periods which have elapsed between one of those epochs and another. And why need the human mind revel in chaos, a thing incomprehensible, an invention of the Persian Magi ? Why endeavour to grasp millions of ages, while there is "a sure word of prophecy, in which fools shall not err" ? "Why should we claim in behalf of our globe, a more ancient origin than that assigned by the inspired chronologist ? Will its rank, dignity and importance, be enhanced by a remote geneology ? Is this not a taint of the pride of ancestry, common to the whole family of man ? But how can it be gratified ? even lynx-eyed science can pierce no farther into the dark veil of creation, than common vision ; her telescopic glasses, which penetrate farthest into space, have no time keeping power whatsoever." Might not the Cumberland coal field have been submersed during the time which elapsed between the creation of the world and the deluge ? And might it not have been restored at that awful crisis, when Noah and his family were floating in the ark ? We think it might, and that there is enough contained in the Scriptures to warrant this conclusion, however humbling it may seem to the expanded views of some modern theorists.

From the vast collection of facts recorded, and observations made by the most distinguished philosophers of the present day, it appears that the events which accompanied the deluge, produced a great and sudden change in the temperature of the terraqueous globe. The proportion of the land to the water, of the antediluvian world, was much greater than that of the present earth, and as evaporation, a very cooling process, is now much increased by the greater aqueous surface exposed to the atmosphere, so the temperature of the earth must have been greatly lowered, as the situations of primeval continents became occupied by postdiluvian seas. "The almost incredible number of bones of fossil elephants, found in Northern Siberia, which betray no marks of having been rolled from a distance, attest the existence on its plains, of huge herbiferous animals, at that distant epoch. These demonstrate, that a vigorous vegetation clothed countries now covered with frost a great part of the year, where even in summer sterilizing cold, and humidity perpetually reign, and where at present the reindeer can hardly pick up from beneath the snow its scanty mouthful of moss." Dr. Ure, of Glasgow, from whose admirable work we have made the foregoing quotation, has produced much testimony to prove that the changes which accompanied the flood reduced the temperature of the earth; and the more we behold and consider of the effects produced by that mighty catastrophe, the more we are convinced that his reasoning is just.

## TRAP DISTRICT.

Trap is a term that has long been used in a very general sense, and therefore much ambiguity and misunderstanding have arisen among Geologists, from the indefinite meaning the word has conveyed. It is derived from the Swedish *Trappa*, signifying a stair, or number of steps. Hence it has been applied to rocks forming a series of steps, by the gradual retreat of their different layers. By this term we mean the trap rocks of the Wernerians, the whinstones of Dr. Hutton, and the floetz traps of the school of Freyburg.

Trap Rocks include greenstone, basalt, amygdaloid, and toadstone. Greenstone is composed of hornblende and feldspar, differing extremely in the proportions of those two minerals—sometimes assuming a homogeneous aspect, but often presenting large crystals of hornblende. Basalt is a homogeneous rock, generally containing black oxide of iron. This rock is remarkable for the appearance it often exhibits, of having been crystalized ; hence it often composes lofty columns regular in their dimensions, and bounded by plain sides and angles. Of this rock Great Britain exhibits some of the finest specimens in the world. Upon the coast of Antrim, in Ireland, both the massive and columnar varieties are seen in all their native beauty. The Giant's Causeway is formed of this rock, likewise the panorama of Staffa, and the celebrated Cave of Fingal. The amygdaloid is named from the Latin (amygdala,) an almond, and is remarkable for containing rounded vesicles or nodules, resembling that fruit. The toadstone is distinguished by its resemblance to the back of a toad. It is now generally believed, that this assemblage of rocks is of volcanic origin : of this there can be no doubt, although no arguments will be produced to support that opinion, until the facts as they appear in the Trap rocks of Nova Scotia, are considered ; when the reader will be qualified to form an opinion, without the bias of any theory previously introduced. Nor is it our object to give a particular description of trap rocks in general, but faithfully to delineate the situation and characters of those belonging to the Province. Such as wish a more extended account of this remarkable class of solids, will find all its qualities described in Lyell's principles of Geology.

It has already been remarked, that the whole of the North Mountains, extending from Brier Island to Blomidon, including the Five Islands, Two Islands, Isle Hant, and all the capes on the north side of the Bay of Fundy, are composed of trap, and rest upon the new red sandstone, throughout the whole of their formation. Some might suppose it singular, that the basaltic rocks of Nova Scotia, which are hard, compact and solid, should be placed upon the new red sandstone, a rock recent in regard to its formation, and soft and yielding in its nature : but similar phenomena appear at numerous places in Scotland ; at Regla, twenty-five miles north east of Mexico, where the prisms of basalt repose on a layer of clay ; and at Totonilca they are found resting upon compact chalk. Some of these groups are elevated with the country around them, six thousand feet above the level of the sea.

Having made these remarks, we proceed to the arduous task of describing the hornblende rocks, and the numerous minerals contained in them. Having during several past years visited different and extensive portions on the coast of the Bay of Fundy, at all seasons of the year, and under a great variety of circumstances,—having always taken notes during each visit, it has appeared most convenient to pursue a plan adopted in regard to the Slate District, and to commence at the most westerly portion of the Trap Formation, and continue our remarks upon the interesting minerals it contains, to its termination upon the shores of the Basin of Mines.

The Trap Rocks on the south side of the Bay of Fundy, form a strong wall, extending from Digby to the eastern shore of King's County. This wall varies from four miles to two miles in thickness ; it is narrow in the Township of Granville, but preserves a very uniform thickness in King's County. It is cut through at the Grand Passage, Petit Passage, and Digby Gut, and is elevated upon an average about four hundred feet above the level of the sea, and on its south side three hundred feet above the sandstone upon which it is placed.

From whatever cause these rocks have been formed in Nova Scotia, they are a distinct and separate class, having no other connection with the secondary formations of the country, than such as arise from their mechanical position upon the sandstone. If the Trap Rocks were all removed, the country now occupied by them would present a surface quite level and uniform, and therefore they now appear like mountains, superadded after the earlier formations had been completed.

## BRIER ISLAND.

This Island forms the most westerly extremity of the Trap Formation, and is separated from Long Island by a narrow channel, through which the tides pass with great rapidity. From that cause, and the exposed situation of its rocks to the open sea, it suffers much from the destructive powers of the elements, and more than the Islands in the Basin of Mines, or Mahone Bay, which are somewhat sheltered from the violence of the waves. On the south side of the Island, and near the entrance of the channel from St. Mary's Bay, the rocks have been worn away, and beautiful cliffs of regular columnar basalt are exposed to the ocean. The columns form long ranges of pillars, like the steps of stairs, reaching from the sea below to the precipice above, against which the waves often dash with fury, breaking down the notched ridges and pedestals forming its base. These pillars are in general hexagonal, although some are enclosed by seven sides. Their articulations occur at short intervals. This circumstance renders the rock more liable to be broken down, than it would be were the columns of greater length. On this side of the Island the basalts extend outwards beneath the sea, forming a submarine causeway, called "the Bar," over which the tide and waves rush with great force, foaming and breaking over the impediment thus placed in their way ; the sea sends forth hollow sounds like those of distant thunder, and in calm weather may be heard several miles off. On the western side of the Island, and near the lighthouse, the rocks attain a greater elevation, altho' their columnar arrangement is not so manifest. At low water the red sandstone was seen cropping out beneath the trap, thus confirming an opinion already advanced, and supporting a fact of considerable importance. In comparing specimens of basalt from Brier Island, with those from the Island of Staffa, they were found very similar, and no important feature was wanting, to identify the rock of Nova Scotia with those of the celebrated Fingal's Cave. Between the layers of trap we found several narrow veins of jasper, and thin veins of the magnetic oxide of iron. They are not however important when compared with those minerals occurring at other places.

From the exposed situation of Brier Island to northern gales and thick fogs, the soil is unproductive ; but what Nature has withheld in vegetation she has supplied in fish, which are excellent in kind and quality, upon the shores. We cannot forget an opportunity afforded for surveying this Island in 1821, although the circumstances connected with our visit at that time were not of the most pleasing kind. On the last of December of that year, on our way to the West Indies, the vessel in which our lot was cast, was overtaken by a violent gale of wind : she soon became a perfect wreck—the crew frozen and exhausted. Fortunately a change of wind drove the crazy bark into the Grand Passage. There had been a cargo of twenty horses upon the deck, but when we landed only five remained, and they had been dragged ashore in the turns of the cable, which had washed overboard, and so encircled them as to prevent their escape. Nor should the kindness of Charles Jones, Esquire, and his family, be forgotten ; to them we feel greatly indebted, and the marks of frost still remaining upon our lower extremities, will not allow the circumstance to flee our memory.

## LONG ISLAND.

On this Island the amygdaloid will be observed, projecting out beneath the almost perpendicular walls of irregular greenstone. The cavities in the amygdaloid often contain chlorite ; a few zeolites were observed at one place only. In some situations these cavities are unoccupied, and the rock possesses all the characters of the vesicular amygdaloid. Sometimes the cavities present small nodules, which when broken disclose green lamina of chlorite, with delicate fibres proceeding from the centre to the circumference of its crystals. It has been said that several large pieces of pure native copper, have been taken from the rocks on the west side of Long Island ; but none of that metal was discovered, during an ardent examination of almost every crevice where it would be most likely to occur. On the north side of the Island, there are several veins of red jasper penetrating the greenstone ; as these veins descend into the amygdaloid beneath, they lose their compact and solid properties, and pass immediately into a kind of clay-stone, of a soft and friable nature. And it appears that this clay-stone has been converted into jasper, by the greater heat to which it has been exposed in the uppermost portions of the rock, while below it has been insufficient to convert the clay into jasper susceptible of a polish.

The trap composing this Island does not assume the perfect basaltiform structure, so manifest at other places ; although some beautiful views might be taken, where its projecting cliffs appear ready to fall into the sea beneath.

## DIGBY NECK.

DIGBY NECK is separated from Long Island, by a deep and narrow channel, called Petit Passage ; both the flood and ebbing tide rushes through this opening, with a rapidity almost sufficient to propel water wheels and powerful machinery. Not far eastward of the Passage, on the side of St. Mary's Bay, a deep notch appears in the solid trap, called Little River. At the entrance of this river, the rocks again assume a regular and beautiful basaltiform structure. They form a lofty precipice, appearing like a great number of square piles, driven down to protect the coast from the undermining influence of the sea. These columns are composed under four, five, seven and nine sides. They are not strongly secured to each other, and therefore are constantly falling to the base of the precipice, where they resemble the ruins of frame work. " Sir Joseph Banks observes, that the bending pillars of Staffa, differ considerably from those of the Giant's Causeway. In Staffa they lie down on their sides, each forming the segment of a circle, and in one place a small mass of them very much resembles the ribs of a ship. Those of the Giant's Causeway which he saw, ran along the face of a high cliff, bent strangely in the middle ; as if at their first formation, they were unable while in a soft state to support the mass of incumbent earth." At several places along the coast of the Trap District, has this bent form of the basaltic pillars been observed, although it is perhaps uncertain whether they have become crooked from the above cause, or some other disturbance which may have taken place during their crystalization.

Between Little River and Sandy Cove, there are several minerals appearing, both in the amygdaloid at the base of the long precipice, and the superincumbent trap. Among them is jasper, sometimes in veins a foot wide, containing geodes of quartz. The quartz is often in beautiful transparent crystals ; amethyst also appears, in various shades of purple, and like the quartz in six-sided prisms terminated by six-sided pyramids, the most common forms in which those minerals appear in the trap rocks of Nova Scotia. The cavities in these geodes are sometimes occupied by white rhombic crystals of chabasie. In one instance we found crystals of quartz, amethyst, and chabasie, curiously combined. Some very singular specimens were obtained, composed of lamellæ of quartz, arranged in parallel and oblique plates, with cavities filled with calcareous spar. They have a peculiar variegated appearance, and furnish a singular imitation of a certain kind of porphyry. Red, yellow, and striped jasper, are frequently seen sticking in the fissures of the rock in some places ; these colours are curiously intermixed, but every variety is inferior, when occurring in the amygdaloid, improving as it ascends into the greenstone placed above. Many of these minerals are very beautiful when polished, but in their present state they are of small value, only making up a variety in the specimens afforded by the country.

## SANDY COVE.

At this place there is a singular opening in the trap, affording a safe and convenient little harbour for small craft.

At its entrance the rocks form steep battlements on each side of a narrow passage, seeming ready to fall upon such as seek shelter between them, when St. Mary's Bay is disturbed by gales of wind. The trap is in large irregular masses, separated by narrow fissures running in every direction, giving its walls the appearance of cuboidal blocks, mechanically piled upon each other. After passing through the opening, the amygdaloid slopes gradually down to the beach, forming an agreeable contrast with the bold scenery in advance. The trap rocks at the entrance of the cove, consist of the greenstone so well described by Jameson. It is generally composed of hornblende and feldspar, in a state of small granular particles, sometimes in crystals. At this locality the hornblende predominates, giving the rock its peculiar greenish hue.

The amygdaloid is of a coarse kind, and contains several beautiful and interesting minerals; among them is the Laumonite, found projecting from the serpentine veins in the rock, and varying from an inch to a foot in width. In order to obtain good specimens of this singular mineral, it should be taken from situations not exposed to the weather, therefore a little previous digging and breaking, are necessary before a selection is made. The veins contain numerous cavities, where beautiful crystals project in clusters of oblique-angled four-sided prisms, terminated by slightly rhombic planes. They are transparent and colourless, varying from half an inch to an inch in length. Calcareous spar in obtuse rhomboids, is associated with the laumonite, the latter forming the base, and lining the sides of the fissures in which both occur. Upon each of those minerals is often implanted delicate and splendent crystals of specular oxide of iron, rendering the aggregate extremely interesting, and plainly shewing the affinity each atom had, for those similar in their natures, during the process of crystalization. The specular oxide of iron is sometimes collected in veins, which when broken contain cavities where white semi-transparent crystals of chabasie, are safely secured upon one of their rhombic planes. Agates, chalcedony, and crystals of quartz, are also found, either occupying veins and cavities in the rock at this place, or having been disengaged by the disintegration of their beds, are scattered upon the shore. Among those detached pieces a small nodule of semi-opal was discovered. In one of the geodes occurring in the amygdaloid, we also found a kind of needlestone, resembling specimens from Iceland : this mineral appears however, at other localities, in much greater perfection and beauty. Should the reader be induced to pay this interesting place a visit, for the purpose of obtaining minerals, he will find that a strict examination of the rocks, and a little labour, will be rewarded with specimens curiously associated, and well adapted for the cabinet.

The specular oxide of iron, appears in considerable veins a short distance eastward of Sandy Cove, and vies in beauty with the best specimens brought from Cornwall, or the Island of Elba. Upon the shore of St. Mary's Bay, it occurs in crystals slightly rhombic, its primitive form ; also in plates and scales, similar to those found in the fissures of lava, in volcanic districts. We could not however discover, that any of these crystals possessed polarity, a property common to those taken from the neighbourhood of a crater. The specular oxide referred to, is connected with the magnetic oxide of iron, seen in narrow veins penetrating the amygdaloid, and often appearing in considerable masses upon the soil. Although the specular and magnetic oxides of iron are valuable ores, they do not occur in a sufficient quantity upon Digby Neck, to admit of being profitably worked. The former yields crystals beautifully tarnished with azure blue, resembling tempered steel; sometimes they are of a light bronze colour, and irised. It is doubtless from the presence of these oxides of iron, that surveyors in running lines upon this peninsula, find the magnetic needle so much disturbed, and there can be no doubt that the magnetic influence of these oxides, was received during the heat which accompanied their formation; nor should we omit to mention in this place, the great similarity existing between the specular oxide of iron on the shore of St. Mary's Bay, and that which is now found in the recent lava of volcanic countries. These evidences of the origin of the trap rocks of Nova Scotia, were noticed during the examination of that class of rocks, where important testimony is afforded in favour of the modern belief of their igneous origin. It was before observed, that the Trap District at Digby Neck, is much narrower than at Granville or Cornwallis; and it is singular, that opposite to Sandy Cove, and upon the shore of the Bay of Fundy, this Formation should have a like indentation to that already described, with a small lake placed between them, so that another Island, similar to the one placed to the westward, might have been formed with a less remarkable occurrence, than it could be effected at any other place along the coast. The existence of that lake might lead to some curious enquiries; and from its situation and appearance, many theoretical propositions might be brought forward. It has however a companion of similar features and dimensions, a few miles farther eastward. Were these openings, in which the fresh water is now collected, at one time craters, giving vent to the melted lava, which now remains in distinct layers upon the shores on each side of their openings? Did they give exit to the various substances now found crystalized and filling the vacancies produced in the rocks by cooling? It is evident that without the aid of heat those splendid specimens could not have become crystalized. Let such as would answer these queries, examine carefully those lakes and the surrounding rocks, and they will find sufficient evidence to authorise such interrogatories. At the cove opening into the Bay of Fundy, thick layers of amorphous trap dip at a low angle beneath the sea: they are similar to those at the inner Sandy Cove, and like them contain some curious minerals. Large veins of imperfect jasper are here seen, forming ridges projecting from the rocks. Pieces of hornstone and chalcedony were also observed along the shore, which we were unable to examine to any great distance, on account of the approaching tide.

