GENERAL REPORT

OF THE

GEOLOGICAL SURVEY

OF

NEWFOUNDLAND,

EXECUTED UNDER THE DIRECTION OF THE

GOVERNMENT AND LEGISLATURE OF THE COLONY

DURING THE

YEARS 1839 AND 1840.

By J. B. JUKES, M.A., F.G.S., F.C.P.S.;

OF ST. JOHN'S COLLEGE, CAMBRIDGE;

LATE GEOLOGICAL SURVEYOR OF NEWFOUNDLAND.

LONDON:

JOHN MURRAY, ALBEMARLE STREET.

1843.

LONDON:
Printed by WILLIAM CLOWES and SONS,
Stamford Street.

GENERAL REPORT

OF THE

GEOLOGICAL SURVEY

OF

NEWFOUNDLAND,

DURING

THE YEARS 1839 AND 1840.

GEOLOGICAL SURVEY,

&c. &c.

---

1. Introductory Remarks.

The object of a Geological Survey of any country is, to become acquainted with its solid structure; to know what are the different earthy or mineral masses of which the country is composed, and what are their relative and actual positions.

As a general term for designating all those masses of earthy or mineral matters which are extensive enough to be considered as forming an integral part of the structure of any country, whether the masses be hard or soft, the word "Rock" is used.

Rocks are of two kinds: stratified or aqueous rocks; and unstratified or igneous rocks.

The stratified or aqueous rocks consist of beds or strata resting one upon another in regular order, which beds vary in thickness from a few inches to several feet, and in extent from a few square yards to hundreds of square miles. The unstratified or igneous rocks have

no regular beds or strata, but occur in all forms, from veins a few inches wide, to irregularly-shaped mountain masses: they are commonly found or may be traced beneath the stratified rocks, but sometimes cut through them like perpendicular walls (in which case they are called dykes), pass among them in irregular and often tortuous veins, or, finally, rest upon them in great masses.

The aqueous rocks have been formed by the deposition of earthy matters from water : the igneous rocks have once been in a molten state, from intense heat. Where the igneous rocks join the aqueous, the latter are often much changed in their structure and mineral character: they are then called metamorphic or altered rocks.

The beds of the stratified rocks are rarely horizontal, but are generally inclined at a greater or less angle to the horizon. This inclination is called the " dip." By reason of this inclination successive beds rise one after another to the surface of the ground, where they may be measured and examined, and in this way a knowledge may be gained of the structure of a rock to an extent far beyond that

which could be attained by direct excavation. The edges, or "outcrop," of a bed, or set of beds, may, under favourable circumstances, be traced for long distances running through a country, and showing themselves here and there, where the soil or other superficial matters are removed. The line of bearing along which this "outcrop," or appearance of the beds at the surface may be traced, is called the "strike" of the beds.

Masses of igneous rock frequently form long ranges of hills, on the sides of which the stratified rocks repose, and from which they dip or incline downwards on either hand. The range or strike of the stratified rocks is generally persistent throughout their course; the dip, however, is often varied, and the beds are frequently undulating, or curved up and down into great ridges and furrows, the curves running along straight lines sometimes for many miles. The curves are of varied extent: they sometimes have a radius of only a few feet or yards, but are sometimes on a grander scale, the opposite sides of the curve being several miles apart. In all cases the lines along which the curves take place are called "anti-

clinal" and "synclinal" lines. The anticlinal line is that which runs along the top of an upward curve, along the crown of the ridge, as it were, and *from* which the beds decline on either hand; the synclinal line is that which runs along the bottom of a downward curve or trough, and *towards* which the beds decline on either hand. In either case the curvature of the beds is not always shown on the surface of the ground, which may be quite level, the beds having been broken, degraded, or cut down, to a certain height.

As a consequence of the inclined position of the beds, it will be seen that the lowest portion of the series may frequently occupy the highest situations above the level of the sea, rising up on the slope of the hills from beneath all the others; and that, conversely, as we travel from the hills to the plains, we frequently come upon higher strata, beneath which the beds we have left behind have successively passed; and thus the highest beds of the series may occupy lands but little above the level of the sea, the other strata lying beneath them in those places.

The stratified rocks consist of an infinite

number of beds, composed chiefly of clay, sandstone, limestone, &c., but containing occasionally beds of coal, salt, gypsum, or other matters.

Different portions of this great series of stratified rocks, having certain characters in common, are classed together, and spoken of in the aggregate under the term "formations." These common characters are of several kinds, but it will be sufficient here to say that they do not necessarily include identity of mineral structure. All the formations, as also all the beds and subdivisions of which they are composed, have a regular order of superposition, which may be broken or incomplete, but is never reversed. In other words, we never find a bed, or a formation, lying above another in one place, and below it in any other locality. Both the formations themselves and the beds of which they are composed, however, thin out in various directions, and gradually come to an end. Thus by the gradual thinning out of some beds and simultaneous thickening of others, a formation, without losing its identity, or much altering its general characters, may yet be composed of an entirely different set of beds in one place

from what it is in another, and the mineral characters of the beds may either be the same or totally different. In the same way the series of formations, by the thinning out or absence of some, and the increased thickness of others, may vary in different countries, the total thickness of stratified rocks remaining the same. This thickness, however, is not always constant; and sometimes, by the absence of certain intermediate beds or formations, two portions of the series may be brought together in one locality which are widely separated in others. It is possible that these two formations may still be parallel to each other, that is, may both be horizontal or inclined at the same angle with the horizon. This, however, is not often the case with beds whose position in the general series is very different, or, in other words, which are of greatly different age. It is more usual to find the lower formation inclined at a considerable angle with the horizon, and the upper one resting upon it horizontally, or at a less angle with the horizon.

This discordance of position is called "unconformability," and when any two formations

resting one upon the other differ either in the angle of their dip or the direction of their strike, they are said to be "unconformable" to each other. This unconformability is sometimes produced, not by the absence of any of the formations, but simply by a difference in their position. Thus, if, of eight groups or formations, the four lower ones are highly inclined, while the four higher are horizontal or nearly so, it is obvious that the upper ones may rest successively upon the up-turned edges of each of the lower ones.

As may be expected, from the fact of their highly inclined and often disturbed position, the stratified rocks are frequently traversed by cracks or fissures, running through the beds sometimes for many miles in a straight line, and extending from the surface to unknown depths. On the opposite sides of these cracks the beds are frequently found to be at very different levels, the difference varying from one yard to upwards of a thousand, one portion having sunk below or been raised above the other to that extent. These cracks are termed "faults." They vary in width from a few inches to several yards, and are sometimes

filled with broken portions of the adjacent beds, sometimes with clay, sand, or other matters. The surface of the ground frequently gives no indication of the existence of these faults, even where the movements of elevation or depression have amounted to hundreds of feet. Faults are often met with unexpectedly in mining operations; and, whether the geologist can detect it or not, the occurrence of a fault in any particular locality must always be looked on as an *accident*.

In certain formations, generally those of a more ancient date, and in igneous as well as aqueous rocks, are found "mineral veins." The origin of these is yet a matter of some controversy. In whatever way they were produced, however, they are, when they occur in the stratified rocks, frequently neither more nor less than faults, containing, among other things, minerals in a crystallized form. Whether in igneous or aqueous rocks, they may always be described as fissures traversing the rocks, generally at a great angle with the horizon, uncertain in their occurrence, and as much matters of accident as faults. No rules can be given for their discovery, except that they are

more frequent in the neighbourhood of granitic or other igneous rocks, and where the stratified rocks have been greatly shattered and convulsed. Metallic ores are sometimes found as bunches, nests, or strings disseminated through the rocks: these, however, are even more capricious and irregular than what are commonly called mineral veins.

As a general fact, then, every large district of the earth is composed of igneous and aqueous rocks, the latter resting on the former. The aqueous rocks are composed of many widely extended layers or strata of earth, resting one upon another, either in a regular series, or in such a way as to be referrible to a regular series. In different places, these strata are tilted up, broken, contorted, and cracked, and are here and there pierced through by igneous rocks, which, having been injected among them in a molten or fluid state, occur in every imaginable form and condition.

Such being a slight general sketch of some of the characters, positions, and relations of the materials of which the crust of the globe, or at least that portion of it above the level of the sea, is composed — it is evident that the

geological surveyor, in entering upon a country with which he has no previous acquaintance, has a task of some difficulty, and often of great perplexity. He must make himself acquainted with the characters of the various beds constituting the series of stratified rocks of which the country is formed. He must discover the natural order of this series, and ascertain what are the general characters which are common to certain large portions of it, in order to divide it into groups or formations. He has to accustom his eye to these characters, in order to detect them where they may be obscure, and many other little points of detail must be worked out before he is thoroughly qualified to enter on his task of describing the solid geometry of the district. For the more perfect fulfilment of this, too, it is necessary that the country should be accessible in every direction, that the surface should not be too much covered up by vegetable soil, or hidden by a thick growth of wood, and that the cliffs by the sea-shore, the natural sections exhibited in the beds of rivers, or the banks which enclose them, and the appearances on the hill-sides, or, in their ab-

sence, artificial cuttings, sinkings, or borings should be attainable. The very first requisite is, that a good map of the country should be placed in his hands, showing the general ranges and heights of the hills, and the courses of the rivers and valleys; and that this map should be on a sufficiently large scale to enable him to trace his daily routes and mark down the phenomena observed. Furnished with this knowledge and these materials, it is the business of the geological surveyor to trace on the map the surface-boundaries between the igneous and aqueous rocks, as also between the different formations or subdivisions of the latter. In doing this, he must also collect such information from the continued observation of the dip, strike, faults, veins, and other phenomena, as shall enable him to show the positions of the rocks below the surface, to as great a depth as he is able. This is done by means of sections, or supposed perpendicular cuttings through the earth in various directions, by which its internal structure may be best exposed. By means of these coloured maps and sections, a cabinet of specimens, and written descriptions, the geologist is enabled

to convey an intelligible idea of the physical structure of the country, and the qualities and properties of the materials of which it is composed.

The results of a geological survey, if fully carried out, will be a knowledge of the existence and situation of all beds of good building-stone, lime-stone, slate, gypsum, coal, iron-stone, salt, or other regularly bedded rocks. It will probably point out the localities in which mineral veins will be most likely to reward the search of the adventurer. It will show the boundaries of the different districts best adapted for agriculture; and will be of the greatest use in draining, well-sinking, road-making, and all other operations of the farmer, the engineer, or the miner. Nor must it be forgotten by the geological surveyor, that while he is bound by every means in his power to discover and lay open the natural resources of the country under examination, for what are commonly called practical purposes, he must not neglect the theoretical portion of the science of geology. A knowledge of the mode of formation of the rocks and the cause of their being placed

in their present positions, will constantly help him in difficult or obscure points; and will more especially be of the greatest possible assistance to him in mining or other operations, in which direct observation is impracticable. He is bound, therefore, to store up every fact, and even every speculation that may rise in his mind from the observation of fact, bearing on theoretical geology, and to contribute, as far as he is able, to the great mass of knowledge which is gradually working out for us the history of the formation of the present crust of the globe.