Along the shore extending from Sandy Cove to the head of St. Mary's Bay, where the trap and red sandstone formations meet, there are numerous pieces of agate, jasper, chalcedony, amethyst, quartz, hornstone, calcareous spar, and oxide of iron. The agates exhibit several singular varieties: among them is the fortification agate, from its resemblance to the zigzag lines of fortifications.

They are composed of alternate lines of transparent and white chalcedony, jasper and quartz, curiously waved, and often lined crosswise with rays : sometimes jasper, amethyst, and chalcedony, are united in such a manner as to form breccia and dotted agate. Many of these if collected and polished, would equal in beauty any found in other countries, where they have been sold at high prices for ornamental purposes. These masses often form geodes containing brilliant crystals of purple amethyst. Messrs. Jackson and Alger, of Boston, found a geode of amethyst on this shore, weighing upwards of forty pounds, and coated externally with fortification agate. The jasper is capable of bearing a good polish, and very compact.—Among the chalcedony, we found that peculiar kind called "cat's eye," the *quartz agathe chatoyant* of Hauy ; when polished it exhibits the remarkable appearance of the cat's eye, hence the French term "*chatoyant*" has been applied. The hornstone and calcareous spar present nothing remarkable, and the specular oxide of iron is like that already noticed.

Not far to the westward of the junction of the trap rocks and red sandstone, on the north side, and a few miles from the head of St. Mary's Bay, large irregular blocks of red and yellowish red jasper, lie scattered at the foot of the precipice, which in some places rises to considerable height. Some of this jasper is very compact, although many masses appear to have been imperfectly consolidated during the operation of the process, by which the more perfect kinds have been rendered sufficiently solid to admit of a good polish. Some fragments are curiously striped with different colours, in others rounded pebbles of chalcedony are united by a siliceous cement, forming a coarse and remarkable kind of agate. Were large pieces of this breccia polished, it would afford an agreeable imitation of mosaic pavement ; and it is quite probable, that as a taste for the curious and refinement advance in the country, so these now misshapen masses, may be removed to ornament the abodes of the wealthy and eccentric. They would excel in beauty many ancient porphyries, and perhaps equal those composing the busts of Apollo and the Twelve Emperors, in the palace of the Thuilleries.

Clusters of quartz crystals, frequently appear suspended in cavities of the jasper, and in a few instances, when the rock is broken, amethystine quartz, in delicate prisms, may be seen lining its crevices. Several of the minerals seem to have been promiscuously thrown together, and cemented by a process in which heat had evidently an extensive influence. Frequently the jasper contains the red oxide of iron, which gives it the appearance of wax. Almost all the minerals at some localities, have their colours greatly diversified by the presence of the sulphuret and carbonate of iron, that often form singular combinations with the siliceous and calcareous deposits.

From the outer Sandy Cove to Digby Gut, upon the shore of the Bay of Fundy, the red sandstone was seen at low water mark, shelving out beneath the amygdaloid resting upon it. The amygdaloid frequently abounds in those hollow vesicles which characterize the genuine species of that rock. These cavities are however, often occupied with zeolites, to be noticed hereafter. Upon the amygdaloid is placed the basaltic trap, which in a few places shews its columnar structure, and approximation to a crystaline form.

Rising from beneath the boundary of the highest tides, the trap forms perpendicular precipices more than two hundred feet high, and presents a majestic front, from whose wavelike summit the waters of the rivulets above fall in glittering spray upon the beach beneath. The wearing effects of the sea upon the amygdaloid, has in many places left rude pillars, overhanging the limited path of the traveller, and seeming ready to fall upon him as he climbs the rugged crag, or seeks his way among the misshapen blocks upon the shore. Frequently thousands of tons break off from the cliff, and fall towards the sea, covering the beach with broken masses, and leaving between them frightful arches and darkened chasms. Silent and lonely we trod this unfrequented shore, and amidst its picturesque scenery, the note of the screaming gull and trumpeting loon, echoing from the gloomy cliffs, added not a little to the wildness of its scenery.

Near Trout Cove there are agates having a base of semi-transparent chalcedony, studded with irregular fragments of jasper and hornstone ; sometimes the jasper is curiously striped with zigzag lines of red carnelian, forming a kind of agate not observed in other situations. These agates occur in veins in the basaltic trap, varying from half an inch to two inches wide.

Milky white chalcedony of a fine quality, and well adapted for seals, rings, &c., also appears in narrow veins along with the agates. A small piece of this chalcedony having been polished, is much admired, and the peculiar reflection of rays of light falling upon its surface, perhaps affords a new variety of that mineral.

Eastward of Trout Cove there is a singular indentation in the coast, which appears to have been formed by the soft and yielding nature of the trap rocks. Here the affrighted mariner finds a shelter between massive columns of greenstone, when the Bay is agitated by fierce winds; for Gulliver's Hole is the only imitation of a harbour along this part of the coast. Stilbite under several different modifications, occurs in the vertical fissures of the rocks. On the sides of the fissures, this mineral appears in horizontal leaves; wherever a sufficient opening has been allowed, the crystalization has been perfect, and several secondary forms are exhibited. Among them is the right rectangular prism, with a pyramidal summit. Sometimes the prisms are compressed, and become six-sided tables with bevelled edges. In other instances the crystalizing process has been so much disturbed, that no regular form has been assumed, and the mass resembles ice. Pieces of each variety are readily obtained, and shew the difference of form that mineral is capable of bearing. On hot coals it exfoliates, and before the blow-pipe it melts into a white enamel. In beauty it is much inferior to specimens discovered at other localities, and to be noticed hereafter. Between Gulliver's Hole and Digby Gut, considerable veins of the magnetic oxide of iron are inserted in the rocks, but they are similar to those already described; and as they are unprofitable for mining, will require little attention. Jasper, agate, chalcedony, and other minerals, were also observed lieing in detached pieces along the shore, as far eastward as the Lighthouse at the entrance of the Gut.

## DIGBY GUT.

Two distinct interruptions in the continuity of the Trap Formations, have already been considered, namely, Grand Passage and Petite Passage : another similar in its appearance to those having formed Brier and Long Islands, appears at Digby, and is called Digby Gut. The peninsula of Digby would also have been an Island, had not a strong barrier or dyke been stretched across from the trap rocks of the North Mountains to the slate of the Southern hills. This barrier cuts off the *cul de sac* of St. Mary's Bay, dividing it into two portions. The smaller portion being terminated by Annapolis River, and the larger communicating directly with the sea.

After having considered the outer and inner Sandy Coves, the deep indentation of Gulliver's Hole, and also the openings upon the surface now forming small lakes, it appears obvious that the Trap District, in this portion of its fixture, originally possessed several weak points. By comparing all those weak points, it can scarcely be doubted that the particular indentation which existed upon the spot where the Digby Gut now enters the Bay of Fundy, was capable of being converted into a channel, from a lesser cause than could produce that effect at other situations along the north side of the Annapolis Basin.

Let us suppose that the trap rocks had been continuous across the present Digby channel, and a notch or cove, like that of "Gulliver's Hole," formed on the north side of the then united rocks : the Annapolis Basin would then have been a lake, and the constant accumulation of water from the surrounding mountains, would over-flow part of Annapolis, the Township of Granville, Wilmot and Aylesford, until they formed a way for their escape into the Basin of Mines. Then also, the pressure of the waters at the narrow barrier of Digby, would have been great, and quite sufficient to force it and make their exit through the channel they had formed for themselves, and still continue to occupy. Now it is not probable that the Annapolis River had an existence prior to the formation or elevation of the North Mountains, which are evidently of later formation than the sandstone upon which they rest. Prior to their elevation, the surplus waters of the country might have been conveyed directly to the site of the present Bay of Fundy, and the ancient channels over which they passed, seem to remain even to this day. After the formation of the North Mountains, a vast accumulation of water must have been made over the great valley of King's and Annapolis Counties; and the weakened columns of the trap at Digby, having offered a more feeble resistance to the pressure of the water in the valley above, than the isthmus already mentioned, have been forced, and their pillar-like masses thrown into the deeper bottom of the Bay. Thus a channel has been formed, through which the waters have pursued their course, and continue to escape ever since. These opinions are supported by the rocks now lying at the entrance of the Gut from its north side, where an immense submarine reef of trap yet remains, and is placed in the same situation where it might be expected if these opinions are correct. Over this reef the sea continues to break with unremitting fury: the pilot knows its bounds, and the hardy mariner shuns the tide that sets upon it, but may not consider from what source the impediment in his way has been derived.

But it may be enquired at what period did these events take place ? Did the collection of water between the North and South Mountains, at the subsidence of the deluge, burst through the passage alluded to ? Or, did the volcanic furnaces, from whence the trap rocks flowed in torrents of burning lava, suddenly block up the avenues through which the waters of the great valley of King's and Annapolis escaped to the sea ? We know that whole islands and mountains have been raised in a single night, from such causes, but leave the reader to speculate upon these phenomena, while we pursue a farther enquiry into the most interesting class of rocks ever discovered upon our shores.

From the sea, the strait at Digby, and the perpendicular basaltic masses of the adjacent coast, present a grand and striking scene. Crowned with the delightful verdure of spring, we saw it in its best dress, and were reminded of the creeping ivy, decorating the lofty battlements of ancient castles.

## NORTH SHORE OF GRANVILLE.

About six miles eastward of Digby Gut, our examinations were again renewed. The whole of the coast is composed of basaltic trap, resting upon amygdaloid.—Here as at other places upon the shore, the red sandstone in broad strata, was seen reaching outwards beneath the amygdaloid, which succeeds it in almost every instance. Not an opening of any kind, nor a projecting cape, offer any shelter for vessels during the northern gale, and for many miles in extent, the perpendicular and undermined rocks appear ready to dash themselves into the sea beneath. Every season masses of tottering pyramids make an avalanche, and cover the beach with fragments, which are again gradually broken up by the constant attrition of the sea: hence sand is produced lining the shore, and filling the spaces between the angular, prismatic, and yet unbroken stones. On this shore we observed the wreck of a large vessel, partially buried by the falling of the rocks from above.

Along this unfrequented and romantic shore, where the traces of the Mineralogist are blotted out by each succeeding tide, and where few persons have any desire to land unless to procure objects of science, there are several minerals that would be carefully collected, were they deposited in more eligible situations. Among them is a peculiar kind of agate, which has apparently fallen from the cliffs, towering several hundred feet in many places, above the beach. This agate is composed of alternate lines of chalcedony and red carnelian, sometimes separated by narrow veins of cacholong. Sometimes they resemble the figures of fortifications, but more frequently run in waves around geodes of amethyst. Jaspery iron ore, and the magnetic oxide of iron, were found in amorphous masses, among the broken and dislocated columns of the trap. The ore of iron appears only in narrow veins, and among the various specimens found, none were of much practical value, being only useful in exhibiting the different chemical combinations they have entered into, and storing the cabinet with singular species of their compounds. At one particular spot, the waters of a brook came spouting through a narrow opening worn in the top of the precipice, that still remains a hundred feet high; and long before they reach the platform below, they are divided into drops, that formed a shower twenty yards from the base of the rock they had escaped. This sparkling torrent, curving its downward way far above the traveller's head, presents fantastic images from the reflection of the rays of light among its pearly atoms. No inconvenience will be suffered beneath its rapid descent, except the collection of the mist upon the visiters' clothes, and the great coolness produced by the steady evaporation of the water.

## CHUTES COVE.

At Chutes Cove, a shallow excavation in the trap affords anchorage to small craft, during the prevalence of south winds. Like the places just described, elevated cliffs are suspended over the affrighted mariner seeking a shelter at their base. In the cove the rocks assume the basaltic figure: their columns have been removed by the constant peltings of the waves, and the pebbles by their constant attrition on the remaining blocks, have worn out basin-shaped cavities. This effect has been produced by the greater hardness of the sides than the ends of the prisms, and the protection the lateral surfaces have received from veins of quartz and jasper, insinuated between them. Similar basins appear in the rocks at Partridge Island, and other places in this district.

Between Chutes and St. Croix Coves, there is a vast collection of pieces of trap, that have fallen from the cliffs, and become rounded by being constantly rubbed against each other. The surf often rolls upon them with great force, and during the retreat of each wave or "undertow," the largest of these masses are moved, and a heavy sea produces a peculiar cracking sound, by striking the ponderous fragments one against another. At a distance they appear like a great collection of bomb-shells placed side by side. Upon the surfaces of these gigantic pebbles, there are small nodules of heliotrope; these as the rocks wear away, fall out, and may be found in the sand beneath. The amygdaloid in some situations, contains narrow veins of white chalcedony; from others thin plates of carnelian were extracted.

## ST. CROIX COVE.

At St. Croix Cove, the majestic walls of trap, incumbent on the amygdaloid, rise boldly from the sea. It often affords subjects worthy of the artist's pencil, and poet's pen. Large blocks of amorphous trap, lie scattered along the shore, giving the clearest demonstration of the destruction ever going forward among the rocks upon this wild and unfrequented coast. The amygdaloid in this neighbourhood is peculiar, on account of its large cavities. Some of these are three inches wide, and more than a foot long; instead of presenting the usual oval opening, they frequently seem as if their sides had been compressed during the consolidation of the rocks where they occur. These cavities are frequently occupied with zeolites, composed of fascicular groups of delicate crystals, diverging from a central point to the surface. In one instance perfect four-sided prisms, terminated by four-sided pyramids, were discovered ; these prisms are sometimes truncated on their lateral edges. Some of the irregular shaped cavities contain white delicate fibres, not unlike cotton wool : this variety forms a jelly with the acids, and becomes electric by heat, like other kinds of zeolite. It therefore only shows the numerous appearances that mineral exhibits, and the variety its crystals are capable of forming. At another station the cavities are occupied with beautiful crystals of heulandite ; and wherever sufficient space has been allowed, the crystals are perfect. The hexaedral prism with dihedral summits, and several other modifications of the right oblique angled prism, its primary form, often appear. Sometimes this mineral fills the cavities in the rock so perfectly, that no indication of a crystaline structure is manifest.

The occurrence of these cavities in trap rocks, is by no means singular ; they appear in similar formations on the Connecticut River, and have been well described by Professor Hitchcock. They are also seen in the trap of the Ferroe Islands, and at several other places. They have been the subject of considerable enquiry, and various are the opinions entertained respecting the manner of their formation. Averaging from a hundred to two hundred feet high, the basaltic trap reposing on amygdaloid, forms an almost perpendicular wall, extending to the eastward, until it is again excavated by a shallow opening about six miles from St. Croix Cove.