Those who are acquainted with the island of Newfoundland will be best able to appreciate the difficulty of applying the general principles and rules laid down in the foregoing observations to its particular case. The interior being trackless, uninhabited, and obscured by woods and morasses, the coast affords the only means of continued observation. Here, though the cliffs are bold, they are frequently inaccessible, and often either too perpendicular or too well guarded by surf to render landing practicable. Not only is there no map of the interior, but no general

knowledge of it exists. No guide can be found who knows more of the country than a few miles round his own dwelling, or a particular path to a neighbouring settlement. Much time was therefore necessarily devoted to gathering materials for a rough map and acquiring some information on the physical geography of the country; and the present Report can only be looked on as a collection of so much preliminary information as would have been of use in the commencing a detailed survey, had the nature of the country rendered such an undertaking advisable.

Sketch of the Physical Geography of Newfoundland.

The general character of the island of Newfoundland is that of a rugged, and, for the most part, a barren country. Hills and valleys continually succeed each other; the former never rising into mountains, and the latter rarely expanding into plains.

The hills are of various characters, forming sometimes long flat-topped ridges, and being occasionally round and isolated, having sharp peaks or craggy precipices: the valleys, also, vary from gently sloping depressions, to rugged and abrupt ravines; and the sea-cliffs are for the most part bold and lofty, with deep water close at their foot. Great boulders, or loose rocks scattered over the country, increase the general roughness of its appearance and character. This uneven surface is covered by three different kinds of vegetation, forming districts, to which the names of "woods," "marshes," and "barrens," are respectively assigned.

The woods occupy indifferently the sides or

even the summits of the hills, and the valleys, and lower lands. They are most commonly found, however, clothing the sides of hills, or the slopes of valleys, or wherever there is natural drainage for the surplus water; and perhaps for this reason they occur in greatest abundance in the neighbourhood of the sea-coast, or round the lakes and rivers, if the soil and other circumstances be equally favourable. The trees consist, for the most part, of fir, spruce, birch, pine, and juniper, or larch; and in certain districts the wych-hazel, the mountain ash, the alder, the aspen, and some others, are also found.* The character of the timber varies greatly, according to the nature of the subsoil and the situation. In some parts, more especially where the woods have been undisturbed by the axe, trees of fair girth and height may be found: these, however, are either scattered individuals, or occur only in small groups. Most of the wood is of small and stunted growth, consisting chiefly of fir-trees about twenty or thirty feet high, and not more than three or four inches in diameter.

* One or two good-sized trees, apparently identical with the common English ash, were seen near St. George's Bay.

These commonly grow so closely together, that their twigs and branches interlace from top to bottom, and lying indiscriminately amongst them, there are innumerable old and rotten stumps and branches, or newly fallen trees, which, with the young shoots and brush-wood, form a tangled and often impenetrable thicket. The trees are often covered with lichens, and tufts of white dry moss are entangled about the branches. Other green and softer mosses spread over the ground, concealing alike the twisted roots of the standing trees, and the pointed stumps of those which have fallen, the sharp edges or slippery surfaces of the numerous rocks and boulders, and the holes and pit-falls between them. Every step through these woods is a matter of toil and anxiety, requiring constant vigilance to avoid falling, and constant labour to procure standing-room; climbing and creeping, and every mode of progression must be had recourse to, and new directions have constantly to be taken, in order to find the most practicable places through which to force a slow and tortuous way. In the heat of summer, while the woods are so thick as to shut out every breath of air,

they are at the same time too low and too thinly leaved at top to exclude the burning rays of the sun, the atmosphere being rendered close and stifling by the smell of the turpentine which exudes from every pore of the trees.

Embosomed in the woods, and covering the valleys and lower lands, are found open tracts, which are called "marshes." These marshes are not necessarily low, or even level land, but are frequently at a considerable height above the sea, and have often an undulated surface. They are open tracts, covered with moss to a depth sometimes of several feet. This moss is green, soft, and spongy, and is bound together by straggling grass, and various marsh plants. The surface is very uneven, abounding in little hillocks and holes, the tops of the hillocks having often dry crisp moss like that on the trees. A boulder or small crag of rock occasionally protrudes, covered with red or white lichens, and here and there is a bank on which the moss has become dry and yellow. The contrast of these colours with the dark velvety green of the wet moss frequently gives a peculiarly rich appearance to the marshes,

more especially when they are seen from a little distance, clothing the undulating slopes of a hill with tufts or thin skirts of wood scattered about. Except in long-continued droughts or hard frosts, these marshes are always wet, and unable to bear the weight of a person walking over them. A march of three miles, sinking at every step into the moss, sometimes knee deep, and always as far as the ancle, is, it may well be supposed, a most toilsome and fatiguing operation, especially when, as must always be the case in attempting to penetrate the country, a heavy load is carried on the shoulders. This thick coating of moss is precisely like a great sponge spread over the country, and becomes at the melting of the snow in the spring thoroughly saturated with water, which it long retains, and which every shower of rain continually renews. Numerous small holes and pools of water, and in the lower parts small sluggish brooks or gullies, are also met with in these tracts, but it must be observed that the extreme wetness of the marshes is due almost entirely to the spongy nature of the moss, as the slope of the ground is nearly always suffi-

cient for surface-drainage; and when the moss is stripped off, dry gravel or bare rock is generally found beneath.

The "barrens" of Newfoundland are those districts which occupy the summits of the hills and ridges, and other elevated and exposed tracts. They are covered with a thin and scrubby vegetation, consisting of berry-bearing plants and dwarf bushes of various species, and are somewhat similar in appearance to the moorlands of the north of England, differing only in the kind of vegetation, and in there being less of it. Bare patches of gravel and boulders, and crumbling fragments of rock, are frequently met with upon the barrens, and they are generally altogether destitute of vegetable soil. It is on the barrens only, of any part of the interior of Newfoundland, that it is possible to walk with any kind of ease or expedition: their hard ground, though frequently broken, rugged, or precipitous, being delightful to tread after traversing the heavy marshes or toiling through the tangled woods. Sometimes, however, in the hollows of the barrens, as also in other situations, a bed of dwarf juniper is met

with, which goes in Newfoundland by the name of "tucking bushes." These grow about breast-high, with strong branches at right angles to the stem, and stiffly interlacing, their tops being flat and level, as if they had been mown off. They are so stiff, that in some places one can almost walk upon them; but as this is not quite possible, the labour of wading through them may be more easily conceived than described.

These different tracts are none of them of any great extent; woods, marshes, and barrens frequently alternating with each other in the course of a day's journey. In describing the general features of the country, one of the most remarkable must not be omitted, namely, the immense abundance of lakes of all sizes, all of which are indiscriminately called "ponds." These are found universally over the whole face of the country, not only in the valleys, but on the higher lands, and even in the hollows of the summits of the ridges and the very tops of the hills. They vary in size, from pools of fifty yards in diameter, to lakes upwards of thirty miles long and four or five miles across. The number of those

which exceed a couple of miles in extent must on the whole amount to several hundreds, while those of a smaller size are absolutely countless. Taken in connection with this remarkable abundance of lakes, the total absence of anything which can be called a navigable river is at first sight most anomalous. The broken and generally undulated nature of the country is no doubt one cause of the absence of large rivers. Each pond, or small set of ponds, communicates with a valley of its own, down which it sends an insignificant brook, that pursues the nearest course to the sea. The chief cause, however, both of the vast abundance of ponds, and the general scantiness of the brooks and smallness of the extent of each system of drainage, is to be found in the great coating of moss that is spread over the country. On any great accession of moisture, either from rain or melted snow, the chief portion is absorbed by this large sponge, the remainder fills the numerous ponds to the brink, while only some portion of the latter runs off by the brooks. Great periodical floods, therefore, which would sweep out and deepen the river channels, are almost

impossible, neither have the rivers power at any time to breach the barriers between them and unite their waters. In dry weather, when, from evaporation and drainage, the ponds begin to shrink, they are supplied by the slow and gradual drainage of the marshes, where the water has been kept as in a reservoir to be given off when required. In this way, many ponds, which, having no great depth, would otherwise be exhausted, are kept full of water in the driest seasons, and it is only in the greatest droughts, when the marshes themselves begin to dry up, that the ponds are found to shrink much below their average level. The quantity of ground covered by fresh water has been estimated, by those acquainted with the country, at one-third of the whole island, and this large proportion would not probably be found an exaggeration.

The province of Avalon is nearly separated from the rest of Newfoundland by the bays of Placentia and Trinity, a narrow isthmus (at one part not more than three or four miles across) alone intervening.

There are in Avalon two principal ranges of hills, forming regular watersheds.

The most easterly range is that which runs from the back of Renews to Holyrood, in Conception Bay. Though not lofty, it is very rugged, the faces of the hills being precipitous. At each end of this range is a remarkable hummocky hill called the "Butterpots;" and so little is the country penetrated or known, that it is a common belief among the inhabitants of the neighbourhood, that the Butterpots of Renews is the same hill with the Butterpots of Holyrood, whence their common name. They are distant about twenty miles from each other, and on account of the distance, and the intervening hills, neither of them can be seen from the summit of the other. Each of them appears to be about the same height above the sea, probably rather more than 1000 feet;* and eminences of nearly equal altitude occur at several parts of the range to which the local names of Bold Face, Bread and Cheese, the Drop, the Flakey Downs, &c., have been attached. One considerable hill detached from the general range is seen a few miles north of

* I was so unfortunate as to break a mountain-barometer during the ascent of one of these hills, and therefore could not ascertain their exact altitude.

Cape Broyle Harbour, and is called Hell Hill. From the Butterpots of Holyrood a range of high land runs along the eastern side of Conception Bay, forming the White Hills, and the lofty iron-bound coast, from Topsail Head, by Portugal Cove, to the neighbourhood of Cape St. Francis. Another spur of this range, also, runs towards the western side of Conception Bay, as far as the Cat's Cove Hills, near Collier's Bay, these latter hills being the three peaks of a picturesque elevation, and rising to a height of 900 feet.

The other principal range of Avalon runs from Cape Dog in St. Mary's Bay, to the neighbourhood of Chapel Arm in Trinity Bay It is less broken and rugged than the one before mentioned, forming a more level and continuous ridge, on which are various elevations, for the most part rounded and flat-topped. The principal of these are called Mount Sea-Pie, North Harbour Lookout, the South-east Mountains, Cap Hill, the North-east Mountain, the North Hill, Spread Eagle Peak, Little Gut Lookout, the Tolt, and the Monument. Of these hills, the north-eastern mountain of Placentia (distant about nine miles from the head

of the north-eastern arm of that harbour) is the most lofty and considerable. It is a round-topped hill of gentle ascent, and probably rises to the height of 1200 or 1400 feet above the sea.* From the top of the North-east Mountain sixty-seven ponds were counted, some of them two or three miles across, none less than 100 yards, and none at a greater distance than ten miles from the base of the hill. Many more existed within that area hidden by woods and intervening hills.