## MARTIAL'S COVE.

This cove, and the coast penetrated by it, abounds in minerals curiously associated and united. Zeolites of different species fill the cavities in the amygdaloid. The heulandite is found in veins frequently six inches wide, and exhibits both in the form of its crystals and its colour, several interesting specimens. Instead of the iron that so often enters into the chemical composition of the minerals, at other localities along this extensive shore, the green carbonate of copper seems here to take its place, and will be found attached to many of the singular combinations from which the iron is altogether excluded. A narrow vein of the carbonate of copper, was seen entering the rock, but its quantity is too small, as far as it has yet been exposed, to offer any profitable speculation in mining. Small globular and stalactical pieces of pure native copper, are sometimes observed attached to crystals of analcime. The analcime appears in solids contained under twenty-four trapezoidal faces, resembling one form of the garnet. The carbonate of copper that enters into its composition, gives it a beautiful green tinge: in some specimens however, the carbonate is absent, and its crystals are transparent. The copper is very pure, and after having been cut or scraped with a knife, exhibits a golden metallic lustre. We have been prevented hitherto, from making any extensive enquiries among the rocks where this metal is found, and remain in some degree ignorant in what quantity it is deposited, and where the best prospects are offered at Martial's Cove, for more expensive investigations: but it is far from being impossible, that a more laborious undertaking might be rewarded with a more important discovery of that mineral.

At Cape D'Or, on the north side of the Bay of Fundy, native copper appears in a much greater quantity than has hitherto been found upon the opposite coast. There can be no doubt therefore, that this metal was formed under similar circumstances at both of those places: At both it appears in the amygdaloid, and although its filiments are attached to a different gangue near Martial's Cove, the absence of the analcime at Cape D'Or, is the only material difference noticed, and even this circumstance is to be considered accidental. Cape D'Or is nearly in a north-east direction from this cove, hence it appears that the same laws observed in regard to the course of the slate and other formations, have also been in operation during the deposit of those substances, from which the copper has been smelted; whether that cause was heat, or as some have strangely supposed, the weight of particles falling downward in a solution, from which the earth was supposed to have been formed.

At Martial's Cove the copper is often in small globular concretions, the form it would appear in, had it been melted at the time the analcime was passing into a crystaline state. Again, it appears in delicate fibres, as if elastic gases had been passing through the cavities where the fibres are now suspended. In one specimen we have drops of pure copper hanging on the ends of small fibres of the same metal: these drops or shot, and the fibres to which they are attached, were evidently once in a melted state, and at the moment the drops of melted copper were about to fall off, they became cooled. This is strong testimony in favour of the igneous origin of trap, and proves beyond all doubt that the copper contained in it, has been in a fluid condition through the agency of heat.

## GATES'S PIER.

ROUNDED masses of water-worn trap cover the beach at this locality. The inhabitants have found the rough pavement extremely troublesome at the only spot where they can launch their boats in the fishing season. Every spring they are compelled to throw and roll the polished greenstone from the path, across which pieces of timber are secured, that their boats may be more readily conveyed to the sea. Twice in every twenty-four hours this causeway is covered by the tide, which runs along the shore with great rapidity. A short distance eastward of the common landing place, a mass of trap extends outward towards the Bay. Here to the work of nature is added the work of art, and a wharf or pier, has been erected at the expense of the Province. Thus a kind of shelter for small vessels is afforded during the prevalence of certain winds. The harbour is very limited, and not a little ingenuity is required to bring small craft into its narrow opening. We recollect of entering this singular haven a few years ago, and before the schooner could be "rounded to," she ran headlong against the perpendicular cliff in front, and drove the bowsprit down the fore cuddy. Our skipper however, soon put things "to rights," and treated the whole affair as a common every day occurrence. The pier is nevertheless extremely useful upon a coast altogether deficient of harbours.

## PETER'S POINT.

An elevated and leaning precipice of basaltic trap, at Peter's Point, renders its scenery somewhat different from that of the place just mentioned. Undermined by the beating of the waves, the solid rocks hang in frightful grandeur over their own ruins, the broken masses of which lie scattered upon the beach beneath in great disorder. The boisterous bay torn up by the northern gale, sends long and lofty billows thundering upon the rocks trembling before them ; even the hungry raven seems affrighted, and soaring high, his cries are lost among the summits of the tottering basaltic walls. Among the fissures of the amygdaloid, beautiful specimens of laumonite often occur in regular crystals, wherever sufficient space has been allowed between the walls where they have been lodged. The more perfect crystals appear in slightly oblique-angled four-sided prisms, terminated by rhombic planes, often replaced on the acute solid angles by triangular facets. The primary form is easily detected, as the secondary planes are but small. This mineral is frequently embedded in beautiful rhombic crystals of carbonate of lime, and in one instance, crystals of laumonite, calcareous spar, and quartz, were found united, each having its own peculiar structure preserved. Sometimes the laumonite occurs in masses in which the crystalizing process has been disordered, and appears in lamina penetrated by small radiating fibres. By being exposed to the air the laumonite disintegrates ; its laminæ separate and fall into small prismatic fragments, and finally into a white powder. To prevent this, it should be immersed an hour or two in a solution of gum-arabic, which will defend it from the air and prevent its disintegration.

Apophylite in laminated masses, is frequently observed along this part of the coast, but in no situation are their crystals more perfect than in the vicinity of Peter's Point. Here its crystals are in right four-sided prisms, with rectangular bases. Several secondary forms were observed, and in some the primary solid is obscured by deep truncations on the solid angles, leaving triangular faces. This mineral has a glistening vitreous lustre, sometimes pearly. Its specimens resemble those brought from the Isle of Skye, where it also occurs in trap rocks. Small pieces of hornstone and jasper, were also observed among the detached fragments at the foot of the cliff.

Great changes are going forward upon this shore, the rocks are almost daily falling, and as they become broken up, and conveyed into the bay, others are dropping from the precipice to endure the same process, by which all seem destined to be removed. A remarkable cavity, abounding in fine specimens of laumonite, in 1828, was buried during the succeeding season, by the downfall of the leaning cliff that before stood over it.

## FRENCH CROSS.

Between Peter's Point and French Cross, the perpendicular walls of trap often rise three hundred feet above the level of the sea. At low water, during the highest spring tides, the sandstone was seen in smooth and level layers beneath the superincumbent amygdaloid. The sandstone is seldom seen above the surface of the sea, even at the lowest ebb, and it was only by taking advantage of a calm day and the greatest retreat of the water, that its situation was discovered. The amygdaloid generally reaches from low to high water mark, although sometimes it extends higher up the cliff before it is succeeded by the greenstone.

Several instances were observed where the sandstone and amygdaloid are mixed, and pass by insensible shades into each other. From this circumstance the latter is rendered so soft, that the constant washing of the sea often wears out large cavities, and forms singular arches and chambers of the most grotesque figures. Upon the walls of grottos thus formed, beautiful crystals of calcareous spar, heulandite, and other minerals, are implanted, or make up a splendent incrustation, easily removed by the hand alone. Near the French Cross, the amygdaloid is rendered quite red by its admixture with the sandstone, and contains numerous zeolites. The same rock as it approaches the basaltic trap, contains unoccupied hollow vesicles, at once deciding the true character of the amorphous masses where they appear : lastly, the basaltiform trap, rising in irregular columns, crowns the whole with a vertical and often tottering cliff. The laumonite appears here also, and fine specimens of mesotype may be obtained from fissures in the rock. Veins of jasper, quartz and chalcedony, penetrate the basalt : in many places these veins are lined with crystals of pearly heulandite, not rivalled by any in the Britwax negative electricity. Before the blowpipe it melts into a brown scoria. The heulandite is of a flesh red colour, and crystalized in right oblique angled prisms—its primary form is seen in the lining of narrow veins in the rocks. A variety of analcime, called by Thompson sarcolite, was discovered upon the side of a fallen mass of trap. This mineral presents the primary cube, having each solid angle replaced by three planes gradually passing into a solid, under twenty-four trapezoidal faces. It is of a flesh red colour, and in its chemical characters is like the analcime with which it is found. In a narrow opening in the amygdaloidal trap, beautiful specimens of laumonite were projecting, and ready to fall into the basket of the Mineralogist. Many of these are of a flesh red colour, and therefore add to the variety afforded by that mineral.

The columnar shape of the trap is manifest in many situations ; in one instance perpendicular prismatic blocks, with articulations several feet apart, rise from the amorphous variety below, exhibiting in great beauty the crystaline structure of the rocks themselves. At the season this visit was made, the brooks had lost a part of their contents, from the constant evaporation from their surfaces, and therefore instead of pouring from the cliffs in rapid cascades, the water trickled down the precipice, or dashing from side to side of the narrow gutter it had prepared for itself, finally was lost among the pebbles of the beach.

Between French Cross and Black Rock, the trap rocks are often arranged in distinct and parallel strata, a circumstance by no means common. The lowest strata, reposing upon the new red sandstone, varies from fifteen to thirty feet in thickness. The layers of amygdaloid succeeding it are different in colour, and often contain zeolites. The superincumbent trap also shews the lines distinctly which divide its masses. These seeming strata dip at a small angle at some localities; at others they are quite horizontal. In no way can the occurrence of those strata be so easily accounted for, as by admitting that they have been derived from volcanic sources, in the way that masses of melted lava ejected from the craters of Etna and Vesuvius, have succeeded each other. One burning deluge overwhelms the country and cools, another and another follows, each having a distinct line of separation between them. The appearance of the hornblende rocks in Nova Scotia, are almost sufficient of themselves to decide the question of their igneous or volcanic origin, in the absence of every other kind of testimony.

At Black Rock the shore becomes declivious, and instead of lofty mural precipices fronting the Bay, a gentle slope affords the inhabitants an easy communication with the sea. At low-water-mark, an amorphous mass of black trap, having supplied the village above it with a name, is seen extending outwards from the shore, forming a kind of harbour, until the waves of the rising tide roll over its surface, and give the signal for vessels to depart: and there is no opening along the coast where they can take shelter, except such as have been artificially erected.

Proceeding eastwardly along the shore, the eye is again hailed by rustic battlements and masses of basalt, projecting far above the heads of such as may venture an escalade over the rubbish beneath. The height of the mountain rising thus abruptly from the sea, leaves its bold front to face the north. Hidden from the light, many chasms and sea worn excavations, receive scarcely a solitary ray of light, to be reflected among the crystals lining their walls. Filtered through the rocks above, large drops of water, cold as the ice itself, fall pattering on the sparry pavement, searching their way back to the sea from whence they came.

A few miles eastward of "The Rock," several large veins of calcareous spar separate the layers of amygdaloid. The spar in many instances is of a rich straw yellow colour, and crystalized in rhomboids, sometimes measuring an inch across their oblique planes. This carbonate of lime is more abundant in the rock as it approaches the sandstone beneath, and declines altogether in the basaltic trap above. Large masses of stilbite having been detached from their native situations by the action of the elements, lie among the debris of the shore. Some of these will weigh more than a hundred pounds. Most frequently these masses are crystalized in fasciculi, resembling fans, or bundles of minute and delicate threads. When broken they present a fibrous appearance, as described by the excellent Mineralogist, Professor Cleveland. Pieces of jasper, of various colours, and milky white chalcedony, are readily obtained. Between two large blocks of amorphous trap, several beautiful agates were procured, and among them the onyx agate ; but as it is inferior to specimens of that mineral occurring at Blomidon, a description of it is deferred, until we treat of that interesting locality.

Besides many of the minerals already noticed on preceding pages, we accidentally discovered one hitherto not found in Nova Scotia, as far as we are acquainted, and its appearance was as unexpected as it was gratifying. This mineral is called Phrenite : it occurs in small botryoidal masses, of which none were found larger than a hen's egg. It consists of very delicate crystals, radiating in all directions from the centre to the circumference. A number of these small circular clusters are collected together, each having its fibres proceeding from an adjusted centre to the extremity of the group composed by them : its colour is pale green, supposed to arise from the green carbonate of copper, also found near it. Before the blowpipe the phrenite intumesces, and melts into a spongy black enamel. It does not form a jelly with acids, and is therefore distinguished from zeolite. It appeared in the amygdaloid, near the junction of that rock with the super-imposed basaltic trap. This mineral received its name from Governor Phren, who first brought it from the Cape of Good Hope. It has since been discovered in many other places, and finally in this Province. The locality of the phrenite was afterwards visited early in the spring, but none of that interesting mineral could then be obtained, as the rock where it was implanted had become dilapidated, and was removed in our absence. The ice still remained on the shore, and in those places where brooks came pouring over the lofty escarpment of the cliff, majestic columns of ice had accumulated, and the basaltes of the trap were rivalled by the fluted and contorted pillars of water rendered solid, and clinging to the precipice until lengthened days and warmer weather, should compel them to relax their grasp and totter down. It is no uncommon thing upon this coast in the months of March and April, to see icicles attached to the leaning rocks, hanging downwards a hundred and fifty feet in length : in one instance a hollow tube had been formed through a perpendicular mass of ice, through which the torrent poured to the beach with "wild unearthly sound." These natural curiosities may be seen at periods when the south side of the mountain is mantled in green, and while the apple and cherry are putting forth their blossoms. Advancing along the shore towards Hall's Harbour, the pseudo-stratification of the rocks gradually declines, and the trap is divided into prismatic and cuboidal masses. In a few places only, was any thing like a columnar structure manifest, and where the architectural regularity of its blocks could be fairly made out. At Huntington's Point there is another sloping descent towards the Bay, but it is immediately succeeded on the east by a frightful and lofty cliff.

## HALL'S HARBOUR.

This place received its name from a Captain Hall, the commander of a small party of plundering vagabonds, who for some time during the American revolution infested Cornwallis. The fate of this unfortunate gang was truly deplorable ; the active inhabitants of King's County destroyed their boats, while the banditti after straggling in the woods, shunning discovery, suffered every privation. Many died, and few ever returned to their homes.

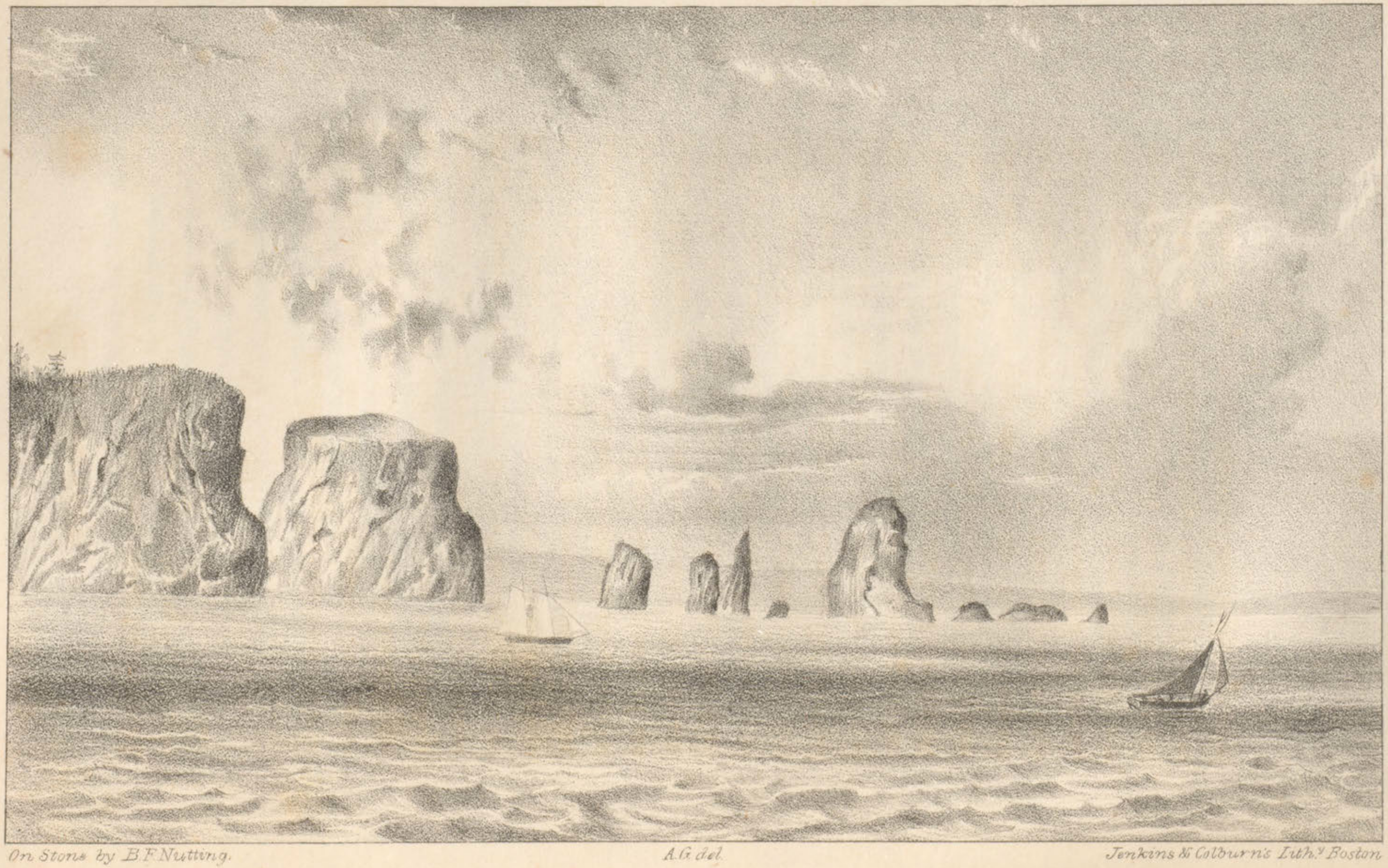
Hall's Harbour is a small creek entering the rocks, and affording a safe harbour for small craft at high water.

Lately a pier has been erected at the entrance of the creek, and the little haven is much improved; therefore, from its situation near a flourishing settlement, it will probable become a place of considerable importance. Eastward of this harbour there is a beautiful beach, and the rocks having attained far less elevation on the adjacent shore than at other situations, they are accessible by teams of horses and oxen. About a mile eastward of the landing-place, there is a notch in the trap rocks called Cranberry Cove. It is only remarkable for the height of the precipice, and the beautiful torrent rushing over its crest into the sea. In noticing this place we are reminded of one of those catastrophes common upon the coast. Seated upon a rock enjoying the remainder of a scanty lunch, and occasionally sipping the best and purest beverage from the brook rippling at our feet, suddenly the rocks trembled, and a noise loud as thunder, directed the eye to the westward, where a cloud of dust and smoke ascended upwards from the beach, then half covered by the flowing tide. An avalanche had taken place, and an immense mass of trap which had stood a hundred and fifty feet high, had fallen headlong upon the beach and into the Bay. The surface of the fallen rocks had occupied nearly an acre, which was covered with large trees of birch and maple: some of these were buried in the debris, the remainder formed an immense raft that floated out to sea. Had we been seated a short distance farther westward, the event would never have been recorded by a living witness. The ruins thus produced form a great impediment in travelling along the shore, and several years will elapse before the sea will have removed the amorphous blocks now leaning against the cliffs.

The foregoing incident should remind the reader of the danger attending such as frequent the base of precipices that are constantly falling. Several instances have occurred during a few past years, when individuals have been instantaneously crushed and buried beneath the ruins of the trap. Nor should the months of June and July be considered perfectly safe as some have supposed : for although during the earlier part of the season the hazard is increased in consequence of the destruction produced among the exposed rocks, by the escaping frost, nevertheless "launches" are continually taking place from the undermining effects of the waves. More than once in the eagerness of a search for minerals, has the tide in calm weather stolen silently around us, and prevented a retreat ; on one occasion we were compelled to sit perched upon a solitary rock beneath a mural precipice, until the ebbing water opened a way for escape. In this cove the water is very deep. About six miles farther eastward, there is a singular submarine causeway, stretching out from the shore into the sea about a mile. Over this causeway the tide passes with great rapidity, in consequence of the obstruction thus placed in the way. It is called by the inhabitants "the Race," and affords a resort for codfish and pollock, which frequently remain around the fishing boats so long during the ebbing tide, that the water becomes shallow, and they are seen darting at the bait containing the fatal hook. Great numbers of gulls are constantly hovering over "the Race," and while the larger fish are devouring the smelts and squids below, these and the fishing hawk are carrying on a brisk attack from above. The smelt in his turn however, devours the ova of the codfish and pollock, thus retaliating upon his powerful foes, by cutting off their infantile broods.

## CAPE SPLIT.

Hitherto in describing the rocks on the south side of the Bay of Fundy, several small openings and protuberances have been considered; but the trap rocks in general pursue a very uniform course from north east to south west; and in this respect are like other Formations of the country. From Scots Bay, advancing towards the Basin of Mines, a great change in that course takes place in the rocks at Cape Split, a lofty promontory extending northward directly into the Bay, where it has produced great eddies and other disturbance in the course of the tides. This cape advances about two miles directly outwards into the sea, increasing the width of the Trap Formation from four to six miles. This width however, gradually diminishes towards Cape Blomidon, where this part of the Formation terminates. Besides the lofty and vertical elevation that is raised far above the surface of the sea, this cape sends out a submarine promontory beneath the waters of the Bay. Hence the flood tide already urged forward by a powerful impulse, is met by a formidable barrier at the super-marine Cape, and its violence turned upon the opposite coast. The submarine cape also offers a partial resistance to the influx of the ocean, notwithstanding the vast column of water that rolls over its embankment. The flood tide thus thrown upon the northern shore, has swept out large bays in places where the solid trap forming the capes and headlands, have not



On Stone by B.F.Nutting. A.G. del. Jenkins & Colburn's Lith.y Boston

CAPE SPLIT, 1836.

resisted its influence, and turned the current back to the coast where it had arisen. Hence a boat leaving Cape Split of a calm day, will be carried to Parrsborough on the flood tide, without the aid of rowing. From the before mentioned causes, the bay at Diligence River, and the placid sheet called West Bay, have been formed, as the rocks at those places are of a yielding nature, and not capable of offering the resistance afforded by the columnar masses of Partridge Island, and Cape Sharp. Again, the ebb tide nearly equalling the flood in violence, is met by the east side of Cape Split, and its submarine causeway ; from thence it is propelled upon the opposite coast near Fox River, where it has worn away the shale, leaving Spencer's Island exposed to its steady and furious influence. These facts have been clearly ascertained by observation and experiment, and may afford a useful hint to masters of vessels in the coasting trade. About half a mile southward of Cape Split, the basaltic trap forms a small sharp point, at the extremity of which there is an isolated mass detached from the neighbouring cliffs. This eminence at high water becomes an island, and during the egress of the sea adds much to the beauty of the landscape. Between this pseudo-island and the cape, the basalt forms a lofty and perpendicular escarpment three hundred and fifty feet high : the rapidity of the tides sweeps all the debris away, and often a polished pavement of solid rock may be seen sloping towards the retired ocean ; although in calm weather in the summer season, a collection of rounded pebbles covers the water-worn surface to considerable distance. Exposed to the fury of the sea, rendered still more boisterous by prevailing westerly winds, the majestic precipice has withstood its violence for many ages, or has retreated but slowly from the site where it formerly overshadowed the enormous whirlpools ever curling at its base. It is inaccessible at every point, and affords at high-water not a single broken pedestal where the tardy traveller might rest, had he neglected to retreat before the coming flood.

Standing two hundred yards from the base of this mural cliff, and towards the sea at low water, a lofty parapet is seen a short distance in its rear, and rising upwards still higher than the precipice in advance. From the appearance of these cliffs it is almost certain, that there is a narrow and frightful chasm between them. Having landed upon the beach we were unable to pay this singular opening a visit, it being impossible to ascend the rocks on either side of the cape. By landing at Scot's Bay, and travelling along the pathless wilderness a few miles, the entrenchment might be viewed from above, a pleasure we hope to enjoy at some future day. Few minerals were discovered at this remarkable locality, which for the grandeur of its scenery surpasses many celebrated views among the basaltic rocks of other countries, and is deserving of a far better drawing and description than has yet been given.

A large geode of crystalized quartz was found at the base of the precipice: it would weigh more than two hundred pounds; but being already loaded at the time of its discovery, we had little disposition to bring it away, nor could a place of security be found, where some future visitor might obtain its splendid crystals. At the extremity of the super-marine cape, several isolated masses of columnar trap with perpendicular sides, stand crowning the reef that extends beneath the surface of the water. The largest of these masses is about two hundred and fifty feet high, with perpendicular sides, and closely resembles an ancient and majestic tower. The surface of this natural edifice is crested with creeping evergreens, which searching their way into every crevice where the decayed rocks have formed a soil, hang clinging to the basaltic castle, like the ivy decorating deserted European castles. Its surface is nearly level, and comprises about half an acre, which during the summer months is perfectly covered with the nests of gulls. In the months of July and August, the winged inhabitants of the cape are seen with a telescope, sitting side by side, hatching their broods. Swarms of male birds are hovering in the air, while their constant screaming would almost make a statue nervous. Even here, notwithstanding they are congregated far from the abode of man, and seldom disturbed by a visitor to the gloomy "Split," the gull is often gulled, and not always secure. During our last excursion to the spot, a fox was seen creeping up the rock, in order to purloin a feast of eggs, while hundreds were darting about his head: upon the approach of our boat reynard retreated, and made his escape along the beach to the eastward. A little farther towards the sea, a smaller basaltic cone-shaped rock stands exposed to the rapid torrents rolling at its base. It terminates in a sharp top, and is bald, black, and barren. Several other irregular masses of lesser elevation, make up the dangerous cape, which affords a most sublime, and often terrific spectacle. Over the submarine cape, the tide rolls in frightful fury; its extent is known by a long chain of white breakers, that even in calm weather, after the tide is turned, are thrown upwards into foaming curls, which may be seen at a distance of twenty miles, accompanied at high spring tides with a bellowing noise, like that produced by the distant firing of cannon. This Charybdis, which in a gale is almost unequalled in any country, is called "The Rips." It has been the grave of several vessels, and is shunned by all prudent pilots in the Bay. The main land at this place presents a bold promontory, in which there is a singular wedge-shaped opening worn out by the pelting of the waves. The cape therefore, viewed at a distance, and from the sea, has a very peculiar notched appearance, and affords a remarkable feature of the class of rocks entering into its formation.

## BLOMIDON.

Between Cape Split and Cape Blomidon, a distance of fifteen miles, the coast like that just described, is uninhabited, and generally known by the appellation of Blomidon, to distinguish it from the lofty cape where it terminates, on the west side of the Basin of Mines. This shore and its celebrated cape, afford a most fruitful field to the Mineralogist, abounding in numerous specimens of the finest minerals, and exhibiting some of the most magnificent scenery in the Province. We found a variety of mineral substances, more abundant and more perfectly crystalized upon this shore, than in any other part of the country, and have selected them for the process of analysis and description; therefore a somewhat more particular detail will now be given of minerals also found at other localities, and to which the same details may be applied when a more extended account of them is required.

This part of the coast, like others already described, is composed of basaltic trap, resting on amygdaloid; the former composes the elevated cliffs, the latter extends in general from high water mark to the sea. At several places perfect basalts are constructed under five, seven, and nine sides. The articulations are numerous, and the prismatic form distinct. The trap is almost identical, in general, with that of other basaltic districts, where the rocks themselves having been crystalized, afford the most picturesque and interesting scenery. In one instance instead of prisms being placed upright, they are leaning outwards towards the bay, so that their ends are exposed instead of their sides. This circumstance has apparently happened, in consequence of some catastrophe which has thrown the pillars originally placed perpendicularly, partially upon their sides, and left them in an inclining position, at an angle of forty-five degrees from the horizon. Towards Cape Split, the basalt is in regular architectural blocks, accurately fitted to each other; but the columnar arrangement becomes more manifest in the vicinity of Cape Blomidon. The basaltiform structure of the rocks is more distinct at the top of the precipice, the lower rocks being separated into cuboidal blocks, sometimes of large dimensions. The rocks have frequently a reddish hue externally, from the red oxide of iron formed upon their surfaces, but when recently broken they are of a dark green colour.

Half a mile from Cape Split, a basaltiform mass of trap extends outwards into the sea, so that it cannot be passed at low water without the aid of a boat: a short distance farther eastward, we entered a dark and curious cavity, cherishing the hope that a cave was at hand: but after the eye had adapted itself to the degree of light then present, to our great mortification the imaginary cave was found to terminate in a wide fissure, extending upwards into the superincumbent trap. A part of the fissure runs off to the right, and opens into a notch in the precipice above. Through this narrow opening the light enters, and appears like a star sending its feeble rays into the dreary chasm below. This excavation has been made in consequence of the rock having been composed of softer materials, that have gradually been washed away by the war of the elements. Many superstitious individuals have believed that money was deposited in this dark opening, and that the place was haunted by evil spirits. Let such as have given credit to these idle stories, now be assured, that during a minute examination of every crevice in its walls, no money was found, and neither ghost nor goblin made its appearance.

At the base of a mural precipice three miles eastward of the Split, and among the debris produced by the downfall of the crumbling rocks, several pieces of beautiful moss agate were obtained, of a kind perhaps never before discovered in the Province. It consists of transparent chalcedony, enclosing small brown filaments perfectly resembling moss: the transparency of the chalcedony admits of the moss being seen in the interior of the different masses; these when polished afford rare and pleasing specimens of that mineral. Dauberton suggested, that these filaments in moss agate might have been mosses, and vegetable fibres, embraced by the agate at the time of its formation. But this idea appears to be absurd, as organic remains are seldom or never found in trap rocks, and the curious figures displayed by agates, are only imitative and accidental. These filaments and twigs are generally composed of the brown oxide of iron, as we shall have occasion to shew more fully hereafter. Thin plates of milky white chalcedony occur near the agates ; they occupy narrow veins in the fallen rocks, and now afford fine materials for setting in rings and seals.

Still farther eastward, and perhaps five miles from Cape Split, the trap becomes declivious, allowing the small spruce to cling to the slope, and rise one above another to its summit. Here the shore is covered with coarse pebbles, and the eye is relieved by the transition from lofty colonnades, to the evergreens decorating the coast.

Several pieces of wrecks lie half buried in the sand, near the spot called "Long Beach," a place often visited in the season of gooseberries, which grow abundantly upon the bank.

Still advancing towards the majestic Blomidon, and near Long Beach, there are several kinds of agate scattered in detached pieces among the pebbles of the shore. Some of these agates are partially polished by attrition in water, during the influx of the tide. A large block of agate, weighing upwards of forty pounds, was picked up at low water mark : it is composed of semi-transparent chalcedony, with curved fortifications of white chalcedony interlaced with lines of red carnelian. On one side the perfect onyx agate is formed, encircled by the same lines, having the pupil dark coloured. The mass contains cavities lined with crystals of amethyst. One part of this beautiful specimen of agate, was presented to Viscount Valentia, by whom it was much admired. At the same place there are large masses of jasper and hornstone. The latter has been thus named from its resemblance to certain horns : it is like some kinds of jasper, but its transparency and splintery fracture will distinguish it from that mineral. The jasper includes several varieties, and among them is that called riband jasper. At this place the gradual passage of claystone into red jasper, was again observed, similar to the transmutation of those minerals at Digby Neck ; and the Geological testimony in both instances is such, as to leave little doubt in regard to the certainty of the latter having been formed from the claystone, in situations where it was exposed to a stronger heat than that to which the latter had been submitted. If this opinion be correct, the basaltic trap must have been formed under a more intense state of fusion than the amygdaloid, in which the claystone occupies veins, the jasper being confined altogether in the greenstone.