As subordinate hills and ranges, may be mentioned the Sawyers' Hills, with a peaked serrated outline a few miles south of Placentia; the ridge of high rough land forming the isthmus connecting Avalon with the main part of the island; Spaniard's Bay Lookout, and the high lands running down the peninsula between Trinity and Conception Bays; Chisel Hill, to the north-east of St. Mary's Bay; and lastly, the ridge of the South Side Hill,

* My barometers being broken, I could only judge of its height by the distance of the sea horizon. The hill in question was seen some miles beyond Cape English in St. Mary's Bay, which is distant thirty miles in a straight line. Reckoning, then, the distance of the horizon at forty miles, the height of the hill would be about 1300 feet.

running from Torbay to the Bay of Bulls, Branscombe Hill, and the other elevations about St. John's.*

The only basin of drainage in Avalon worth mentioning is that lying between the two principal ranges of hills, the waters of which are poured into St. Mary's Bay. A number of ponds, however, lying south of Renews Butter-pots (some of the eighty which were counted from the summit of that hill), give rise to a considerable brook which empties itself into Biscay Bay, Trepassée. The rivers emptying themselves into St. Mary's Bay are, the Salmonier Brook, flowing out of a large pond called the Hundred Island Pond, and Colinet and Rocky rivers, emptying themselves close together into Colinet Arm. Of these, Rocky River is the most considerable, having the longest course of any river in Avalon. At its mouth it is 150 yards wide, and for half a mile is several feet deep, with rocky and precipitous banks. Its navigation is then stopped by waterfalls of very picturesque appearance: the river here,

* The principal heights about St. John's are Signal Hill, 520 feet; the Southside Hill, about 700; and Branscombe Hill, 870 feet above the sea-level.

forty yards across, takes two leaps of about twenty or thirty feet each, over ledges of hard rock, with a foaming rapid of 100 yards in length between the falls. Above this spot the river is from sixty to eighty yards in breadth for some miles, but rapid, stony, and rarely more than knee-deep. About twelve miles up it forks, and the principal branch, called Hodge River, takes its rise from some ponds which are not more than five or six miles distant from Brigus in Conception Bay.

To enter on the description, at greater detail, of the many smaller hills and brooks of Avalon would be waste of time, more especially as the more remarkable of them are marked on the rough map which accompanies the Report.

Of the physical geography of the main portion of the island of Newfoundland I can only give a very slight sketch, taken from two or three unconnected points.

The western shores of Placentia Bay and its adjacent islands, from Cape Chapeau Rouge to Piper's Hole, are rugged and precipitous, with every character of a mountainous country in miniature, none of the hills exceeding 1000 feet in height. Cape Chapeau Rouge and the

neighbouring hills of St. Margaret and St. Anne, probably attain a height of 800 feet, and hills of equal elevation are seen occasionally along the coast to the northward. The narrow island of Merasheen cannot be less at some points than 600 feet high. This same range of lofty, broken, and precipitous land runs along the western side of Trinity Bay, down to Trinity Harbour, and thence crosses into Bonavista Bay about Keel's Head. It has an irregular width of several miles, occupying the eastern half of the peninsula between Fortune and Placentia Bays, and forming a fine peaked and serrated mass of hills some miles west of Random Sound in Trinity Bay, which stretch also to the neighbourhood of Goose Bay in Bonavista. It is probably to the same range that we must refer Gerard's Hill, Mount Stanford, the Lonil Hills, and the other high and precipitous lands about the many islands and sounds of the southern part of Bonavista Bay. One remarkable hill at the head of Trinity Bay deserves mention for the extensive view it commands. It is called, in Trinity Bay, Sainters Hill; on the chart, Centre Hill; but is known in Placentia Bay by the name of Pow-

der-horn Hill. It is an isolated peak, upwards of 1000 feet above the sea, and overlooks nearly the whole of the Bays of Placentia and Trinity, as well as some of the high grounds about Conception, Bonavista, and Fortune Bays. From the summit of this hill 153 ponds were counted of all sizes, some of them having a diameter of two miles, and all within a radius of five miles on one side and ten miles on the other. It is evident that to map such a district as this with any degree of accuracy, and within any reasonable time, would be a hopeless task.

The western side of Bonavista Bay, from Clode Sound northwards, is comparatively low. As far as could be seen from the top of the Lonil Hills, or elevations farther in the interior, the country consists, towards the west, of regularly undulating ridges, running generally about north-north-east and south-south-west, never rising to a greater height than 300 or 400 feet, and covered for the most part with dense wood. At the northern extremity of Bonavista Bay, about Cape Freels, the country is still more low and level, and the woods are much thinner. For several miles on each side

of Cape Freels there are fine level sand beaches, with shoal water, gradually deepening out to sea. The only other instances of such an occurrence are between Langley and Miquelon, and along the south side of St. George's Bay.

To the westward of Bonavista Bay, there are two ranges of hills, parts of which I saw at a distance, but neither of which was I able to visit. The first is that lying between the waters which empty themselves into Gander Bay, and those which fall into the Bay of Exploits. The northern end of this range is called the Blue Hills, and its continuation to the south goes by the name of the Heart Ridge. It runs about north-north-east and south-south-west, in a line with the promontory between Gander Bay and Dildo Run. No part of the range can exceed 1000 feet in height, as it is not visible from the coast.

The next range of hills crosses the River Exploits at about thirty miles from its mouth. The part to the north of the river gradually rises to the north into a summit called Hodges Hill; that to the south of the river goes by the name of Shutebrook Hills. These are seen from the mouth of the River Exploits, closing

the view up the valley of the lower part of the river. They are flat-topped, with precipitous sides, having thus a square appearance, whence the more southerly of them is called Square Hill. Their height may probably be about 1500 feet. A ridge of high land runs from them towards the south-south-west, and I was informed that another lofty hill had been observed far in the interior nearly on the same line of bearing.*

The southern portion of the island of Newfoundland, from the neighbourhood of Fortune Bay to Cape Ray, is barren and desolate in the extreme. About Cape La Hune the cliffs are very lofty, and the high land close upon the coast excludes all view of the interior from the sea. West of the Burgeo Islands the cliffs are low, the land rises gradually from the sea to the interior, and the coast is fringed with low islands, and rocks above and under water. The country, as far as could be seen, is of the most rugged and broken character possible,

* It is possible that this may be "Mount Misery," or else "Jameson's Mountain" of Mr. Cormack. A very lofty hill was mentioned to me by an Indian as visible at a distance of forty miles to the south-east from Orie's Hill near the Grand Pond: this also is probably the same hill.

grooved in every direction by small valleys or ravines, and covered with round hummocky knobs and hills with rocky and precipitous sides. This rocky country is partially covered by moss, and low bushes, and berry-bearing plants; but the only trees are a few dwarf firs, huddled together in some more sheltered nook, where a little soil has lodged that may form a support for their roots. Nothing like a prevailing direction or grouping together of the hills is perceptible in this kind of country. On approaching Cape Ray, however, a distinct ridge of a more decided character is perceived, running from the cape into the interior in a north-east direction. Three remarkable sugar-loaf hills rise from the low land which forms the projecting point of the cape, but beyond them the hills are one unbroken ridge, with a very steep face towards the north-west, but rather flat and regular at top. This flat-topped ridge, which here and there probably attains a height of 1000 feet, is very well seen from the Great Codroy River, forming the southern boundary of the valley for twenty miles at least; and from the top of the cliff near Crabbs River, on the south side of St. George's

Bay, it was also seen running at a distance of about twenty or twenty-five miles towards the head of the bay. At the head of the bay, hills of various character and height are seen to sweep round from the south, and coming within eight or ten miles of the harbour, to stretch off towards the north. They here form not so much a connected chain of hills, as a band of broken and hilly country, frequently without any well-marked or definite boundary. One conspicuous hill bears true north-east from St. George's Harbour, distant about twenty miles in a straight line. It was called Hare Hill by an Indian, is a round bare-topped hill, and is within three or four miles of the south-west end of the Grand Pond. This range of hills runs from St. George's Bay northwards to the Bay of Islands, where it is cut through by the valley of the Humber River. It continues thence to the north, at least as far as Bonne Bay; and from what I could learn of the country, as well as from the hills laid down on the chart, it appears to be continued thence down the centre and eastern side of the projecting tongue of land which stretches out to the north between White Bay and the straits of

Belle Isle. To the west of this chain of hills, which on the whole is the longest * and best marked in the island, lie two tracts of land, one on the south side of St. George's Bay, and the other between that bay and the Bay of Islands. The former is generally low and level, except the corner towards Cape Anguille, where it gradually rises to the height of 300 or 400 feet, forming the hills north of the valley of Codroy River. The latter tract has some low and generally level land to the west of Port-au-Port, but from Indian Head to York and Lark harbours there is a line of rugged and hilly country, forming the lofty peaked hills about those harbours, and the heights called "The Blow-me-down Hills," on the south side of Humber Sound. These attain the height of at least 800 feet, and in August, 1839, large patches of snow still rested in the hollows of their northern slope.

The principal lakes and rivers in the main part of the Island of Newfoundland are, the Grand Pond and Humber River, the Red Indian Pond and River Exploits, the Gander

* On this account I propose, in the present Report, to distinguish it by the name of the "Long Range."

Bay Pond and Brook, and the ponds called by Mr. Cormack "George the Fourth's Lake," "Jameson's Lake," and "Bathurst Lake."

The Grand Pond is full fifty miles long, and about five miles across at its widest part, namely its north-eastern extremity. Its south-western extremity bears about north-north-east from the head of St. George's Bay, and is about fifteen miles distant from it. It cuts deeply into the eastern side of the long range of hills before mentioned, and receives several brooks which flow into it from their valleys. For the first seven miles it bears east-south-east,* and is about two miles wide, with precipitous, densely-wooded cliffs, rising to a height of 500 or 600 feet directly from the water. It then trends round to east-north-east, dividing into two arms, each about one mile wide. These two arms enclose an island about twenty miles long, and four or five miles wide in its middle portion, which is very steep and equally lofty with the surrounding country at its south-west end, but becomes much lower at its north-

* The bearings in this Report are all "true," an allowance of 25° having been made for the variation of the compass.

eastern extremity. From this island the pond runs in a north-eastern, and eventually in a north-north-eastern direction, and becomes wider as it proceeds, till it attains a breadth of about five miles. The surrounding country, especially that on the north-western side, gradually sinks towards the north into a very level and densely wooded tract, which extends towards the north-east as far as the eye can reach, no hills being seen in that direction except three low and distant peaks, which my Indian guide assured me were within six miles of some part of White Bay. At the north-eastern corner of the Grand Pond a considerable brook comes in, fifty or sixty yards wide, and several feet deep at its mouth, but three or four miles up it becomes too shallow for anything but a bark canoe. According to the information of the Indian, it proceeds from a chain of four ponds, each from four to six miles in length, the last of which is not more than fifteen miles from Hall's Bay, and by carrying their canoes about half a mile from which, the Indians meet another brook, down which they can float to Hall's Bay *.

* The mouth of this brook is marked in Bullock's chart "Indian Brook."

About three miles to the west of the mouth of the river in the Grand Pond, called "the Main Brook," an equally large brook runs out of the pond towards the north-west. This stream, marked in the map "Junction Brook," forms a succession of rapids for six or eight miles, when it falls into the Humber River. The Humber, from the account of the Indians, flows from two large ponds on the eastern flank of the "Long Range," and about in the latitude, or, as they expressed it, at the back of Cow Head. It is encumbered with several rapids, one of which occurs just above the mouth of Junction Brook, and for a quarter of a mile is of a very difficult and dangerous character. From this point the Humber runs to the south-west with an average width of sixty yards, and, though in places shallow, with a general depth of three or four feet. In about five or six miles it enters a pond called Deer Pond. This pond is fifteen miles long and three or four broad, lying in a north-east and south-west direction, and having its south-western extremity embosomed among the hills of the Long Range. Through these hills the river, escaping from the pond, finds its way by a narrow and pre-

cipitous valley into the Humber Sound. About half a mile from the pond is a dangerous rapid a quarter of a mile long: below this the valley expands to a width of about two miles, but within three miles of the mouth of the river the hills meet again, producing a rapid three-quarters of a mile long, but not of a difficult character. The scenery is here very picturesque; cliffs of white limestone rising in precipices of three or four hundred feet on the brink of the river, while thick woods of a finer character than usual conceal their bases, mantle over their sides, and frequently crown their heights. Through this narrow opening the drainage of a very considerable portion of the country is effected, extending from the latitude of St. George's Bay to that of Cow Head, and from the watershed of the long range of hills over a width of thirty or forty miles at least, into the interior.

The Indians informed me that a walk of about thirty miles due east (by compass) from the middle of the Grand Pond brings them to the southern end of the Red Indian Pond, and that a similar walk from that point to the south-east (by compass) takes them to the mid-

dle of another large pond, which must, I think, be one of those called, by Mr. Cormack, Bathurst and Jameson's Lakes:* they said, however, that both the Red Indian and the other pond emptied themselves into the Bay of Exploits.

I did not succeed in getting more than twenty miles up the River Exploits: the following sketch, therefore, of that system of drainage is derived chiefly from the information of Mr. Peyton of Toulinguet.

The Red Indian Lake is about thirty miles long and in the middle six or eight miles wide. Its general direction is north-east and south-west, bending, however, slightly at each end towards the west, like the Grand Pond. At its south-western extremity a considerable brook flows in, which, according to Mr. Cormack's map, proceeds from a large pond called George the Fourth's Lake. Another considerable brook flows in at its northern extremity, which comes

* The Indians assured me that the general direction of these three ponds was the same, or nearly north-east and south-west. In Mr. Cormack's map, Jameson's Lake lies east and west, but he may have neglected in this instance to allow for the variation of the compass. Bathurst Lake lies about north-east and south-west, but it empties itself to the south instead of the north.

from the neighbourhood of Hall's Bay. The pond contains two islands near its south-west shores, one nearly at its southern extremity, and several smaller ones in a bight on the south-eastern side. The land along its western and southern shores is bold and lofty, and the cliffs of its eastern shore south of the River Exploits are likewise high and precipitous. About ten miles from the northern end of the pond, on its eastern side, the River Exploits runs out. Its course is at first north-east, gradually bending as it proceeds more towards due east. The river is shallow and rapid, and for the first twenty miles receives but few tributaries. The first accession of any importance is the Badger Bay Pond Brook. This runs from two large ponds called Twelve-mile Pond and Badger Bay Pond, near the north coast, * passes through a succession of smaller ones round the northern extremity of Hodges Hill, and falls into the River Exploits a few miles west of that ridge. Two or three miles east of this a considerable

* With a flat or canoe on these ponds, this would probably be an easier route to reach the Red Indian Pond, than by ascending the River Exploits from its mouth.

brook comes in from the the south, called Sheernock or Shannoc * brook, flowing from a pond called by the furriers Sandy Pond. Eight or ten miles east of the ridge of the Shute-brook Hills, the river takes a sudden turn to the south, and leaps down some falls fifty or sixty feet over hard and craggy rocks. Below these it whirls with a succession of pools and rapids through a precipitous ravine for upwards of a mile, having cut back a channel to that extent. Nearly half way down the ravine a brook comes in from the south, which not having cut back a channel so fast as the main river, shoots out its water from a height of several feet like a spout or shute. It is hence called "Shute-brook," and the hills among which it rises the "Shute-brook Hills." In ascending or descending the river the boats or canoes have to be carried for a mile and a half through thick woods to avoid the falls. At the bottom of the ravine the river resumes its easterly course, running nearly east-north-east, thence to the sea, a distance of twenty

* Shannoc was the name by which the Red Indian designated the Mic-Macs.

miles. About eight miles from the ravine a large brook comes in from the south, called the Great Rattling Brook. This brook has a very straight course for nearly thirty miles, running in a northerly direction, and receiving several smaller brooks and tributaries from the east and west. Six miles below the Great Rattling Brook, some smaller falls, called the Bishop's Falls,* oblige the boats to be again carried for 200 yards. Between the Bishop's Falls and the Great Falls the river is generally from 100 to 200 yards wide, but very shallow, and for the most part a succession of rapids, full of large boulders and ledges of rock. A short distance below the Bishop's Falls a ledge crosses the river, where a rapid is alternately formed and obliterated by the rise and fall of the tide, which reaches to this point. Below this the river is navigable for any kind of row-boat, but above it nothing drawing more than four inches of water can be got up in the summer, and that only by tow-lines, and with infinite labour and difficulty. The whole length of the river from the lake to the sea is

* From the present Bishop of Nova Scotia having visited them.

reckoned at sixty miles, being probably forty in a straight line.

By a salmon-fisher in Gander Bay I was told that Gander Bay Pond is about thirty miles long, but never more than two miles wide. It is crescent-shaped, the eastern end running to within about eight miles of the mouth of Travers's Brook in Freshwater Bay, while the west end trends greatly to the south. At its southern extremity two brooks come in, the most westerly of which is said, by the Indians, to come from near the Bay of Despair. From about the middle of the pond a brook runs out into Gander Bay, passing through three other small ponds, and having a very winding course, reckoned by the furriers at forty miles. From the numerous rapids and small falls, it requires three days to get a small punt up to the pond in the best season, one day being amply sufficient for returning.

There are two considerable brooks emptying themselves into Bonavista Bay, one at the head of Freshwater Bay, and the other at the head of the middle arm of Bloody Bay. The first is called Gambo Brook: it flows by a wide

but shallow and rapid channel two miles in length, out of a pond which is one mile wide and about nine miles long; at the end of this another shallow and rapid stream of only half a mile flows out of a second pond similar in size and shape to the first. These ponds lay in a pretty straight line bearing west-south-west. Two small brooks flow into the upper one at its farther end, neither of them navigable for anything but a bark canoe. From an elevation two miles beyond the end of the upper pond, nothing was seen but the undulating ridges and woods before mentioned as forming the country to the west of this part of Bonavista Bay.

Bloody Bay Brook discharges a very considerable quantity of water, and is upon the whole the most important in Bonavista Bay. Its navigation, however, is impeded at the distance of half a mile from its mouth by a very rocky and dangerous rapid of more than half a mile in length. Above this is "steady water," for six miles, navigable for a punt. I understood from a salmon-fisher, the only person inhabiting the neighbourhood, that a succession of "steadies," with occasional rapids, may be

met with for twelve miles farther. There is then a fall, the water shooting clear over a precipice estimated at eighty or one hundred feet high. Immediately above this is a long and narrow pond called "Terra Nova Pond." This is reckoned to be twenty miles long, lying, as does the valley of the river, in about a true south-west course.* About six miles above the mouth of the river a brook flows in from a large pond on the north, called Maccles Pond, the northern end of which is within three miles of the middle of Lower Gambo Pond.

According to Mr. Cormack's map, there is a large brook running out of a considerable lake, called Barrows Lake, into North Bay, Fortune Bay. Another, emptying itself into East Bay of Bay Despair, runs through a chain of ponds from the immediate neighbourhood of Jameson's Lake. South-west of Jameson's Lake is another considerable one, called Bathurst Lake, emptying itself through a chain of

* I regretted much that, never having heard of this river and lake before arriving at its mouth, I had no means of ascending it; as, if a sufficient quantity of provisions could be conveyed to the head of Terra Nova Pond, it would be a very favourable point for making excursions in the interior of the country.

ponds into Little River Bay; and from its immediate neighbourhood another brook and chain of ponds runs out to White Bear Bay. It is by this latter route that the Indians informed me they proceeded into the country when they wished to cross from the south shore to the Bay of Exploits.

Great Codroy River (north of Cape Ray) is navigable for boats as far as the tide runs up, which is about nine miles; above that it is a mere mountain torrent, rarely more than knee-deep, and full of rocks and boulders.

The latter part of this description is applicable to all the brooks flowing into St. George's Bay.

In the rough map which accompanies this Report, all the features now mentioned, as well as some others of minor importance, have been delineated. As, however, their positions are laid down only from bearings and estimated distances, nothing like accuracy can be claimed for them. I have inserted Mr. Cormack's route from a small map given in the 'Edinburgh Philosophical Journal' for 1824, vol. x., page 156. As he used nothing but a pocket compass, his positions are, of course, only approxi-

mately accurate:* I have therefore, in one or two instances, shifted them a little, to make them accord better with my own.

* Under the circumstances of his journey, the very attempt to delineate the country reflects great credit on his industry, energy, and power of observation.

SKETCH OF THE GEOLOGY

OF NEWFOUNDLAND.

Series of Formations.

THE aqueous or stratified rocks of Newfoundland consists of the following formations, which are arranged in descending order :—

	Subdivisions.
1. COAL FORMATION.	*a*. Upper portion. *b*. Lower or red portion.
1*a*. MAGNESIAN LIMESTONE.	
2. UPPER SLATE FORMATION.	*a*. Belle Isle shale and gritstone. *b*. Variegated slates.
3. LOWER SLATE FORMATION.	*a*. Signal Hill sandstones. *b*. St. John's slate*.
4. GNEISS AND MICA SLATE FORMATION.	

* In adopting these names I have been guided by the desire of only describing what I have seen, and especially of avoiding the use of terms which may have a theoretic import, until their propriety is proved. The general series of the stratified rocks of North America has first to be worked out on its own basis, before it can be advantageously compared with the European series, and the relative signification of the terms of the two satisfactorily settled. In the absence of all direct evidence of their place, then, in the general series, either from organic remains or the more unequivocal proof of superposition, I have applied to the

The unstratified or igneous rocks consist of various kinds of Trap, Greenstone, Serpentine, Hypersthene, Porphyry, Sienite, and Granite. Erratic blocks, diluvial drift, or superficial accumulations, will be spoken of lastly.

1. The Coal Formation.

The upper part of the coal formation consists principally of dark shales, clunch, or bind, with brown and yellow sandstones or gritstones in thin beds. It contains several small beds of coal, one of which has a thickness of at least three feet. This upper portion is similar to the coal-measures of England, but differs from them in containing some beds of red marl, or clunch, and in the sandstones frequently passing into conglomerates containing white quartz pebbles as large as an egg. The lower portion of the coal formation is characterized by beds of red sandstone, and red and green marls and gypsum. The two portions pass by perfectly insensible gradations into one another: yellow, brown, and

rocks of Newfoundland local names, rather than attempted to identify them with European formations by terms which have a chronological signification.

whitish flags and sandstones, dark blue clay, and an occasional bed of black shale occur throughout the formation, but are more abundant in the upper part, where alone they appear to contain coal. In the lower portion, the red colour gradually becomes more frequent till it predominates over the others. The red sandstones are generally soft and friable, and frequently contain quartz pebbles: they are also often blotched and streaked with green or white. Some of the lighter-coloured sandstones contained carbonate of lime, while in a bed of blue clay, crystals of selenite were observed; and in the red and green marls are large and important masses of gypsum.* This mineral occurs either as large veins of fibrous gypsum passing irregularly through the marls, or as thick beds interstratified with the marls. This latter variety is soft, powdery, and finely laminated, little black patches or very thin scales marking the lamination. Its formation seemed to be due to the disintegration of pre-

* This portion of the coal formation is so similar to the new red sandstone of England, that I was at first sight tempted to give it that name, till further investigation showed that it lay below the coal, instead of above it.

viously existing masses of gypsum and black shale, and the tranquil deposit of the debris in calm water. It is very abundant, occurring in several thick beds.