Seven miles eastward of Cape Split, the precipice has attained a more considerable elevation, and according to the altitude taken by Sir Howard Douglas, is four hundred and fifty feet high. Nowhere along the coast have the rocks a greater height, except at Cape Blomidon, where they rise still higher. Here these ejected monuments display magnificent forms, and present some of the most magnificent scenery in the country. Near the former place a small brook pours from the cliff, and in the spring, when the melted snow increases the stream, it lands upon the beach beneath, twenty yards from the foot of its exalted bed. A short distance from this cascade, a large collection of debris lies sloping from the side of the mural trap. This debris was produced by a great avalanche from the top of the precipice, in the spring of 1834 ; and the noise of the downfall was heard many miles along the opposite coast. Being made acquainted with the circumstance, we hastened to the spot, and were richly rewarded for our trouble. This place however, has been visited so often since, that little now remains there worthy a place in the cabinet. Among the numerous and beautiful minerals obtained during the first visit to this interesting locality, was the onyx agate. A large mass, weighing upwards of eighty pounds, had been dislodged, and lay among the ruins of the cliff. This agate exhibits distinct and parallel zones of different colours ; these zones consist of white circles of cacholong, alternating with small rings of chalcedony and pale red carnelian. When these agates are polished they are extremely beautiful, and resemble the eyes of certain animals. Sometimes there are white lines of cacholong, and grey circles of chalcedony, forming the chalcedonyx of the ancients. Other curious figures are presented ; among them is one imitative of the gay figures made by our Indians with the quills of the porcupine on boxes made of bark. The mass containing these agates, enclosed a cavity crusted with small crystals of violet coloured amethyst. In another specimen of the fortification agate found near the debris, the parallel lines were pierced with rays, which add much to its beauty. Large blocks of amethyst had been broken by the downfall of the cliff, and lay among its broken masses. In several instances perfect geodes of that beautiful mineral were obtained. These geodes when whole, appear like balls of quartz, indented all over their external surfaces with botryoidal cacholong, which often encloses the geode; but when broken the mass often presents large crystals of amethyst, of a deep violet blue colour. Frequently also the shell of the geode is composed of riband jasper, or agate. The amethyst also occurs in cavities in the amorphous trap; a single block when opened with a blow of the hammer, presented a surface a foot square, perfectly covered with splendid crystals of that mineral: some of these crystals measure an inch in diameter, and when they are perfect are six-sided prisms, terminated by six-sided pyramids. The amethyst found along this shore, is seldom surpassed in beauty. A crystal from Blomidon is now in the Crown of the King of the French, and other pieces have been much admired in England and the United States; but as these minerals are carefully sought by all persons, they are becoming comparatively scarce. In several instances we found large geodes of this gem filled with zeolite, and one of the cavities in a fine specimen, is occupied with that variety called mesotype. It is also associated with chalcedony, calcareous spar, and stilbite, exhibiting rare and interesting combinations. Amethyst is only used for ornamental purposes, "it receives a good polish, and is much esteemed in jewellery for necklaces and ring-stones. In the Royal Library at Paris, there is a bust of Trajan, engraved on amethyst." It was supposed by the ancients, that wine drank from a goblet made of that mineral, would not intoxicate. If the mineral really possessed that extraordinary virtue, vessels made of it would be invaluable in the present day, when sad effects are produced by using glass.

The amygdaloid contains many small veins of the magnetic oxide of iron, incrusted with grey oxide of manganese. It is doubtless from these oxides entering into crystals of quartz, that the amethyst with its peculiar tint has been produced. Sometimes these ores are crystalized in red jasper, from which they drop leaving their impressions perfect. Numerous veins of iron ore penetrate the trap upon the coast of Blomidon; at one place a vein six inches wide is seen, extending upwards in the compact rock; it is of the richest quality, and highly magnetic. This vein has been explored, and a quantity of the ore shipped to the United States. It is called by the inhabitants *magnus*, the common term for manganese; but the Americans are not particular about the shadow of a name, if they obtain the substance. We have a specimen of this ore in our possession, which will yield eighty-five per cent. of pure iron, and possesses the highest metallic lustre we have ever seen in the ore of that metal. Frequently it is united with quartz and jasper, making singular aggregates.

Apophyllite occurs among the minerals at Blomidon, in great perfection and beauty; sometimes it appears in prismatic crystals, and exhibits a glossy pearly lustre. In a few instances however, has the right four-sided prism with rectangular bases, its primitive form, been found. It is seen in broad laminated masses, divided into leaves transparent and colourless. Again, its regular crystals are truncated by triangular faces, sometimes so deeply, that four-sided pyramids having rhombic planes, are produced. Several other secondary forms may be observed among the detached pieces on the beach. This mineral also appears, partially filling the cavities in geodes of quartz and amethyst ; the pearly lustre of the apophyllite, contrasted with the purple crystals where it is imbedded, forms a pretty variety, and furnishes rich and elegant specimens. Agate, amethyst, and apophyllite, are sometimes found combined, each affording an instance of the singular process by which they have arranged their particles during the progress of crystalization. Almost all the geodes containing this mineral, and those in the neighbourhood, are coated and curiously indented with botryoidal cacholong. Before the flame of the blowpipe, the apophyllite melts into a white enamel ; it forms a jelly with the acids, and is easily distinguished from stilbite by its pearly and irised colours.

The amygdaloid at one spot contains analcime, in colourless transparent dodecahedral crystals. These crystals are nevertheless sometimes coloured, and appear to be lightly coated on the surface with extremely minute crystals of the same mineral, as if after the regular dodecahedron had been formed, a gas containing analcime had lighted on their surfaces, giving them a peculiar incrustation. This circumstance we do not recollect of having seen noticed before, although it is equally obvious in specimens of this mineral from other countries. Attached to the analcime there are frequently delicate four-sided prisms, of that variety of mesotype called needlestone, from its resemblance to needles. It often occurs in radiating masses, and bundles of delicate fibres, which terminate on the surface of each group, in elongated four-sided pyramids. This mineral is in much greater beauty at Two

Islands, and will be noticed when treating of that place. The needle-stone does not in any instance penetrate the analcime, and the prisms are but slightly attached to its crystals.

Besides the minerals already brought under consideration, one hitherto unknown to us in Nova Scotia, appears upon this interesting shore. This mineral is called the leucite, or the trapezoidal Kouphone spar of Professor Mohs: probably it is the same described by Jackson and Alger, who supposed it to be a new variety. It appears in the amygdaloid, in well defined crystals, contained under twenty-four equal and similar trapeziums,—sometimes this form is slightly modified: the faces of the crystals are occasionally striated parallel to the surfaces of cleavage, like those of the garnet. It is transparent and colourless generally, although some pieces have a milky appearance. Before the blowpipe it is infusible, and is easily distinguished from the garnet and analcime. We have not yet had an opportunity of analyzing this mineral, but having taken the opinion of Professor Emmons, of William's College, a distinguished Mineralogist, and compared it with accurate descriptions, think we are safe in calling it the leucite; the only mineral in Professor Cleaveland's catalogue agreeing with it in the characters examined.

Heulandite and calcareous spar are frequently associated, and fill narrow veins in the amygdaloid. Agates, jasper, chalcedony, hornstone, iron ore, and a variety of other minerals, lie scattered along the foot of the debris. During every visit to this locality, the Mineralogist will discover some new association or combination, so rich and varied are the natural productions of the coast. An outline of description has only been attempted, and much yet remains to be performed by such as may succeed us in these enquiries. But before we take a view of the majestic cape, and bid adieu to its magnificent scenery, a peculiar mineral should receive a little attention, on account of the Geological testimony it supplies, in regard to the igneous origin of trap. We mean the cacholong, a variety of chalcedony. It appears in white and yellowish-white masses, resembling chalk—it frequently passes into chalcedony, and envelopes other minerals, producing on their surfaces impressions resembling those made by the fingers in soft putty. Frequently it adheres to the tongue, being possessed of absorbent properties. This mineral is identical with pieces brought from recent volcanoes, and cannot be distinguished from specimens contained in the lava of Etna and Vesuvius. This fact, in addition to numerous others of a similar kind, although not so plainly marked in their characters, should have been sufficient to convince even Werner himself, that trap rocks were produced by heat ; that during its energy reduced the ingredients of the numerous minerals they contain, so that they have assumed those regular and determinate figures under which they now appear.

Approaching the lofty cape from the westward, the amygdaloid begins to ascend, extending to the southward until it is cut off, and the basaltic trap permitted to rest directly upon the sandstone, in the manner it is seen at "White Water," a small cove on the south side of this headland. The basaltic trap attaining still greater elevation, forms separate and distinct ranges of columns. The first of these ranges composes the perpendicular precipice in front, and stands facing the Basin of Mines: two others rise in succession in the rear, and are lifted up like steps of stairs to support the higher lands of the coast. The two ranges placed rearward have been clearly made out, although they are obscured from a view beneath, by the growth of trees covering the summit of the mountain. These successive facades of columns resemble those on the coast of Antrim, and were the surface cleared would nearly equal in beauty those of the Scottish Isles. It is true that the basaltic arrangement is not so perfect in Nova Scotia, but the columnar structure throughout the whole of this formation is manifest, and in many places extremely beautiful and well defined.

Beneath the basaltic trap, the amygdaloid emerges, supporting the slope of debris that forms a semicircle around the bold promontory. This immense collection of debris is composed of broken columns and shapeless masses of trap, which have fallen towards the sea beneath. Even here the trees of the forest have taken root, and form a beautiful terrace around the cape, that far surmounts the altitude of their highest tops. Many of these trees have been transplanted from the summits of the highest cliffs, now leaning over their adopted homes, and seeming to gaze with frightful pride over the ruins to which they will finally be consigned. Often have we made an escalade up the accessible part of the abrupt escarpment, and our brain has reeled over the frightful chasms open in the cliff. Arriving at the summit of the slope, the mural precipice above stands frowning over the ruins of its less elevated and broken masses. Beneath the sloping amygdaloid and perpendicular trap, the sandstone forms a bold outcropping, stretching away to the southward, where it gradually declines and forms the great valley of Annapolis and King's Counties. The red sandstone dips at an angle of ten degrees, and forming a broad base projects outwards beneath the ponderous pillars above. Here the Trap Formation of the North Mountains terminates, and seems at the close of its reign to have given the master-piece of its grandeur. Here the sandstone, amygdaloid and trap appear, exhibiting a perfect section of their extensive formations. Here the melted lava ceased to flow, and winding rivers were allowed to unite, and pass towards the ocean. Like some imperishable tower, with circling battlements, the ranging columns of basalt seem to resist encroachment; but Time with ever wearing and destructive energy, undermines the stupendous cliffs, and the sea by washing away the substrata, bids the lofty colonnade descend and totter downwards to the beach, where each retreating wave transports its crumbling masses to their ocean grave. On the south side of the cape the new red sandstone rises from beneath the amygdaloid, at an angle of seventy-five degrees, until it has attained an elevation of upwards of three hundred feet: the vescicular amygdaloid having disappeared, a precipice of basaltic trap, two hundred feet high, rests upon its almost horizontal strata. The highest part of the cape is six hundred and forty feet, the most elevated promontory in this part of the country. The sandstone in several places is excavated by deep and narrow ravines that extend up the embankment. Having ascended upwards of three hundred feet, a peep over one of these rude indentations will produce a tremour well known to those who are unaccustomed to climbing. Upon a part of the cliff where the precipice had become a little sloping, some large blocks of trap were set at liberty. Hurling in rapid motion down the escarpment, and over the beach, lighting up their way with streams of liquid fire produced by their collision with the rocks lieing in their way, they plunged into the sea, whose placid surface foamed above their momentary tract.

The red sandstone contains numerous veins of fibrous gypsum and selenite, deposited with mechanical regularity. Many of the plates of selenite are beautifully transparent, others are of different shades of red, and appear like ice stained by foreign ingredients. Having ascended the lofty cape, the visitor will enjoy one of the most splendid, varied, and extensive views the country affords. Looking over the frightful precipice, before him is the Basin of Mines studded in summer with the white sails of coasters, which in calm weather are hurried along by the rapid tide, and often in an opposite direction to their "desired haven." On the right, the great valley already described, is seen stretching towards the far west, and decorated with scattered villages and fruitful fields, through which small rivers wind their serpentine way. Here and there the spire of a church reminds the traveller, that the Author of these terrestrial wonders is not forgotten, and the temples dedicated to his service commemorate the tidings, that even He has promised to dwell among his creatures. Far beyond the chain-like villages of Horton and Windsor, the unfrequented hills of slate and granite rise in succession, until the sight is dimmed among their wave-like summits. Eastward a depression in the horizon marks the site of Truro : on the left the picturesque village of Parrsborough, points out a safe retreat for vessels in stormy weather. Still farther north, beyond the rugged peaks of shale, the more level coal fields of Cumberland, once shaded with the lofty palm and antediluvian pine, retires from the sight, leaving the imagination to complete the scene.

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## General Remarks on the North Mountains.

Having thus furnished a description of the Trap Formation on the South side of the Bay of Fundy, so far as it forms the coast, and having given a brief view of its mineral contents, it remains to notice the South side of the North Mountains, between Cape Blomidon and Digby Gut. Wherever the soil has been removed and the rocks exposed, for instance on the sides of roads and ravines, and at other situations where the vertical position of the basaltic trap will not permit vegetation to go forward,— there in every instance without one exception, the hornblende rocks will be found reposing upon the red sandstone as before described. Sometimes the amygdaloid is apparently absent, and columnar masses of basalt rise upwards from the sandstone ; but at numerous places along this range, few such instances occurred, and the vescicular rock containing zeolites is in *situ*. The North Mountains therefore, have the same Geological relations throughout, and contain on all sides those numerous and interesting minerals already noticed.

On the road leading to Hall's Harbour, in the Township of Cornwallis, and near the highest part of the mountain, the amygdaloid rises to the surface. It contains occasionally small unoccupied cavities, which have been filled with zeolites; these having been decomposed by being exposed to the atmosphere, have left their situations vacant. In some instances however, the zeolites are perfect. Large pieces of stilbite were found among the soil, but they are not dissimilar to those recognized upon the shore. Quartz, agate, jasper and chalcedony, were discovered at several localities upon the mountains; but as those minerals have already received that share of description we intended to give, any further detail of them in this place will be omitted. There is however one mineral occurring in the mountains of Aylesford, and described by Jackson and Alger, that we have been unable to obtain, and therefore avail ourselves of their description of it. "Specimens of chlorophæite when recently broken are of a greenish tinge, sometimes approaching to leek green. It is translucent on the edges and soft, yielding to the nail with about the same readiness as horn silver. Its fracture is distinctly conchoidal; on exposure to the air the colour changes, and the substance becomes black and opaque. This peculiar change is also observed in specimens before being removed from the rock, even to the depth of six inches from the surface." The above mineral occurs in the amygdaloid at Hadley's and Gates's Mountains.

It may be enquired of what practical value are the minerals contained in the Trap District of Nova Scotia, and what Provincial advantage can arise from their discovery ? In reply it must be acknowledged, that although many of them are gems of great beauty, and such as have been eagerly sought for to be set in rings, seals and necklaces, or to ornament the abodes of a highly civilized people, and therefore are of considerable value ; notwithstanding it is not probable that they will ever afford an article very important to commerce, or make up the source of an abundant revenue. As objects of science they are however, more valuable. They shew the chemist how variously different substances may be combined, and the different forms they are capable of assuming. The discovery of such combinations have produced the most beneficial results, and chemical affinities exhibited by mineral substances found in the earth, have supplied mankind with useful hints. These having been laid hold of, are now followed by vast improvements in the arts, and the manufactories of this kingdom are now teeming with the richest and most valuable productions, many of which have arisen from the advanced state of chemical knowledge. The mind of the Natural Philosopher becomes enriched by the objects drawn from Nature's private cabinet, and he is enabled to supply his fellow men with knowledge, the most valuable of all earthly blessings : and although he may toil in silence, and remain unknown, and may not receive the least encouragement amidst his labours, or reward for his pains, yet when he disappears he leaves something in the hands of his successors that may administer to their wants, and render them wiser and more happy.

The North Mountains have evidently been formed much later than the sandstone upon which they rest.