The total thickness of the coal formation must be considerable; neither its base nor its highest beds were seen, while the portion examined certainly had a thickness of 1000 or 1500 feet. It is denoted in the map and sections by a red colour, with streaks of black to mark the existence and position of beds of coal.

1 *a*. Magnesian-Limestone. No evidence was found to show the relation of this rock to the coal formation. The portion more particularly examined had a thickness of about fifty feet, in beds of from two to three feet each, frequently splitting into flags. It contained one bed of carbonate of lime, of a grey colour, two feet thick, with a band of brown chert. The magnesian limestone had generally a yellow colour, but rudely spheroidal concentric stripes of pink frequently occurred. These, in whichever direction the rock was split, produced markings similar to those seen in fortification agate, but on a much larger scale, being often two or three feet

across. No tendency to break or decompose along the line of marking could be observed. This rock had a much greater thickness on the whole than the fifty feet mentioned above.

2. The Upper Slate Formation.

This formation was not observed anywhere in the immediate neighbourhood of the coal or magnesian limestone. The exact relations between them, therefore, cannot be ascertained. Every consideration of analogy, however, leads us to believe these slates to be below the coal formation in the series, though at what distance is not known. The upper slate formation consists of two subordinate groups, which graduate or pass by insensible degrees into one another.

a. The upper portion or group, called the Belle Isle shale and gritstone, consists of dark micaceous shale, with interstratified beds of a very fine-grained grey gritstone. The shale frequently splits into laminæ as thin as paper, and when exposed to the air, rapidly decomposes into a very fine mould or dust. Sometimes, however, it is entirely composed of sil-

very mica, and is then more firm, and often corrugated like mica slate. On the firmer pieces occur singular markings in relief, which sometimes assume the shape of leaves, branches, or other organic bodies, but which are, I believe, entirely concretionary, and not organic. Beds of reddish stone, and of red marl or shale, of an inconsiderable thickness, occur sometimes among the upper parts of the shale. The interstratified beds of grey gritstone are generally about one foot thick, with smooth surfaces, and are much jointed by planes, which are frequently at right angles to the beds. In the upper part of this group the shale predominates, a few beds of stone occurring together here and there, with many feet of shale above and below them. As we descend to the lower part, however, the beds of stone increase in number and thickness, until the shale becomes subordinate to the gritstone, serving but as an occasional separation to some of its beds.

b. A little lower still, the shale disappears altogether, and we have then a mass of grey gritstone, frequently thick-bedded and generally fine-grained, but sometimes coarser, and

in one or two instances passing into a conglomerate of black and white quartz pebbles. Sometimes, more especially when the beds are fine-grained, the grey colour is variegated with red, and the beds pass down into a mass of slate of a brick-red colour, with a fine cleavage. This cleavage is that of true slate, crossing the beds at various angles, and being perfect only in the finest beds, gradually dying away as it approaches a coarser band. The slate produced, however, is invariably brittle, and unfit for economical purposes. From its variety of colour, the group is called the variegated slate. The colours of red and greenish grey are capricious in their extent, and sometimes calcareous beds of a brown colour, with nodules of grey limestone, or cream-coloured bands of slate rock slightly calcareous, may be observed.

The total thickness of the upper slate formation must be very considerable, as each of its two portions are many hundred feet thick at least. As there does not occur, however, any continued section in which the whole formation may be observed, it is difficult to estimate its total thickness.

3. The Lower Slate Formation.

As no locality is known in which the lowest beds of the upper slate formation appear in contact with the upper beds of the lower slate formation, their precise relations cannot be determined. It is possible that they might pass into each other, or, at all events, that they are consecutive formations, in other words, that their antiquity is not greatly different. One or two clear instances, however, will be produced, in which beds of variegated slate rest uncomfortably on beds belonging to the lower part of the lower slate formation; proving some movements, at all events, to have taken place between the periods of their respective deposition. As, in this instance, it is not a question of practical importance, the lower slate formation may be considered as *next* in the series below the upper slate formation. The lower slate formation may likewise be considered as composed of two groups.

a. The Signal Hill sandstone consists of a mass of dark red sandstones and conglomerates. These are very hard, having a dull fracture, and are incapable of being easily worked

into shape. The embedded pebbles are generally small, never being larger than a man's fist, and consist almost entirely of quartz. The beds are usually about three feet thick. The lower part of these red sandstones contains bands, or thick and irregular beds, of light grey gritstone, very fine-grained, and intensely hard, with a splintery and conchoidal fracture. It resembles the gritstone-beds of the Belle Isle shale in appearance, but occurs in much thicker beds, with fewer joints. This mass of red and grey sandstone, which, from its forming the hills at the entrance of St. John's Harbour, is called the Signal Hill sandstone, has a thickness of at least 800 feet. It passes down by a regular gradation into the slate rocks below, which, as the town of St. John stands upon them, are called,—

b. The St. John's slate. Beds of red, green, and grey stone, of a fine grain, alternate, near the junction of the sandstone, with the slate rocks, forming the transition beds between the two. These gradually get more slaty and perfectly cleavable as we descend. The cleavage of the slate is frequently parallel to the plane of stratification, more especially in its

upper portions. In other places, however, the cleavage cuts the beds at various angles, and sometimes exhibits a beautiful "stripe" of blue, pink, and green. The thickness of the formation must be very great, certainly 2000 or 3000 feet, and probably much more. Neither this, however, nor the order of succession of its lower beds, can be sufficiently ascertained from the want of a good continuous line of section. There are beds of gritstone and large masses of conglomerate at various depths below the Signal Hill sandstone. Large thick-bedded masses of very hard, grey, fine-grained rock also occur without any cleavage whatever. In other places a well-developed cleavage produces excellent roofing slate. This formation is frequently traversed by veins of white quartz, and masses of porphyry are found associated with the slates, but whether of contemporaneous production, or as erupted and intrusive masses, is not often determinable.

4. Mica Slate and Gneiss.

The rocks of this formation in Newfoundland (supposing the term formation to be

properly applied to them) do not differ from those of other parts of the globe. The mica slate, however, does not here appear to be separable from the gneiss, as they alternate with and pass into each other. Masses of quartz rock, chlorite slate, primary limestone, and the usual accompaniments of the formation occur also abundantly.

With the exception of some very indistinct vegetable impressions in the coal formation, I have never succeeded in discovering organic remains in any rock of Newfoundland. I have several times searched diligently, more especially in those parts that were at all calcareous. The limited extent of the exposed sections, however, the difficulty frequently of landing on the sea-cliffs, and the nature of the survey necessarily prohibiting long-continued examination of small spots, all combined to prevent that minute and accurate search which is probably necessary to find them if they exist.

The igneous rocks of Newfoundland do not, of course, differ from those found elsewhere: their several varieties, therefore, will be mentioned in describing the localities where they are found.

In entering on this description, we will begin with the province of Avalon.

Nearly the whole of the province of Avalon is composed of the lower slate formation. Along the eastern shore, from Cape St. Francis to Cape Race, the beds of this formation have a general easterly dip, varied, however, by numerous minor undulations. (See section, No. 2.) By reason of this easterly dip, the headlands which project farthest to the east are composed of the highest beds, and the land between Shoal Bay and Torbay, projecting some miles beyond the general line of the coast, consists of the upper part of the formation only, namely, the red sandstones and conglomerates called the Signal Hill sandstone. These beds are very well exhibited on the south side of Torbay, and in the narrows of St. John's Harbour. They form the ridge of the Sugar Loaf, Signal Hill, and the South Side Hill, and along this line they are inclined to the east at an angle of 70°. On both sides of the tongue of land forming Cape Spear, however, namely, in Deadman Bay, and Petty Harbour Bay, this easterly dip may be seen gradually to decrease, and the beds, after be-

coming horizontal for a short distance, rise towards the east, into the cliffs forming Cape Spear, where they have a westerly inclination. This is a good example of a synclinal curve, the synclinal line running through the headland in about a north-north-east course. In going down any of the inlets and harbours along the eastern coast, the slate rocks in the cliffs exhibit a beautiful series of synclinal and anticlinal curves on a small scale, being continually undulated into regular arches, looking frequently like mason-work. On the south side of the inner cove of Torbay, and on the north side of Aquafort inlet, excellent examples of these may be seen. (They are similar, but on a much smaller scale, to those shown in section, No. 2.)

Either from the effect of these undulations, or from faults, the line of strike (or direction of the beds across the country) is sometimes, also, varied or undulated. The strike of the Signal Hill sandstone from Torbay to Shoal Bay is nearly north and south, but just below Shoal Bay it becomes north-north-west and south-south-east: its lower beds consequently soon come out to the sea-cliffs, which thence

into the Bay of Bulls is composed of slate rock. South of the Bay of Bulls, however, the red sandstones come in again, dipping south-east and striking south-west, and Gull Island and Green Island are composed of them. By another flexure, and by the trending away of the coast, they are again thrown out, and their lowest beds are finally seen at the base of Cape Broyle, and in Ferryland Head, where they are nearly perpendicular. (See map.) The St. John's slate, then, forms the coast uninterruptedly to the southward, round into Trepassée Bay. On going into the country, from Renews to the hill called the Butterpots, slate rock is found the whole of the way to the flanks of the hill. It is then perceived to wrap round the base of the hill on its eastern and southern sides, and dipping everywhere from it at various angles, it apparently abuts against the porphyries and sienites which form the principal mass of the hill. The porphyry is a dark green rock, with a few disseminated crystals, and forms the exterior and summit of the hill: it apparently passes downwards or internally into sienite, as at the foot of one or two small precipices sienite of a reddish

colour, and with rather large crystals, was found; the top of each cliff consisting of porphyry. (See section, No. 4.) No dykes were seen traversing the slate, but such may exist hidden beneath the thick moss and tangled woods on the slope of the hill. Near the summit of the hill curious patches of an apparent conglomerate of small angular pieces of porphyry were seen, very hard, and adhering firmly to the mass of the hill. It might be a conglomerate, or a mass traversed in every direction by small reticulated veins. From the summit of this hill, the range of broken and hilly ground mentioned before was seen to stretch to the northward towards Conception Bay, evidently composed for the most part of the same igneous rocks as the Butterpots at each end of it, while the slate rocks swept round to the south, producing generally a more level country, but forming also some lower hill to the west of the principal range. No other part of this range was traversed till it comes out on Conception Bay, where the Holyrood Butterpots is found to be of a precisely similar character to the Butterpots of Renews, namely, red sienite at the base, and

for about two-thirds of the height of the hill, but capped by a mass of dark grey trap rock. No slate rock was observed on the western slope of the Holyrood Butterpots; but, from the character of the country, the slate must approach to, or abut against, its eastern side. From the Holyrood Butterpots the St. John's slate formation runs down at a distance of about three miles from the shores of Conception Bay, till it approaches Topsail and Broad Cove, where it forms the sea cliffs. The bold height of Topsail Head is chiefly a mass of pure white quartz rock. At Portugal Cove the slate is found to be traversed by dykes or large veins of greenstone and trap rock, and masses of an impure serpentine occur, together with hard, grey, compact quartz rock. From the shapes of the hills, intrusive masses of igneous rock probably occur among the slate from Portugal Cove down to Cape St. Francis, where the slate is almost entirely concealed and supplanted by a close-grained siliceous porphyry. The slate rock in the neighbourhood of Portugal Cove and Topsail has generally the mineralogical character of grauwacke and grauwacke conglomerate.

These must be some of the lower beds. (See section, No. 1.) The higher beds at Middle Cove, Torbay, and in the neighbourhood of St. John's are fine slate, with a good cleavage, and might be used for economical purposes.

Round the head of Conception Bay igneous rocks predominate. On the east side of Holyrood is found a yellow, crystalline quartz rock, with circular nodules of a grey rock of inferior durability to the yellow quartz, in which, by decomposing more rapidly, it leaves a number of curious basin-shaped hollows, about two feet in diameter. The western side of Holyrood, down as far as Chapel Cove, consists of porphyry, and thence through Salmon Cove, Cat's Cove, and Collier's Bay, down to Turk's Head, and Bull Cove, the principal rocks are porphyry and sienite. Some slate rocks, to be mentioned presently, compose the extreme points of the headlands. Between Cat's Cove and Salmon Cove a red sienite occurs, which might be used as a building stone. The Cat's Cove hills are composed of porphyry passing into an amygdaloid of white crystals in a purple base. The western boundary of these rocks runs from the western

flank of the Cat's Cove hills straight to Bull Cove, near Brigus, and the last trace of the porphyry is seen in the cliff immediately south of Brigus Harbour. To the west of this boundary the St. John's slate sets in with a high westerly dip, and runs thence uninterruptedly down the western side of Conception Bay, as far as Bay Verde. Throughout this space the general inclination of the beds is towards the west-north-west: there are, however, many minor undulations, which may be seen in the cliffs of the various inlets and harbours which cut across the strike of the beds. Very much of the slate rock immediately on the coast has a fine grain, and would make excellent roofing slate. In Flamborough Head the slate rocks are perpendicular and appear disturbed; and in Bay Verde they pass beneath a mass of red sandstones and conglomerates evidently belonging to the Signal Hill sandstone. These sandstones form the whole of the headland thence to Old Perlican, but the slate rock re-appears in Baccalieu Island. From Old Perlican to Heart's Desire the cliffs are composed of the lower slate formation, but its details were

not examined. It is principally composed of slaty rocks, striking along the coast, and dipping generally to west-north-west. Form Heart's Desire, towards the south, this formation trends away from the sea-coast, and leaves a strip of lower land between it and the sea, occupied by beds of the upper slate formation. The boundary of the two is obscured, partly by a great accumulation of gravel and boulders, and partly by marshes and woods.

Returning now to the south coast of Avalon, we find the St. John's slate on both sides of Trepassée Bay, and forming the whole country thence to St. Mary's and Placentia. Several large and regular flexures may be observed along the western side of Trepassée harbour and along the coast by Cape Pine and Cape Freels. The anticlinal and synclinal lines of these are strictly parallel to each other, and run along a true north-north-east course. Along the eastern shore of St. Mary's Bay, as far as the harbour, the dip of the slate rock is generally to the east, but in Mal Bay, after one or two more undulations, it becomes westerly at a high angle, and continues so thence to Salmoniez. The same beds are by the effect of these

undulations continually re-appearing, and a description of one part serves for all. Round the head of St. Mary's Bay, about Colinet and Rocky Rivers, some beds of hard thick conglomerate, generally grey or brown, with white quartz pebbles, are found, as also here and there some thin beds of soft and rather shaly rock. There was no reason, however, to suppose that these beds belonged to any other than the lower slate formation; and the same north-north-east and south-south-west anticlinal and synclinal lines were frequent, causing the rocks to dip alternately to the west-north-west and east-south-east, at various angles. In North Harbour the dip is westerly; and on the banks of a small brook there, a jet-black slate, with fine white laminations, was observed, dipping also to the west. The range of hills mentioned before as running from St. Mary's to Trinity Bay consist of beds belonging to the lower slate formation, but rather differing in character from those which are generally seen elsewhere. They are very hard, rather coarse-grained, splitting into flags rather than slates, brown or red outside, grey inside, and dipping at a high angle to the

west. On North Harbour Lookout, and on the North-east Mountain, the sharp weather-worn edges of the beds bristle up from the bare ground along the strike of the rocks in a most singular manner, indicating both the strike of the rocks and the cleavage to the north to be 15° east, true bearings. West of this ridge, the country is obscured till we come to the head of the north-eastern arm of Placentia Harbour. Here a red sandstone and slate rock is found, dipping towards the east at a considerable angle, from beneath which other slate rocks, identical in appearance with the St. John's slate, continue to rise towards the west of the shores of Placentia Bay. (See sections, 2 and 3.) At Point Verde, near Great Placentia, is a conglomerate in the slate formation, which contained, among many quartz pebbles, one about the size of a man's fist of a dark-red sienitic rock of a peculiar character, and identical in appearance with a rock forming a wide tract of country on the opposite side of Placentia Bay. Around Great Placentia there is much porphyry, principally dark-greenish-grey, with white crystals. The Castle Hill, on the north side of the harbour, and a con-

siderable part of the cliff along the north-eastern arm, is all porphyry. On the south side the junction of the porphyry with the slate-rock may be seen in Dixon's Hill, which is a mass of porphyry with patches of slate-rock abutting against it. In approaching the porphyry the slate loses its cleavage, becomes tough and rather crystalline, and at last passes into the porphyry by such insensible gradations, that it was only by carefully observing the faintly-coloured stripe of the slate that the place of junction could be discovered. The porphyry stretches into the country towards the south; and, from the shape of the hills called Sawyer's Hills, a few miles south of Placentia, it is probable that they are chiefly composed of porphyry or other igneous rocks. With the exception of these, the whole peninsula between St. Mary's and Placentia Bays is composed of the lower slate formation, which formation runs likewise through Little Placentia, as far as Long Harbour at least, and forms a great part of the isthmus that connects Avalon with the main land. In crossing from Long Harbour to Chapel Arm, in Trinity Bay, we find, on the banks of a

brook about three miles from the latter place a bright red-slate, evidently belonging to the upper slate formation, dipping towards the north, and passing upwards in that direction, into dark shale. The shores of Trinity Bay, from Heart's Desire to Dildo Harbour, and thence through Chapel Arm to Tickle Harbour, are composed of the upper slate formation. Between Heart's Desire and Dildo Harbour the variegated slate-rocks, exhibiting a frequent alternation between greenish-grey and bright red colours, are traversed by several anticlinal lines, running in a direction, as nearly as possible north-north-east and south-south-west. In consequence of this undulation of the beds, patches of shale and gritstone are brought in here and there in the hollows of the slate-rocks, and the gradation from one into the other abundantly exhibited. One interesting locality where the shale and gritstone is shown is between Long Point and Witless Bay. In approaching it from the north, the red slate is observed dipping about south-east, and passing under some grey fine-grained gritstone or slate-rock, destitute of cleavage. As we successively come

upon higher beds, we find the gritstones gradually become separated by thin partings of shale. These thin partings, as we proceed, increase in thickness, and the beds of gritstone diminish, till we come to a mass of shale, fifty feet thick, without any stone-beds whatever. This shale is nearly black and rather hard, but splits into fine laminæ, and the cliffs are coated outside with great streaks of brown and yellow, so commonly seen in shaly cliffs. The shale lies in a beautifully symmetrical basin or trough, rising from the centre at an angle of about 45° on either hand. Proceeding from the centre towards the south, we find the same beds successively rising into the cliff which were seen dipping below it towards the north, until we come again to the bright red slate-rocks. (See section, No. 5.) The effect of cleavage is very peculiar here. In the lower beds of bright-red slate the cleavage is well developed, the rock splitting across the beds into fine slate, which is, however, very brittle. In the grey beds between this and the shale the cleavage is scarcely perceptible, though they are not of a sensibly coarser grain than the red rocks.

In the shale, however, the cleavage is again apparent. These beds are as perfectly fissile as any shale along the planes of lamination, and the laminæ separate readily whenever a portion is detached from the bed; but the mass of the shale is likewise traversed by a fine cleavage, preserving a constant angle of nearly 90° to the horizon, and having the same strike as the beds. The shale is thus minced, at it were, into small scales, or little narrow chips, being cut *thin* by the lamination, *narrow* by the cleavage, and thus made too fragile to retain any *length* in the direction of the strike of the beds. The lower surfaces of the gritstone-beds, alternating with the shale, are likewise traversed by the cleavage for an inch or two upwards, as they break or decompose into sharp jagged edges. About half a mile south of this spot, in a small cove opposite Red Rock, among the red slates, a band of red and brown calcareous rock was observed. It was traversed in every direction by small strings of carbonate of lime, and contained concretionary balls of grey crystalline limestone. Beneath was a pinkish-yellow con-

cretionary rock, with veins of carbonate of lime and small balls of ironstone. The thickness of these beds was about twenty feet, and they are capable of being burnt for lime. Some of the strings of carbonate of lime looked at first so like fragments of shells, that I searched diligently for organic remains, but without success. Towards the head of the bay the variegated slate formation sweeps into the interior for four or five miles, forming a tract of land more capable of cultivation than the generality of the country. On entering Chapel Arm we come immediately on some igneous rock. This is for the most part a rather largely crystalline greenstone; its texture, however, sometimes varies into a nearly compact basalt. It is frequently marked with circular bands in relief of some inches in diameter: these are sections of spheroidal concretions, which are not, however, sufficiently developed to be detached from the mass, and the nuclei of which are of the same character as the rest of the rock. On the west side of Chapel Arm, near the Point, the variegated slate-rock abuts against the greenstone without under-

going any apparent alteration, except that its colours become fainter, and that the red beds lose that hue entirely as they approach the greenstone. A little farther up black shale is seen, and beyond that greenstone again, and the two continue to alternate in the cliffs to the head of the Arm. The shale is hard and brittle, and rings with a metallic sound; and the greenstone is apparently in the form of dykes or spurs, from the hills called the Tolt and the Monument, immediately to the west of the inlet. On the east side of Chapel Arm patches of dark shale and grey gritstone rest upon, and are caught in amongst, the greenstone, and are of course greatly altered from their original characters. The shale is hard, brittle, rings with a metallic sound, and does not easily split into thin laminæ, but rather into small flags, half an inch in thickness, though the marks of a much finer lamination are plainly visible externally. The gritstone is dark outside, almost crystalline in texture, and in places jointed so as to assume an irregular columnar form. The greenstone does not come out upon the coast at any other part of the neigh-

bourhood, but the adjoining hills are probably formed of it, and from its conical shape it is possible, also, that Spread Eagle Peak, about five miles distant, is composed of the same rock. The red slate continues through Long Cove and Collier's Bay, where it dips to the north beneath the shale that forms the long tongue of land called Tickle Harbour Point. On the western side of Tickle Harbour Point, near its extremity, a great bed of grey conglomerate is seen in the shale, forty or fifty feet thick. The pebbles, consisting of white quartz, are seldom larger than walnuts, and are compacted together by a grey cement which is slightly calcareous.