They must be distinguished from every other Formation in the country, and admitting them to be of volcanic origin, their occurrence may be considered extraneous.—Had they never been elevated to their present situation, the lower lands of Annapolis and King's Counties, would have presented an almost level surface, even to the margin of the Bay of Fundy ; then numerous rivers and creeks would have entered those counties from the north, and the unprotected sandstone would have been exposed to the more rapid encroachments of the sea. But the trap rocks have been thrown up like an embankment upon the border of the sandstone, protecting it from the angry tides and turbulent billows of the Bay. The torrents of rain collected upon these elevated lands, instead of being peacefully conveyed to the sea, through the gentle windings of the vallies, are precipitated over stupendous precipices of the hard basalt, and fall headlong into the ocean that rolls beneath. At some of those romantic spots a thousand persons might receive the vapour bath at once, and at the same time behold the sparkling rainbow formed in the mists above their heads.

The Annapolis and Cornwallis Rivers meet in the great valley before mentioned, and the floods that are often accumulated on the lower grounds, are sullenly conveyed to the ocean through a narrow opening in the trap rocks at Digby, while the small rivers of King's County convey the surplus waters from the fertile soil into the Basin of Mines. The soil covering the North Mountains, although in many places scanty, is nevertheless very good. Here and there the rocks appear above the surface, but they do not hinder the progress of cultivation, which is rapidly advancing in every quarter.

The soil is composed of disintegrated trap rocks; these having a considerable quantity of lime and potash contained in the hornblende and feldspar of which they are constituted, greatly promote vegetation. Not only is the surface of the mountain enriched by those chemical substances, but the washing of the rain and numerous small brooks, are constantly carrying the debris of the hills to the sandstone at their base: from these causes the lower grounds are constantly supplied with a most appropriate source of fertility.

Affording a shelter from bleak northern blasts, and refracting the rays of heat upon the valley below, the great wall of trap also produces a regular supply of manure to fertilize its covering. From these causes there is a belt of land extending from Cornwallis to Granville, along the base of the mountains, not surpassed by any in the Province for richness and the production of good crops. No better evidence of the good quality of the soil covering the trap rocks need be produced, than a reference to the immense growth of beach, birch and maple, thriving upon them.

Hitherto a consideration of the destruction that is continually going forward in the solid materials of the country, has not been introduced any farther than it appears along the sea coast; for it must be obvious to every one who will bestow a little reflection on the subject, how rapidly the dilapidation of every class of rocks is advancing. Having thus given a description of the Trap District, so far as it extends on the south side of the Bay of Fundy, we now proceed to bring before the reader's notice the remainder of the rocks belonging to that division.

These form the Isle Haut, Cape Chignecto, Cape D'Or, Spencer's Island, Cape Sharp, Partridge Island, and the other headlands and islands on the shore of Parrsborough.

## ISLE HAUT.

About ten miles from Cape Chignecto, Isle Haut rises abruptly from the sea, and is on an average about four hundred feet high. Its surface occupies an area of about one hundred acres, covered with a thick growth of timber. At several places it affords safe anchorage, although it is not much frequented by vessels in the Bay. It has not proved dangerous to coasters, as the tides are separated at this spot on the flood, one portion rushing up the Chignecto Channel, and the other advancing eastwardly through the Gut to the rapid Shubenacadie. On the south side of the Island the massive trap rises in towering sublimity, and presents o'erhanging cliffs of great grandeur. On the north-east quarter a collection of sand forms a small "bar," and contains a beautiful basin filled with clear water. The minerals occurring at this Island are but few in number, and are similar to those on the south coast of the Bay. Sometime in the summer of 1835, this desolate Island obtained an inhabitant, who hoped some aid would have been given him by the Government, to render his retreat comfortable; but as little public benefit could arise from his location at a place where there are few shipwrecks, the anticipated allowance was withheld, and he has since removed to better quarters.

## CAPE CHIGNECTO.

Cape Chignecto is also composed of amorphous trap, which extends about two miles and a half from its extremity, on the shores of Cumberland Bay and Advocate Harbour. It is difficult to determine the boundary of the trap, it being intimately blended with the shale upon which it is placed. This is the only instance in Nova Scotia, so far as we have discovered, where the hornblende rocks are not deposited upon red sandstone. It is curious to observe the great difference in the overlieing rocks at this place, compared with those where the red marl group instead of the shale, forms the foundation upon which they rest. Instead of having a beach along its base at low water, as is common on the shores of the country, the rocks at this place descend, almost perpendicularly into the sea, rendering it impossible to examine them without making an aquatic excursion. Rude and lofty cliffs rise out of the sea, and hang in solemn pride over the head of the adventurous visitor; added to this circumstance a rapid tide whirling in frothy pools, requires dexterous boatmen to shun the vortices threatening on every side. Instead of rolling upon the beach, and curling their brows forward upon the trembling shore, the waves dash against the upright cliffs, rebounding and shooting upwards as if disappointed in their landing place. About a mile eastward of the bold extremity of the Cape, and between isolated towers of greenstone, a narrow opening affords a retreat for boats in stormy weather. This opening is called Refugee Cove. Here the sea has thrown up a small beach, and a brook comes rushing down a tremendous chasm, situate in the rear. Half an acre of marsh has been formed, and upon its margin there were at the time of our visit, craneberries as large as musket balls. These are in no danger of being devoured by greedy schoolboys, for seldom indeed does a visitor venture so far from any inhabitant. Having ascended the top of the cliff, the surface for several miles around presents a most gloomy aspect: the lofty spires of trap and upturned strata of shale, render it almost impossible to pass their frontier, and years will elapse before an accurate description can be given of their minerals, or a hardy settler begin to fell the spruce now skirting the ravines, and cresting the pathless hills.

The trap of Cape Chignecto is of two kinds, which alternate with each other in pseudo-stratification. One of these kinds resembles the common greenstone, and contains a moderate quantity of hornblende; the other is of a reddish colour, and is apparently mixed with silex.—Both pass insensibly into shale, and contain not a specimen of any mineral worth notice.

Perhaps it may be observed, that the trap at this locality being mixed with the shale, furnishes an argument against its volcanic origin: but it should be remembered, that the shale itself might have been exposed to the operation of subterraneous fires, forming a part if not the whole of the mass, from which the trap has been produced; or the superimposed rocks might have been thrown up in such an intensely heated state at the time of their formation, so as to liquefy the shale that came in contact with it. In either case nothing more has been effected than would certainly result, admitting that the crystalized rocks have been produced in the same manner as granite, to which the hornblende rocks of the country are nearly allied. The former or both of these opinions may be true ; for if the basaltic rocks in Nova Scotia, have all originated from the same cause, (a fact which few can doubt,) and have been produced by the same materials, then they would be uniform in their composition. Such however is not the impression they produce upon the mind, as those rocks where they rest upon the shale at Cape Chignecto, are different in that particular ; and although they have evidently been produced by the same cause, their original connection with the shale, and subsequent mixture with its materials, have evidently produced the difference in both structure and composition, now so obvious. The different appearances of granite, porphyry, and other crystalized rocks, can only be accounted for in this way. The minerals of which all the rocks are composed, are but few in number ; it is their dissimilar combinations that make up the great variety among them. Perhaps Geologists have often reasoned from preconceived opinions, and have neglected circumstances like those thus briefly detailed. Notwithstanding, the facts remain the same, and the trap rocks where they rest upon the shale, in Nova Scotia, are very different from those placed upon the new red sandstone.

Advancing from Refugee Cove towards Advocate Harbour, the shale in general is black. Its strata are broken, torn asunder, and often twisted in the most remarkable manner, and form a cliff about two hundred feet high. The strata become more regular in proportion as they are placed at a distance from the trap. This circumstance, and the carbon entering into the composition of their masses, clearly indicate that there has been great heat in the neighbourhood at some former period, which will appear still more certain when Cape D'Or is examined.

## CAPE D'OR.

Like Isle Haut, this Cape received its name from the French, who upon its first discovery mistook its native copper for gold. Rising upwards four hundred feet from the level of the sea, this bold cliff extends outwards into the Bay in a southerly direction. At its southern base a submarine cape reaches still farther into the sea, and produces the well known whirlpools called "Dory Rips." During a heavy gale, the sunken pillars of trap throw up frightful breakers; notwithstanding at ordinary periods there is sufficient water upon them to allow the largest ships to pass in safety. The rapid flood tide, rolling forward to fill the Basin of Mines, meeting an impediment at the submarine precipice, is thrown above the common level, and much broken in its tortuous course. The red sandstone is seen at Advocate Harbour, (a small bay between Cape D'Or and Cape Chignecto,) dipping at a small angle beneath the overlieing rocks. The superficies of the country occupied by that rock is low and level, and extending eastward is characterised by the same features it bears in King's County, on the opposite side of the Bay.

The majestic cape, composed of massive trap, reposing on amygdaloid, lifts its crest far above the strata of sandstone, and seems like a huge tower erected after the work of creation had been completed. Northward, elevated ridges of grey sandstone and shale, have been thrown up, leaving the red marly rock, sole occupant of the valley between them and the more recent trap. Viewed at a distance the cape appears like an island ; and under a peculiar condition of the atmosphere, when low banks of fog skirt the horizon, this headland, Cape Chignecto, and Isle Haut, present the most delusive appearances. Often the desolate Isle appears like a black spot in a cloud, and the capes exhibit the most fantastic shapes. On the west side of Cape D'Or, the trap forms a mural precipice, beneath which large blocks of the solid rock, worn round by constant rubbing against each other, when overflowed by the sea, lie over the broad polished pavement of amygdaloid, that slopes gently down beneath the water. The amygdaloid is divided into cuboidal blocks, by seams that run across its surface, and the whole platform is curiously figured with narrow fissures. In these seams and fissures, the pure native copper appears in dendritic, reniform, and flattened pieces. Each fragment is indented by the inequalities of the rock where it is secured, and it conforms in every instance to the matrix which surrounds it. Often the globular masses composing the moveable portion of the shore, agitated by the waves, wear down the more tenacious copper, leaving a bright surface exposed ; hence the metal may be often seen, shining with great brilliancy beneath the margin of the sea. More commonly however, the surface of the copper becomes oxydized, and is covered with a beautiful green coat. The fragments are of various figures, and weigh from a few grains to several ounces. A few years ago a piece of the pure metal was discovered, weighing fifteen pounds. It is closely compressed in the rock, filling up the interstices very perfectly, and therefore to procure good specimens, a hammer and chissel are indispensably necessary. The amygdaloid is gradually worn down by the constant attrition of the large loose blocks covering its surface, hence the copper, which is more capable of enduring this scouring process, becomes disengaged, and is often found among the sand and pebbles of the shore. From these circumstances has arisen the erroneous idea, that the copper is constantly rising upward, and performing its own exhumation. Near the extremity of the cape, and on its west side, at about "half tide," we have been most successful in obtaining fine specimens for the cabinet. Near this spot we also discovered a vein of quartz, about two inches wide, penetrating the rock downwards. This vein of quartz encloses reniform pieces of pure copper, which are not seen on the sides of the vein, but extend upwards in the centre of its siliceous contents. A learned and elegant writer on Geology, Dr. Ure of Glasgow, has brought forward very ingenious testimony to prove the igneous origin of trap; but while he admits that this class of rocks has been formed by heat, it is in our humble opinion extremely singular, that he should suppose their mineral contents have been formed by the infiltration of water. He says,—"The infiltration of quartz and carbonate of lime in aqueous solution through rocks, is proved by the formation of chalcedonies, quartz crystals, and calcareous spar, in the inflated cavities of trap rocks, and may be traced through every stage of the process." Is it not more probable, that while the rocks themselves have evidently been formed and crystalized by heat, that the numerous crystals contained in them and widely disseminated throughout their solid masses, were also formed by the same powerful agent. A great distinction should be made between those chalcedonies found in the very vitals of trap rocks, and such as are produced by the remarkable process of petrifaction. What will become of the fact presented in the quartz vein of Cape D'Or? Was the quartz collected by infiltration, and did it contain "inflated cavities"? If so, those cavities would doubtless have been coated with crystals. Was the pure malleable native metal also filtered first through the rock, and then through the quartz, so as to fill up the cavities? This certainly is a roundabout way of arriving at the conclusion. While it is generally admitted, that the trap rocks have been formed by heat, to us it is equally plain, that both the quartz and its enclosed copper, have also been in a melted state, and cast into the fissures where they are now found, whether they are in the quartz or amygdaloid.

It is acknowledged by the best modern Geologists, that all the rocks possessing a crystaline structure, have been produced by heat. In granite and porphyry there are frequently large crystals of mica, quartz, and feldspar. Few have ever supposed that those rocks have been collected in an aqueous solvent; but it is generally believed that they are the result of ignition. It cannot then appear singular, that the minerals so beautifully crystalized in the hornblende rocks, have also been aided in forming regular solids through the medium of caloric. These few observations on this subject have not been introduced with a view of entering into the details connected with such arguments, but merely to accompany the facts as they are presented by the copper of Cape D'Or, and to afford a hint of its probable origin ; for few who will examine the trap rocks of Nova Scotia, will ever believe that they and their numerous minerals, were ever produced by any other cause than that which would accompany volcanic influence. Thus far a description of the copper has only been given where it appears in the amygdaloid ; but it was also discovered in the amorphous trap, of which the perpendicular cliff on the west side of the cape is composed ; and finally it was found in the soil covering this promontory. This circumstance was by no means surprising ; for as the rocks at their surface are undergoing a gradual decay, the copper being better qualified to resist the action of the elements, is left among the debris of its more decomposable gangue.

On the east side of the cape the amygdaloid receives into its composition a large proportion of red sandstone, by which it is rendered less durable. Here again the waves that roll upon the shore, with almost irresistable fury, have worn out extraordinary chasms and arches, which are placed over the pathway at low water, affording a grand and imposing spectacle. Beneath one of these natural arches, we discovered a narrow vein of jasper, containing like the quartz already mentioned, irregular fragments of native copper. In one instance the sulphate of that metal was discovered, and it nearly equals in purity the blue-stone of commerce. The green carbonate of copper is however, more common, and frequently enters into the composition of other minerals in this neighbourhood.

A short distance eastward of the cape, the conflicting currents of the coast have worn out a semicircular opening, called Horse Shoe Cove. At this place there are veins of calcareous spar, containing small particles of copper. Crystals of analcime, sometimes transparent, and sometimes coloured green by the carbonate of that metal, are found in cavities in the rocks. Irregular crystals of calcareous spar are often beautifully coated with delicate crystals of stilbite : some of these also have received the green tinge and afford rare specimens. Several other minerals appear at the cove, but they are similar to those of the Trap District in general, and may be obtained at Blomidon in greater perfection.

Eastward of Horse Shoe Cove, a bold headland extends into the sea, and prevents the pedestrian from passing that way even at low water. Having entered the Bay westward of Spencer's Island, the red sandstone will be seen dipping beneath the trap, which even here, limited as its dimensions are, retains the same Geological relations, so clearly manifested in the more extensive ranges of the North Mountains. The appearance of pure copper at the above cape, has proved a fertile source of reasoning to many ; some have supposed that a considerable quantity of gold is contained in the copper. It has been analysed by good chemists, and it certainly is not auriferous ; the copper itself is extremely pure and malleable. Much labour has been applied to discover what prospects might here be afforded for mining ; but the most accurate observations have resulted in the conclusion, that the quantity of metal is not sufficient to offer any profit to such as might be disposed to open the rocks in search of its hidden treasures. Near the cove, we discovered the remains, not of a fossil hyena, but of a small furnace, which had been secretly erected by a party of Americans, who are ever ready to lay hold of the precious metals, and probably expected to obtain a quantity of gold at a cheap rate. The project was nevertheless abandoned, for reasons already given. Mr. Backwell, an English gentleman, dug a pit on the top of the cape, but for what useful purpose we never could discover. It is among our mountains of granite, slate, and transition limestone, where these treasures are concealed, and not among those recent and isolated collections of hornblende rocks, where all the ores have been smelted, and are now in a pure state, from the heat which accompanied their formation.

## SPENCER'S ISLAND.

Spencer's Island is situated about three miles from Cape D'Or, and although its position is somewhat sheltered from the rapidity of the tides, by the headlands to the westward, it is gradually crumbling down. It is separated from the main land by a narrow channel, through which the tide rushes with great force. This channel is gradually becoming wider : an old and respectable inhabitant upon the coast informed us, that he can remember when he was used to wade at low tide from the peninsula of Cape D'Or to the Island. The channel is now several fathoms deep, and half a mile wide : such are the changes daily going forward in every part of the country. Spencer's Island is composed of basaltic trap, that on its south-east side rises abruptly from the bay.