In the districts now mentioned no clear evidence is given of the relation between the upper and lower slate formations. That they are not the same thing, however, is proved by the fact of the variegated slates passing upwards by regular gradation into black shale and grey gritstone, while the slate in the neighbourhood of St. John's passes upwards into a very thick mass of dark-red sandstones and conglomerates. It is highly probable also that the two formations are in Trinity Bay

unconformable to each other, as nowhere in the neighbourhood of their junction are the upper beds of the one or the lower beds of the other to be seen, and therefore they cannot graduate one into another. If we return to Conception Bay, we shall find patches of a bright-red slate resting upon and apparently abutting against the lower slate at the points of Bay Roberts, Port-de-Grave, and Brigus Harbours. These patches of red slate dip towards the east, while the other slates have a westerly inclination; and in a cove just south of Brigus Harbour, called Sculpin Island Cove, the beds of variegated slate are clearly seen to overlap and cover the edges of the lower slate in a perfectly unconformable position. (See section, No. 6.) The lower slate dips to the north-west at an angle of 45°: it is rather thin bedded, of a dull-green and reddish colour. The upper slate is bright-red, thick-bedded, with bands of a cream-coloured concretionary rock and calcareous nodules, and dips at an angle of 30° to the north-east. The cleavage is well marked in the upper beds, which it traverses nearly at right angles, while in the lower it is faint and imperfect and appears to coincide with the strati-

fication. On the south side of the cove, part of a dyke or other mass of porphyry is seen cutting through and contorting the older slate, but it is not observable on the north side of the cove, which is occupied by the red slate. These variegated slates, of which the bright-red colour is most conspicuous, form the extreme points of the headlands of Collier's Bay, Bacon Cove, Salmon Cove, and Holyrood, resting sometimes against the porphyritic rocks, and sometimes separated from them by a mass of schistose and apparently altered rocks. Near the western point, at the entrance of Holyrood, the red slates dip gently to the north, but at the distance of 300 or 400 yards are suddenly contorted, and turned up by a mass of grey crystalline trap-rock or greenstone. Near the junction of the two the colours of the slate are much duller than usual, it becomes more brittle and siliceous, and loses its previously well-defined cleavage. The continuation of this section to the south is obscured by loose sand and gravel, but in Chapel Cove are some thin beds of limestone dipping slightly to the north. This limestone is of a grey colour, is very compact and siliceous, and of

a poor quality. It is traversed by small tubular concretions of calcareous spar, which look as if formed in the hollows where a vegetable stalk or other organic body had decomposed. It is not more than ten feet thick, and has both above and below it some grey schistose beds which are slightly calcareous. To which formation it belongs there is no direct evidence to inform us. There is a strip of low land running down from a little north of Holyrood to Topsail, and having a width of from two to three miles, left previously undescribed: this, together with Bell Isle, Little Bell Isle, and Kelly's Island, is composed of the dark shale and gritstone. The tract on the main land is covered with diluvial detritus, having a portion only of the shale exposed here and there. The perpendicular cliffs of the islands, however, expose every bed to the view. The general dip of the beds of which the islands are composed is to the north-west, so that the lowest beds are seen on the south-east side. On the south-east side of Kelly's Island a mass of gritstone in many beds, having a total thickness of thirty or forty feet, rises into the middle of the cliff; and as the soft beds of shale on which it rests

have decomposed or been washed away, it has continually fallen down, so as to form a great mass of disjointed fragments at the foot of the cliff. This heap of fragments, being protected from the action of the breakers by a considerable pebble beach which stretches out around it, remains as a great natural stone-yard, from which much stone has already been carried away for the erection of the Catholic cathedral and other buildings in St. John's. In Little Bell Isle, as well as in Bell Isle itself, several bands of similar stone exist, but none of such thickness, nor in so favourable a situation for working, as in Kelly's Island. In the upper beds of Bell Isle, those namely on the north-west side, there is but little stone, although one bed of bright-red sandstone about eight feet thick was observed.

Several faults of greater or less magnitude are discernible in the cliffs of these islands.

Having given a sketch of the structure of Avalon, we will now proceed to trace the same formations farther to the west from the entrance of Fortune Bay, through Placentia, Trinity, and Bonavista Bays, to the Bay of Exploits. The French islands of Miguelon and

Langley are composed partly of variegated slate rocks and partly of reddish sandstones and slaty rocks belonging to the inferior formation. Langley Island is chiefly formed of red and purple slaty gritstones; an anticlinal line runs through it in about a north-east and south-west direction from Cape Percée. Immediately at the cape some bright-red slate rocks abut against the gritstones seemingly in an unconformable position, but on the western side of the island, near the neck of land connecting it with Miguelon, bright-red and grey slates dip to the west from the centre of the island at the same angle as the gritstones inside them, and pass underneath some shale; the whole lying in an apparently conformable position. St. Peter's and the mainland opposite, from Point Mary to Cape Chapeau Rouge, is composed of a dull-red igneous rock. This is sometimes a compact red feldspar, with here and there a whitish crystal, sometimes a regular red and white porphyry, and sometimes it passes into a red sienite of feldspar and quartz. It forms on the mainland a low country destitute of trees, and rising into low barren hills in the interior. At Cape Chapeau Rouge a

dark slate rock sets in, and runs along the coast, through St. Lawrence and Burin, for some distance along the west side of Placentia Bay. It is very much broken and contorted, too shivery to form roofing-slate, and dips in various directions. In the small inlet of Mortier Bay there is a great and most perplexing variety of rocks: the dark-green schistose beds above-mentioned continue for about two miles into the bay, but are suddenly replaced by quartz rock in a large amorphous mass on the south side of the bay, while on the north a serpentine with bands of quartz comes in, and over these lie patches of black shale, with thin beds of grey gritstone, precisely like the Bell Isle shale formation, but much twisted and contorted: these latter rocks run for some distance on the north side of the bay, into the large cove called Spanish Room. On the south side of the bay, the quartz rock, after forming a lofty cliff for about half a mile, suddenly ends, and regular beds of variegated slate are found abutting against it and dipping from it in a westerly direction. The bay here trends to the south-west, and these rocks apparently continue along its southern shore; on the opposite

side of the bay a peninsula juts out, forming the south side of Spanish Room; it is nearly a mile in length, and is composed of the following rocks. (See section, No. 7.) The point of the peninsula is occupied by a rock which whether to call it a sandstone or a gneiss is a matter of doubt.* It has evidently been formed of the detritus of red sienite, a round pebble of which rock I found enclosed in it: it is tough, but not very hard, it is regularly bedded, dips to the north-west at an angle of 70°, and is divided into square blocks by joints that follow the dip and strike of the beds. It would make a very fair building-stone, if care were taken to place it with its planes of lamination in a horizontal position. The thickness exposed of this rock is about 200 feet. To the low cliffs composed of this succeeds a small bank of sand and rubbish, immediately beyond which is another cliff about forty feet in height, composed of beds of red and green marls, containing a band of red sandstone and conglomerate, dipping at a very slight angle

* It resembles gneiss in its crystalline components, but differs from it in these components being more loosely connected, the particles being more easily separated by a blow.

to the south-west, and exposing a thickness of about 150 feet. In the lowest beds of marl are bands of white marl indurated and very calcareous, and one or two beds of very hard concretionary limestone, mottled with red and white. The cliff again ends, and a low bank of sand and boulders extends for about 200 yards, when suddenly some black and brown shale is found resting on two beds of light-brown or whitish limestone, siliceous, and containing small tubular concretions and strings of spar, and agreeing in every respect with the thin beds of limestone in Chapel Cove, Holy-rood, at the head of Conception Bay. The two beds of limestone are separated by a thin parting of shale; they are each about five feet thick; and the whole mass of shale and limestone dips at an angle of 75° to the south-south-east. The beds of limestone form a ridge running across the beach and keeping the same dip and strike for some distance into the water. Unfortunately the section here is again interrupted by a hollow filled with sand and boulders, immediately beyond which is a cliff of red sandstone and conglomerate, dipping in the same direction with the red marls and

sandstones before mentioned, and exposing a thickness of about forty feet. This last mass of conglomerate is rather soft, full of large quartz pebbles, imbedded in fine red sand, and marked by regular lines of stratification. The remainder of the peninsula is a low beach running up to the main land, the cliffs of which are there composed of the same serpentine rock, associated with quartz, which was mentioned before. These beds of red sandstone and marl are certainly very like those belonging to the lower part of the coal formation. Their extent, however, is so limited that it is impossible to say to what they belong, and I never saw any other beds like them in the eastern portion of Newfoundland. I did not visit any other portion of the west side of Placentia Bay, but from its rugged appearance throughout, and from the structure of the neighbouring islands, I should judge it to be composed chiefly of igneous rocks.

The island of Audierne consists for the most part of a mass of dark-purple porphyry and quartz rock, against which a patch of variegated slate abuts at one part of the harbour.

The Isle of Valen consists of a red and grey

slate rock, with a grauwacke conglomerate of small angular quartz pebbles.

The island of Merasheen consists of a great ridge of porphyry running down the centre of the island, with patches of slate rock on each side of it. In Merasheen Harbour alternate bands of slate and gritstone are seen. The gritstone, where it approaches the central porphyry, becomes a white and rather compact quartz rock. The slates are black with a white stripe, and in places have a fine cleavage, and would probably make good roofing-slate. They dip to the north-west at a high angle, and the upper part contains some beds of dark-red sandstone and conglomerate. The Ragged Islands, on the west side of Merasheen, consist of porphyry and granite or sienite. The granite is confined to the low islands in the centre, and it sends large and frequent veins into the porphyry. Barren Island I did not visit, but, from a block I procured from it, it appears to be composed of steaschist. The northern part of Red Island is composed of granite or sienite. It is of a red colour, coarse-grained, principally quartz and feldspar, but with a few flakes of black talc or hornblende here and there. Near

the harbour are several bands of a grey rock traversing the granite in nearly a north and south direction. This grey rock is finely crystalline, principally quartz, with a little hornblende. The grey rock and the granite mutually intersect each other by veins in various directions. I saw some pieces of a dark-brown flag-stone from the south side of the island, and heard of some red slate. Similar red granite and grey quartzose rock to the above compose the Ram Islands. The remainder of Placentia Bay I was not able to visit, but from its appearance similar rocks to those already mentioned run throughout it. On the north side of the neck of land dividing Placentia from Trinity Bay, the older slate rocks are seen dipping to the north-west from Tickle Harbour to Bay of Bull's Arm. A mile or two west of Tickle Harbour is a mass of serpentine with some obscure steatitic or feldspathic rocks, apparently altered, and in one place a yellow quartz rock containing crystals of feldspar. Over these occur slate rocks of various character passing upwards in Bay of Bull's Arm into purple and red gritstones, sandstones, and conglomerates, which no doubt represent the