At its north base there is a pretty beach, where a landing can be safely effected. The minerals here consist of siliceous sinter, jasper, and perfect crystals of quartz. The latter appear under several different forms, the most common of which is the six-sided prism. The siliceous sinter is much inferior to that found at Two Islands, where it appears in more interesting varieties.

## CAPE SHARP.

The next headland composed of trap is Cape Sharp, situated about fifteen miles from Cape D'Or, and opposite the coast of Blomidon. The intermediate rocks are sandstone and shale ; these afford scenery which forms a pleasing contrast with the lofty peaks of the basalt, standing like centinels upon the boundary of the Bay, and resisting more powerfully its daily encroachments. On the east side of this cape, the red sandstone will be again seen, shelving downward beneath the amorphous trap, and forming a small valley between it and the shale. Here again the crystaline rock appears to have been produced by some fortuitous circumstance, and resting upon the strata of marly sandstone, lifts its summit far above the level of the adjoining country. At this place the shale and red sandstone meet, and although the strata of the former are almost vertical, it is evident they dip beneath the latter, declaring its more ancient character. The red sandstone here contains veins of selenite, that often appears in large and beautiful transparent plates. The cape is about two miles in circumference, and affords the bold scenery so peculiar to basaltic districts. Even here the poor inhabitants have discovered the fertility of the soil covering trap, and have ascended the lofty precipice to obtain its advantages. At one particular situation on the east side of the cape, the rock is a coarse brecciated greenstone, composed of angular fragments of trap, amygdaloid, and a dark coloured sandstone. In this aggregate we discovered a large geode of amethyst, that would have contained before it was broken, two gallons. Its inner surface was studded with large and regular crystals of a deep violet colour ; over these crystals, extremely delicate atoms of siliceous sinter, form a light incrustation, so that the internal superficies of the geode appears as if it were covered with an autumnal frost. A similar appearance was observed among the minerals at Blomidon, and we can only account for it by supposing, that after the crystals of amethyst had been constructed, a kind of gas or vapour containing sinter intensely heated, had alighted on their surfaces, and supplied them with a singular covering. Several pieces of agate, composed of chalcedony and carnelian, have at different times been found among the ruins of the cape. A large vein of calcareous spar, occupies a place between the amygdaloid and trap. At another site, a considerable vein of the magnetic oxide of iron fills a similar situation. In the spring of 1834, a mass of stilbite that would weigh upwards of two hundred pounds, fell from the overhanging precipice, and supplied a great number of beautiful specimens. Many of these have been forwarded to English and American Naturalists, who have acknowledged them equal in beauty to any hitherto discovered. The mass was composed of large fasciculi, or groups of diverging crystals, of a straw yellow colour, and resembled sheaves of wheat. During one of our visits to this cape, we collected a number of masses, covered with large and splendent crystals of amethyst; but being unable to remove them at the time, on our return a part of the cliff had fallen, and our treasure now lies buried beneath a heap of stones, from which it will probably never be rescued.

## PARTRIDGE ISLAND.

Four miles eastward of Cape Sharp, Partridge Island, so justly celebrated for its numerous minerals and picturesque scenery, rises in lofty grandeur from the Bay. Its name has probably arisen from the numerous broods of partridges reported to have frequented its surface. These however have long since disappeared, leaving the fox sole occupant of its elevated area. This island is northward of Blomidon about six miles, and separated from it by the narrow outlet of the Basin of Mines called "The Gut." These strong collections of basalt, may be compared to the pillars of a gateway, and being more unyielding in their natures, have resisted the impetuous tides more faithfully than the shale and sandstone which they defend. While Blomidon protects the softer rocks of Cornwallis from the encroachments of the aqueous element, Partridge Island and Cape Sharp, on the opposite side of the Gut, stand like giants guarding the coast of Parrsborough. The great body of water rushing forward to fill the Basin of Mines during the flood tide, is thus compelled to pass this narrow opening, and rushes with fearful rapidity along its confines. Through this contracted but deep channel, the tide runs eight miles an hour during the spring tides ; and when it is considered, that it rises upwards of fifty feet high in the short space of six hours, its violence cannot be surprising. Often in calm weather, when vessels have been prevented from anchoring by their distance from the shore, they are seen passing along with great speed stern foremost, through the "Gut," over the rippling surface of the Basin. Frequently a single flood will sweep them fifty miles, either towards or from the place of their destination. It is on this account that the harbour of Partridge Island is so extremely advantageous ; the peculiar direction of the currents, with a light air of wind, almost always allows them to make that port, where they are often collected in great numbers. Partridge Island not only offers a retreat from the fury of the tides, but also in tempestuous weather affords a shelter both on its east and west sides. A fine navigable river at hand, where a thousand vessels may lie in safety, opens in the rear ; here during the cold and blustering months of autumn, their masts are seen rising almost among the clusters of spruce, like leafless pines among the underwood.

From Cornwallis to Digby, following the course of the shore, not a solitary harbour of any importance can be found : also from Cumberland Bay to Truro, on the north shore of the Bay of Fundy and Basin of Mines, the coast affords no protection to vessels in stormy weather, except that which may be found at Partridge Island. Hence that harbour is invaluable, and although not duly appreciated by many in the present day, it will at some future period become a port of much public importance. It is curious to observe the deep excavations made by the sea, at those situations where the basaltic trap rocks have not been thrown up on the coast. West Bay, situated between Partridge Island and Cape Sharp, is an example of the speedy destruction of shale, compared with the greenstone. Notwithstanding the locality to which we again refer is called an Island, it is only surrounded by the water at very high tides, having a level beach connecting it with the mainland. Here again, the red sandstone dips beneath the amygdaloid, similar to its sub-position at Cape D'Or.

On the shore of West Bay, the shale in vertical strata meets the red sandstone, rendering it difficult to decide which of those rocks should claim priority. The shale, however, belongs to the coal formation, and is evidently of more ancient composition than its neighbour.

On the west side of Partridge Island, the basaltic trap deposited on amygdaloid, forms a sublime and stupendous cliff, three hundred feet high. At some places it is undermined, and hangs frowning over the visitor who ventures to stroll among the fragments at its base. Beneath the most lofty part of the precipice, a cone-shaped insulated mass of amygdaloid rises to considerable height, only a few yards from the base of the more exalted summit of the Island. Even this limited portion of the rock, is beautifully topped with regular basalts. At the south east extremity of the island, several small detached and grotesque rocks, form a kind of rampart in front of a rugged point. These rocks are beautifully crowned with low evergreens, above which the spear-shaped top of the spruce mocks the fury of the waves beneath. Viewed from the summit of the lofty precipice, or from the beach study beside him; the calculating merchant would be invigorated for new labours; and the fair daughters of our land would receive another charm from the refreshing influence of a pure and wholesome atmosphere.

Among the numerous minerals of Partridge Island, is calcareous spar, often in large and regular crystals, sometimes transparent, and of a light straw colour. When a few laminæ have been separated from the surfaces of cleavage, the rhomboidal masses are sufficiently pellucid to allow the finest prints to be seen through them; and as the mineral is possessed of double refraction, each line becomes duplicated, and may be read at two different places upon the paper. This carbonate of lime is beautifully phosphorescent when thrown upon hot iron, and if then put in a dark place, will emit a clear gold-coloured light. Sometimes large and perfect rhomboids, measuring an inch and a half in diameter, are sealed upon thin plates of stilbite. The rhombs are separated from each other, and nearly approximate the primary form. The spar also appears lining veins in the amygdaloid, and occurs in small splendent hemitropic crystals. These from having the acute angles of the rhombs turned up, appear to shew tetraedral or wedge-shaped summits. Large pieces on the shore, when broken, exhibit groups of stilbite in fasciculi, or bundles resembling sheaves of wheat: upon these the carbonate of lime in regular forms is secured, sometimes upon the base of the rhomb, and often hemitropically. We opened a rich vein at the base of the cliff, and after much labour were rewarded with large masses of wine-coloured stilbite, curiously studded with crystals of spar, and where the spar is deficient, delicate crystals of bright red heulandite tips the bundles of that mineral, and renders the collection not only highly interesting on account of its singular associations, but gives it a peculiar splendour seldom met with. Often thin plates of stilbite are separated from half an inch to two inches, by crystals of the carbonate of lime. Often small cavities are left void, when the sides of the rhombic angles are seen interlacing each other, in a manner seldom witnessed at other places. Many other varieties might be mentioned, in which the spar and stilbite have been upon terms equally friendly. The subjacent rock contains numerous hollow places, surrounded with colourless, transparent, and rhombic crystals of chabasie : this mineral however, possesses a variety of colours, varying from gold yellow to a bright red, which added to its peculiar glassy appearance, renders it easily distinguished from the carbonate of lime.

Arragonite is a mineral, that according to Stromeyer, is composed of carb. lime 95.29, and carb. of strontian .50. This singular substance has exercised the talents of many distinguished chemists, who have endeavoured to discover its constituents. It occurs in the amygdaloid of Partridge Island, in six-sided prisms, terminated by diedral and tetraedral summits : frequently all the angles of the prism and pyramid are truncated, and the crystal assumes a cylindrical form. It is often transparent, and possesses double refraction : in nitric acid it dissolves with effervescence, and small fragments split when held in the flame of a candle. Perhaps the arragonite is the same substance Messrs. Jackson and Alger have called phosphate of lime, a mineral which generally occurs in primary rocks, and one we have been unable to find at the above place. The arragonite was first discovered at Arragon, in Spain, hence its name has been derived. That variation of apophyllite called albin, has also been observed in small pieces among the fragments of the beach : this mineral appears in right square prisms, the terminal angles are more or less truncated, sometimes producing octaedrons. It is now becoming scarce, and few good specimens can be procured at the Island. Several veins of jasper enter the rock, and ascend with it a considerable distance. Chalcedony, and botryoidal cacholong, may be easily obtained in rich varieties ; the latter frequently encloses geodes of amethyst, and small agates, similar to those found at Cape Blomidon. Sometimes the chalcedony forms geodes of a milky white colour, and encloses cavities occupied with splendent chalcedonic crystals. Several veins of magnetic iron ore, run in tortuous veins up the cliff. Two of these are each a foot wide, and although composed of rich ore, are useless for Mining speculation. Large pieces of hornstone may be procured along the shore, many of which would be extremely beautiful if ground and polished.

Opal and semi-opal, are also among the interesting specimens of Partridge Island. We have obtained two small nodules of the former—both resemble pieces of wax. Both varieties are greatly improved by the labour of the lapidary, and when they are cut and polished, afford beautiful gems. This mineral was much esteemed by the ancients. Nonias, a senator, suffered banishment rather than relinquish to Mark Anthony a precious opal. Of all the minerals for which Partridge Island has been celebrated, none is more admired and carefully sought for than the amethyst. This gem is now becoming scarce, and nothing but the downfall of the cliff will bring it to view. Monsieur DeMonts, a leading character among the French emigrants to this country during the reign of Henry IV., was so much pleased with these brilliant crystals, that he conveyed a number of them to France, where they were received by the King and Queen as a token of his loyalty. Many similar specimens have been transported to Europe, where they are much admired.

The north side of the island descends with a somewhat gradual slope. About half the distance from its summit towards the base, a large vein of the magnetic oxide of iron breaks through the soil ; the ore is of a good quality, and sufficiently abundant to supply a smelting furnace. The waters of a spring in the neighbourhood, are impregnated with the ferruginous oxide, and possess medicinal virtues superior to far more celebrated pools. The south side of the island is entirely barren of good specimens, and the minerals on its east side are like those of the western cliffs.

## SWAN CREEK, AND TWO ISLANDS.

About five miles eastward of Partridge Island, an inconsiderable indentation in the coast, has received the appellation of Swan Creek. At the entrance of the creek, and a mile from the mainland, two small Islands are situated, and have received the above appropriate name. Approaching Swan Creek from the westward, the attention of the Geologist will be arrested by a bold bluff called Clarke's Head, formed by a confused collection of red sandstone, shale, limestone, and gypsum. These have been noticed when a description was given of the Red Sandstone District. Upon a thick formation of the sandstone, and forming the surface of the Bluff, a thin insulated layer of basaltic trap extends a short distance to the northward. This layer is unconformable to the strata of sandstone, with which it forms a peculiar contrast, neither rock having had its colour changed by mixture. If it be admitted that trap rock is the production of volcanic heat, a fact not to be doubted, it really appears that the crater from which this detached mass has issued, has been demolished or swept away. From its appearance it must have been the very border of a column of melted matter that overflowed this section of the country. This small collection of hornblende rock, lies above the shale, sandstone, and lime ; and as it was doubtless coeval with the ponderous masses of the majestic Blomidon on the opposite coast, it plainly proves that the trap rocks of Nova Scotia are of recent formation.

No more of this rock is seen until after crossing Swan Creek, where another isolated collection of the massive kind appears, resting upon the sandstone as usual. Here also wherever the trap occurs, the land is elevated just in proportion to its extent ; and as it was before observed, it forms a crown to the substrata beneath. The basaltic rock at this locality passes by gradual steps into amygdaloid, and contains many beautiful and interesting minerals. About two furlongs from the creek, the amygdaloidal trap is seen in immediate contact with the sandstone. The trap along this coast appears in insulated and detached portions, forming several remarkable prominences and obtuse elevations, above the subjacent members of the red marl group. It appears like a number of separate masses, that have been superimposed at several different points, and which are disjoined by the less elevated freestone. These elevated accumulations extend but a few hundred yards from the shore of the basin, and have the sandstone rising up their sides. The whole of these singular collections of the hornblende rocks, including the Two Islands, and parts of the Five Islands, appear like immense molehills, raised from the materials of which the surrounding earth is composed. The largest of these mounds will not exceed a mile in circumference. If they have been formed from the melted lava of a crater, that vomited its liquid contents upon the surface, and discharged boiling torrents upon the sandstone, filling up hollows and ravines that were placed in its way, then these remarkable cone shaped hills of trap cease to be a phenomenon. At each of those places it is curious to observe, the gradual passage of shale and red sandstone, first into a perfect vescicular amygdaloid, and finally into compact trap. In some instances the layers of sandstone are filled with angular masses of compact greenstone, forming a coarse breccia. It has been supposed by an American Geologist, that the shale, sandstone, and trap of this place, have been converted into a coarse breccia, and finally into amygdaloid. But, if it be true that the latter rock has been formed and elevated by heat, (and there is most unequivocal testimony supporting the fact,) it is necessary to enquire of what materials amygdaloid and basalt were originally composed, and the changes those materials have suffered from volcanic influence. With the nature of the ingredients from which granite, porphyry, and other crystaline rocks have resulted, by the application of heat, we are altogether unacquainted, and little is known of those substances from which lava is formed in the bowels of volcanoes. One thing however appears certain, that the amygdaloid of Swan Creek, has not been formed of the trap that lies above it ; and as both the trap and amygdaloid are evidently volcanic productions, it is most probable they were both produced by the same cause. Let it for a moment be supposed, that a crater is opened and its melted matter poured out upon the soft sandstone : the result would be a mixture like that now seen. If it be observed that the amygdaloid is unlike the basaltic rock in its structure, it may be replied, that these two rocks agree very nearly in their chemical characters, and resemble each other more than the different layers of lava in some volcanoes now in operation.

From the splendid discoveries of Sir Humphrey Davy, a cause of volcanic heat has been introduced, not only plausible but extremely probable. Of these, Dr. Ure justly remarks, "the metals of the alkalies and earths, from their paramount affinity for oxygen, could not possibly exist on the surface, but only in the interior of the globe. On this principle volcanic fires would be occasioned wherever those metals were extensively exposed to the action of air and water. Thus also the formation of lavas might be explained, as well as that of granites, porphyries, basalts, and many other crystaline rocks, from the slow cooling of the products of combustion, or oxidation of these remarkable substances." Should any one enquire how were the isolated portions of trap of the islands and elevations on the north side of the Bay of Fundy and Basin of Mines formed, so far from any continuous range of that rock, a reply is readily furnished in the volcanoes of other countries, where the smoke of their burning materials is pouring in clouds through numerous openings on the surface of the earth." To the west of the valley of Limagne, immediately behind Clermont, rises a gigantic *plateau*, about 1600 feet above the valley, and 3000 above the sea. On this rests a chain of volcanic hills, about 70 in number, composed of steep cones called the Puys of the Monts Dome, which form with the ashes and scoria scattered around, an irregular ridge from 500 to 1000 feet high, and about 18 miles in length by two in breadth." "In the ancient Province of Velay, Mr. Scrope counted more than one hundred and fifty cones, so thickly sown along the axis of the granitic ridge, that separates the Loire and Allier from Palhaquet to Pradilla, as generally to touch each other by their bases, and to form a continuous chain." These cones are all volcanic, and many similar occurrences might be quoted ; but we forbear, feeling confident that it would not be a difficult task to prove, that in Nova Scotia those remarkable openings in the earth have poured forth torrents of liquid trap, and that the conical hills of basalt along the coast of the Bay and Basin, have been like so many enormous chimnies ascending from the earth at some former period.

Having thus given some idea of the singular structure of this part of the Trap District, so far as its rocks have been examined, and having described the shale, sandstone, &c. of this part of the Province, when treating of the other rocks upon this coast; it seems proper to remark here, that at Clarke's Head, McKay's Head, and other situations where the shale approximates the overlieing rocks, the greatest possible confusion is manifest. At one situation, the shale has apparently been partially melted, its strata are broken, contorted, and thrown upwards in a vertical position. At another place, black shale, limestone, red sandstone, and gypsum, are collected in confused heaps, and all of these bear the marks of having been under the influence of heat. Numerous are the minerals of this interesting coast, for the number of materials which have thus been exposed to some powerful agent, have produced a corresponding variety in their contents. Those belonging to the basaltic trap are few, while the vescicular rock abounds in rare and beautiful specimens.

Near Swan Creek the rock contains large plates of analcime; some of these are of a dark brown colour, others have their crystals of pure white piled one upon another, frequently resembling bunches of grapes. In these crystals the cube is greatly modified, and the trapezoedron under twenty-four equal trapeziums, is produced. Often large masses of analcime are thickly covered with transparent and elongated groups of needlestone; these projecting outwards, give the aggregate an appearance similar to that of the urchin covered with thorns. Frequently this species of zeolite exhibits long crystals not larger in diameter than hairs, and may be blown away with the breath; and instead of bearing the common appellation of needle-stone, might more properly be called hair-stone. Veins in the amygdaloid are often occupied with beautiful crystals of pearly heulandite : this mineral also appears in plates containing the brown variety. Large pieces of siliceous sinter are covered with delicate bundles of stilbite, interwoven with the heulandite, and superior in beauty to any we have seen from other countries. Chabasie in large yellow and wine-red crystals, in rhomboids, is seen sticking to the side of a low cliff, where with the aid of a ladder the most splendid specimens can be obtained. Often chabasie, stilbite, and heulandite, are associated, and may be picked up among the ruins of the coast. Indeed the Mineralogist will be well rewarded, and a cabinet richly stocked with the curious objects of science, in the distance of a few yards. Half a mile eastward of the creek the trap forms a bold precipice, with a slope at its base composed of the detritus formed by the falling rocks : here also the amygdaloid abounds in minerals.

McKay's Head is a lofty overhanging cliff, affording the most rare and beautiful crystals of siliceous sinter. This mineral occupies geodes and veins in the cliff, and appears under a variety of forms. Stalactical, mamillary, and branching groups of crystals, may be easily procured, imitating flowers, leaves, and a variety of other figures ; its lustre is shining, pearly or vitreous, and sometimes it is shaded with a light tinge of red. In a large open fissure the sinter is perfectly covered with delicate crystals of hog tooth spar, so finely pointed as to wound the fingers when they are incautiously handled. Among the curious specimens of the siliceous mineral found here, is that variety called michaelite, first discovered by Dr. J. W. Webster, in the Island of St. Michael, from which its name has been applied. The michaelite forms a net-like incrustation on the interior of cavities abundant in the rock ; sometimes it constitutes delicate wreaths and chains, over which branching crystals of the sinter are curiously congregated, affording rare and beautiful groups that are unrivalled by any in the world ; its colours are pure white, greyish white, and light cherry red, lustre glistening and pearly. With these minerals there frequently occur small geodes, lined with crystals of amethystine sinter, a gem of the greatest beauty. These crystals, like those of quartz, are six-sided prisms, terminated with six-sided pyramids, and are well adapted for rings, necklaces, &c.

The above minerals generally occur in volcanic countries : they are abundant at the hot springs of Iceland, Isles of Ischia, and St. Michael's. In Iceland the sinter forms a deposit around the celebrated Geysers ; hence another witness is produced at the above situation, to prove the volcanic origin of the trap rocks of Nova-Scotia. Jasper, calcareous spar, and jaspery red oxide of iron, are among the detritus of the shore, where numerous and singular combinations have been exposed.

The largest of the Two Islands, or that which is situated nearest the shore, is about three quarters of a mile in circumference, and presents a bold and perpendicular precipice on each of its sides : it being accessible only at one spot, where by climbing some rugged rocks the summit may be gained. On its east side there is a great collection of debris produced by a launch of the precipice a few years ago. Not far from this place a vein of compact brown oxide of iron, about three inches wide, enters the trap and may be seen extending up the escarpment. Within a few feet of the vein of ferruginous oxide there is another of moss agate, varying from half an inch to three inches in width. The base of this agate is transparent chalcedony, in which numerous brown filaments are curiously intermixed, perfectly resembling moss. Pieces of this agate, after they have been polished, will vie in beauty with any hitherto discovered. Wherever the oxide of iron approximates the agate nearly, the latter becomes opaque, and it is easy to observe the gradual passage of the iron into the agate : therefore the filaments so much like moss, are delicate crystals of the oxide, which have insinuated themselves into the chalcedony during its fluid state, or probably when both were cooling down from an intense heat. In this instance, however, it is by no means probable that the moss in the agate was ever the plant itself, as some have supposed. These, and many other kinds of agate, have arisen from circumstances evidently accidental, and their various figures are only imitative.

On the south side of this island the cliff reaches its greatest altitude ; here a large vein of beautiful jasper winds its way through the compact rock. We were surprised to find small pieces of this jasper on the border of a lake fifteen miles from the Two Islands, knowing it was impossible that it could ever be found among the strata in that neighbourhood. But pursuing our enquiries still farther, we discovered that on the side of the lake, the aborigines of the country had manufactured their "arrow points," and the fragments of jasper now found upon the spot, had been brought from the Islands, and were the discarded splinters from the points of their weapons. We have now in our possession perfect spear-shaped arrow points, composed of jasper, identical with that in the vein near Swan Creek, and others which have been made of pieces of chalcedony from Blomidon. The Indians, in these instances, certainly selected the hardest of stones for cutting instruments, but by what means they could have broken them into such regular lances, it is not easy to determine. There are now before us several stone axes, which like the arrow heads, were used by the natives of Nova Scotia previous to the introduction of iron and steel by the Europeans. These relics illustrate the great advancement of useful knowledge, since their proprietors pursued the bounding moose over our mountains ; and happy would it have been for our red brethren, if the necessary implements of husbandry, and the chace, had been put into their hands, unaccompanied with habits and vices, which have so nearly annihilated their race. Between these islands there is a narrow channel, and the Mineralogist may drive a gig to each of those romantic spots at low water; but his visit must be short, or the coming tide will surround him, and an escape be rendered impracticable. The outermost of the Two Islands is neither so large nor so lofty as the inner one, but is far more remarkable on account of the little coves and hollows that have been gradually worn out by the violence of the tides. On its south side the sea has dug out a deep notch in the leaning wall, ready to plunge into the waves dashing at its base. The west side presents an excavated front, which is rendered truly singular on account of a very grotesque opening, that runs entirely through the island and beneath its ponderous masses. This opening is near high water mark, and is formed beneath a majestic gothic arch of trap, and extends under and through the island, allowing sufficient space to drive a coach and four. The distance through the passage is about thirty yards, and the archway opens into a most romantic narrow cove, forming a natural tunnel beneath the rocks and herbage above. Here also minerals are abundant: some of the richest pieces of stilbite we have ever seen, were found projecting from the sides of the archway. Analcime and heulandite, in beautiful specimens, the latter lining the walls of a deep and narrow chasm, will be readily secured at this wild and romantic little Island, where the eagle, fishing-hawk, and gull, have long claimed an equal, although not undisputed title, to the privilege of occupation.

## FIVE ISLANDS.

The Five Islands form a small group six miles eastward of the Two Islands. Three of their number are composed of trap, the other two are chiefly red sandstone, and in their Geological characters are similar to the detached portions of the overlieing rocks already described. The gradual passage of sandstone into a reddish amygdaloid, which is succeeded by the amorphous trap, is strikingly displayed among them, and the mixture of these different rocks is similar to that appearing near Swan Creek. Situated about a mile from the main land, this cluster of small islands is seen forming a kind of chain, in front of a considerable settlement bearing their name;

and so far does the tide recede in this part of the Basin, that these islands may be visited on horseback at low water, when the tide has rolled away from their foundations, and retreated from the small rivers which wind their way into the country beside them. At high water they become islands again, and cannot then be examined without crossing the rapid waters of a boisterous channel. Ever exhibiting the grandest and most picturesque scenery, the trap is lifted up in lofty colonnades, or towering walls, strongly testifying that the modern theory of its origin is true. The moment the sight is directed to the sandstone of the neighbouring or opposite coast, the landscape becomes tame and humble, while the lofty mural cliffs of the islands, shew that their rocks have been produced and elevated by other causes than those which formed their frail foundations. The largest of the chain is called Moose Island, which probably supports an area of one hundred acres : it has recently received an inhabitant, a poor industrious fellow, who is quite safe from the attack of the midnight invader, but not so from the humid peltings of the south-east gale. A second island is inaccessible on all sides, and rises perpendicularly from the sea about two hundred feet. Two others are less elevated and of smaller dimensions. The most westerly island consists of several needle-shaped spires of greenstone, rising from fifty to an hundred feet. These are called the "Pinnacles," and greatly embellish the romantic scenery of this part of the coast. These islands contain but few minerals. Such as have been discovered are inferior in beauty to those belonging to other localities. Our last visit to the Pinnacles, was in the season when the gulls are hatching their broods. The ferocity of the male birds was surprising. Darting with great rapidity at the unexpected intruder, and within a few inches of his head, their open beaks were brought together with a devouring snap, by no means pleasing to our auricular organs. Leaving the subjects of Geology and Mineralogy for a moment, the reader it is hoped will pardon a short account of a natural curiosity at this place, which is introduced from our manuscript pencilling upon the spot, and appeared in the Novascotian, in 1834. There is at Five Islands, in the Township of Parrsborough, a pond between two islands, of considerable extent. Three of its sides are formed by a small *cul de sac*, penetrating the shore ; the other sides have evidently been created by the violence of the sea, throwing up a barrier of sand in front, so that an hour before low tide, a perfect basin filled with water, clear as crystal, remains.

Great numbers of fish, of different kinds, have been incarcerated in this decoy. While they are in search of food, or depositing their ova, the tide leaves them enclosed in the pond, and in water about two feet deep. It is curious to observe the inhabitants repairing to the spot at low water, with pitchforks and other implements of husbandry ; they make a deadly charge upon the bewildered prisoners, and a great many cod, halibut and pollock are caught without hook or bait. Seven hundred codfish were taken at one tide ; at the same time a boy threw a barrel of herrings out of the pond with his hands. Although this kind of fishing might not afford much amusement for the scientific angler, nor furnish matter for a treatise on cod fishing, nevertheless the flakes of the inhabitants of the adjacent village, declare that their amusement has not been unprofitable.

At Indian Point, on the main land, the trap rocks descend to the beach, where several conical masses stationed upon a bar, afford a singular imitation of ancient and dilapidated castles. The red sandstone now begins to ascend to its proper level, forming shelving walls of considerable height. The trap rocks keep their place, and form the summit of Gerrish's Mountain. Here they leave the shore, and extend to the eastward several miles, where they terminate in an abrupt precipice, similar to that of Cape Blomidon. Thus we have followed the course of the trap rocks, from Brier Island to Economy in the County of Colchester, a distance of an hundred and forty miles; and throughout this extensive range, the rocks abound with numerous objects of science, not rivalled by any other in the world.

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## Concluding Remarks on the Trap Rocks of Nova Scotia.

Besides the abundant testimony furnished in other countries, to prove the volcanic origin of Trap Rocks, Nova Scotia produces in addition to those which have been collected by distinguished Geologists, some of peculiar interest; many of these have already been detailed.—The Rev. W. Conybeare, in a note to his paper on the North East of Ireland, and in the third volume of the Geological Transactions, remarks:—

1st. The identity of chemical composition in basalt and lava.

2nd. The constant occurrence of Trap Rocks in volcanic districts.

3rd. The confessions of the Wernerians themselves, that the basalt of Auvergne is of igneous origin.

The red sandstone of Nova Scotia, is a soft granular rock, forming an extensive area in the Province. Its superficies is level and low, never rising above a certain altitude. From its situation and structure, it must have been deposited beneath water, and doubtless derived from the detritus of older formations. Not so with the superimposed Trap Rocks; they are hard, compact, and often sonorous,—their structure is crystaline, and the changes they have produced in those strata which have been in contact with them, although not remarkable, are indicative of a power they at one time possessed, of heating all that came in their way. The position which the Trap Rocks of Nova Scotia holds, is of much importance; they are placed unconformably upon the strata of sandstone, and the height of the country is exactly in proportion to the thickness of their masses, which as we have previously remarked, seem to have been added by some fortuitous circumstance, after the work of creation had been completed. The appearance of the hornblende rocks overlieing red sandstone, is by no means uncommon; it is extremely frequent in Scotland, where the trap is often elevated 2000 feet above the level of the sea. "What a vast body of lava must have been ejected, to cover an island like Skye, fifty miles long, and twenty broad, with coulies in many places one thousand feet deep. The basaltic mantle of the island of Mull, is in like manner enormous, and from these two central foci, the antique lava seems to have spread over the whole district of the Trap Isles, of which only small fragments are exposed to view, the great portion being now engulphed in the deep, forming dark basaltic caves, and submarine causeways." What tremendous convulsions must have shaken the primeval ocean, when the North Mountains of Nova Scotia came boiling to the surface of the earth; and how magnificent must the scene have been, when spiral flames and curling clouds of smoke rose from their summits, and the lesser cones of the north shore were giving vent to accumulated heat.

Between earthquakes and volcanoes there is an intimate relation, and where the latter has once appeared they are liable to break forth again. For many centuries however, the internal fires of the earth have been subsiding, and therefore it may not be probable that the inhabitants of this happy country, will ever be visited by those calamities, that have at different periods inhumed thousands of their fellow men. We cannot however be surprised, if shocks of earthquakes, and trembling of this planet be felt. They are only the movements of those causes which have often opened fountains of burning lava, or vents for the combustible materials of the earth, to breathe out its swollen contents, and obtain relief from concentrated internal fire.

To the Geologist such phenomena are not surprising: he sees the changes the crust of the earth has already undergone, and to which it is still liable: he beholds the wreck of a world that has been once destroyed; and he knows that the earth contains within her vast domains, the materials of her own destruction. These only require the command of their Almighty Creator—" when the elements shall melt with fervent heat, the earth, and the works that are therein shall be burnt up."—2d Peter, III, 10.

ERRATA.

Page 6, line 7th—for *Isle Hant* read Isle Haut.
33, line 3d from the bottom—for *prevents* read presents.
64, line 12th—for *oxyde* read oxide.
74, line 12th—for *underpriming* read underpinning.
162, line 16th—for *bissinate* read bipinnate.

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