Signal Hill sandstones. These likewise dip to the north-west, and at the head of Bay of Bull's Arm they are overlaid by the variegated slate rocks. The cliffs hereabouts, however, are so low, and the junction so obscure, that it is impossible to say whether the two are conformable or not. From the Bay of Bull's Arm along the west shore of Trinity Bay as far as Buonaventure Head, the same rocks occur in the same position, the red sandstones dipping to the west under the variegated slates. A narrow band of these latter rocks runs from the head of Bay of Bull's Arm, through the centre of Random Island, into the country west of Pope's Harbour, and to the west of this band the red sandstones again rise to the west, and in Random south-west arm expose a long series of slate rocks, which rise to the west from beneath them, and are apparently similar to those near Tickle Harbour. The lowest of these slate rocks at the head of the arm is a smooth black shivery rock, very brittle, without any cleavage other than that of the lamination, and containing much hornblende and iron. This rock is likewise seen on the south side of Random Sound. In Random Island this recurrence of

the red sandstones and inferior slate rocks is not apparent, the variegated slates being succeeded towards the west by the Bell Isle shale and gritstone, which form all the north-western corner of the island and a considerable tract on the mainland opposite it. A chain of hills with a sharply peaked and serrated outline runs through the country a few miles west of Bay of Bull's Arm and the inlets about Random Island. These hills send down a spur to the coast, opposite the western extremity of Random Island, which consists of red sienite: patches of schistose rock were at various places seen resting on the sienite, and at one point its junction with the shale was exposed. The sienite was found here partly to overlie the shale and gritstone in a slanting position, the beds dipping towards the sienite and abutting abruptly against it. (See section, No. 8.) No great alteration was observed, except that the shale might be a little firmer, and the gritstone more than usually hard and of a semi-crystalline texture. The detached islands about the mouth of Smith's Sound are composed of a red and grey fine-grained gritstone. In Anthony's Island the grey variety is full of large cubical crystals

of iron pyrites. Just east of British Harbour (called also Shut-in Harbour) a large trap-dyke comes out on the coast, cutting through the red and purple gritstones without producing in them any sensible alteration or disturbance. This dyke is about 200 yards wide: near its sides the rock is vesicular, and nearly black, the cavities being here and there filled with white crystals. Farther towards the centre of the dyke it becomes compact, of a dark-grey colour, and the central portion of the dyke is rudely columnar. The part in which the columnar structure is best developed is about twenty yards wide, forming a nearly perpendicular band slightly curved. The columns are horizontal, very short, irregular in the number of their sides; and the outside ones are slightly bent, those on the east downwards, those on the west upwards. (See Section, No. 9.) Near the principal dyke two or three smaller ones were observed cutting through the gritstone without disturbing it.

From Pope's Harbour to Trinity Harbour the lower slate formation, containing red and purple gritstones and conglomerates of small pebbles and greenish slate rocks, forms the

whole country. One anticlinal line passes through New Buonaventure and runs into the country in a north-north-east direction: west of this the rocks dip westerly, to the east of it they incline to east-south-east at various angles. These same rocks continue from Trinity to Catalina and Bonavista, having in the former place an easterly, in the latter a westerly, inclination. Catalina is locally celebrated for an abundance of iron pyrites, which is found there in a grey slaty rock of very fine grain and frequently destitute of cleavage. The iron pyrites occurs in large cubical crystals: it is called, in Newfoundland, Catalina stone, and has often been mistaken for copper or gold. In Bonavista the slate rock is ordinarily destitute of regular cleavage, but much divided by lines in all directions. About Keels a quantity of dark-red gritstone forms high and barren ground, and is probably the continuation of that forming part of Random Island. It represents the Signal Hill sandstones. It dips rapidly in some places to the east, in others to the west, and is traversed near the west head by a mass of white rock, apparently quartz. The Long Islands and their neigh-

bourhood are composed of greenish-grey slate rocks, which dip to the north-west. The deep inlet of Clode Sound, though it crosses the strike of the rocks, does not expose a very satisfactory section. Near its head, about Platter Cove, a dull-red feldspathic rock, similar to that found at St. Peter's and Lameline, runs along the east side of the south-west arm towards the south, and for some distance into the country towards the north. West of this the banks of the brooks exposed here and there masses of hard dark-brown slaty gritstone like that of the north-east mountain of Placentia, forming continual sharp ledges, over which the brooks fretted and foamed in their course towards the sea. In the river, which comes in at the head of the south-west arm, some beds of red and brown sandstone, in some places soft and shaly, were observed, with a slight dip to the west-north-west, and in another brook bright-red slaty rocks looked like beds of the variegated slate formation. East of the band of red igneous rock, which is about two miles wide, a red and yellow schistose rock, very rotten and crumbly, and consisting principally of chlorite slate, occu-

pies some distance. Upon this in Long Cove and one other place rested some hard brown sandstones and conglomerates, which on the south side of the Sound seemed to run into the country for some distance. In Brown Cove and its neighbourhood the rock is a black slate similar to that at the head of Random south-west arm. Almost all the islands which fill Bonavista Bay, north of Clode Sound, are composed of slate rock, belonging probably to the lower slate formation. In Morris's island the slate was found to be black, with a few bands of grey gritstones; the slate had a fine cleavage, and would probably make a good roofing slate. It would be as useless as it would be tedious to enter into the detail of the position of the beds in all these localities: suffice it to say, the various dips and strikes of the beds and cleavage, when observed, were not found to vary from those seen in other parts of the country. In Bloody Bay and for five miles up the main brook of the middle arm of that bay, the prevailing rock was a grey slate with but little cleavage. The Lonil Hills, however, and probably Mount Stanford, are composed of a grey quartzose granitic rock,

rather fine grained and spotted with brown. From Bloody Bay to Content Reach, grey slate rock, similar to that just mentioned, is alone found. At Man Point a dark red gritstone, however, is seen, and Man Point Ridge is composed of a light greenish grey, fine-grained, very hard gritstone, in thick beds. It dips to the north-east. At the mouth of Freshwater Bay a dark schistose rock occurs in a perpendicular position, and strikes thence through Hare Bay into Locker's Bay. The shores of Freshwater Bay to the mouth of Gambo Brook are all granite, which runs thence down the west side of Locker's Bay to Chalky Cliff.

In the country, however, round Gambo ponds a dark slate rock is alone visible. This slate rock differs sensibly from that found in Avalon, or even in Bonavista Bay. It is smooth, shining, splits along the planes of lamination, has no cross cleavage, is sometimes micaceous, but consists principally of chlorite slate. Its strike is nearly north and south, with a general inclination to the west, and its thickness must be very great. The granite at Chalky Cliff is composed of large

crystals, sometimes reddish, but generally of a pale flesh colour, weathering almost white. The crystals of feldspar are very large and perfect. This granite is tolerably easy to break, and would make an excellent and very handsome building-stone. Many large loose blocks are now lying about near Chalky Cliff, and could readily be carried away in calm weather.

In Trinity Gut a sloping sheet of this granite was exposed, inclining at an angle of 35°, in size between 200 and 300 yards square, and, as far as I could see, without a joint or line of division of any kind whatever. This granite forms the Fair Islands, all the country round Indian Bay, the islands about Greenspond, and the mainland round Cape Freels as far north as Muddy Hole and Ragged Harbour. At Greenspond it is a very hard rock, of a grey colour, with large crystals of white feldspar. This variety would make an excellent building-stone, and have a very handsome appearance, as it gets whiter by exposure to the atmosphere. In Newell's Island, on the south side of Greenspond Harbour, some gneiss and mica slate is found, and the junction

of these rocks with the granite clearly exposed. At some distance from the granite the rock is thick-bedded mica slate, of a dark grey colour, the mica being in large flakes. It contains some long lenticular-shaped masses of a fine-grained rock, nearly black, running along the strike of the beds: this is almost entirely composed of very minute scales of mica. Approaching the granite, and about one hundred yards from its boundary, small nodules and strings of yellowish quartz rock are visible in the mica slate. The mica slate then splits more easily into thin laminæ, and is more varied in its composition, some beds having more the character of coarse gneiss, interstratified with others entirely composed of large flakes of mica. On continuing to approach the granite, the quartz veins and nodules increase, and nodular patches and bands of a regular fine-grained granite with but little mica appear. These granitic portions are not veins proceeding from the neighbouring mass of granite, but integral parts of the beds; a perfectly laminated bed, gradually losing, first its fissile character, and then its laminated appearance, and passing in the direction of its strike into

a band of fine-grained flesh-coloured granite several inches thick. This band of granite, after the course of a few feet, gradually thins out again, and the bed regains its original character of gneiss or mica slate. This alternation and passing of one rock into another increases in frequency, until, after walking over the edges of many such beds, we find ourselves imperceptibly led to a mass of red or flesh-coloured granite perfectly crystalline, and having no appearance of any lamination or bedding whatever. In the granite itself, however, for some distance from the junction, nodular masses of the black rock mentioned before as consisting of minute scales of mica were observed. This red granite does not contain the large crystals of feldspar which are found in the grey variety on the other side of the little harbour, and is altogether more close-grained than that rock. Altogether the gradual passage or transition from the granite into gneiss and mica slate was most remarkable. The granitic portions contained in the mica slate and gneiss struck me as just such as would be produced supposing great heat to be applied to a mass of rocks, some portions of

which were in a state to be more readily affected and more thoroughly changed by it than other and intermediate parts.

At one or two points along the shore north of Cape Freels small patches of mica slate and gneiss similar to these may be observed resting on the granite. In a headland just east of Cat Harbour the granite occurs in immense sheets unbroken for twenty or thirty yards by any division-line. The principal joints were perpendicular and struck east 35° north, quite parallel to each other and at regular distances of about twenty yards, no cross-joint occurring sometimes for thirty or forty yards. In one loose block, of very large size, a mass of gneiss and mica slate with a fine lamination was enclosed on two sides by granite with large crystals of feldspar. The junction of the gneiss and the granite was well marked, but the two were firmly united, and the large disseminated crystals of feldspar were in some instances half in the granite and half in the gneiss and mica slates. One detached piece of the latter also was enclosed in the granites. I did not myself visit the western boundary of this granitic district, but was informed that

it was situated near Ragged Harbour. In Gander Bay a dark shivery slate was found, and slate and slaty rocks stretch thence into the Bay of Exploits, and form the chief part of all the islands to the northward. These slate rocks probably belong to that called the lower slate formation, but it is possible that in some instances chlorite or other slates of a still inferior formation may occur.

The central portion of the island of Fogo, about Hare Bay, is composed of a red sienite or granite of rather a peculiar character, being almost entirely composed of crystalline quartz. North of this, about the harbour of Fogo, is the common light grey fine-grained gritstone or slate rock, generally hard and compact, but having here and there an imperfect slaty cleavage: it forms the bold hills about the harbour, rising 500 feet above the sea, and dips to the north or north-east. The Change Islands are blue or green slate, and from the Indian Islands I saw a specimen which would form good roofing slate. The North point of New World Island contains large beds of coarse conglomerate with little or no appearance of bedding, but having the enclosed pebbles arranged in

regular lines. The remainder of the island is almost entirely slate rock. Toulinguet Islands are principally coarse slate rock, but on the east side of Toulinguet Harbour a white granite, rather fine-grained, shows itself. In the low and crumbling cliffs along the eastern side of the harbour, and for two or three miles to the south of it, a trap-dyke of a very remarkable character may be traced here and there. It is a dark-brown trap, rather soft and readily decomposing, and it is full of small crystals of mica. These are hexagonal, generally one-eighth to half an inch long, and split horizontally into thin plates. The general width of the dyke is not more than three feet, and at the place where it is best exhibited the rock on each side is a whitish quartz.

At the head of the Bay of Exploits, near Lower Sandy Point, the cliffs are composed of grey slate rock, full of small joints crossing each other at all angles, but having no well-defined cleavage. The river Exploits, in the first twenty miles from the mouth, exhibits the following rocks. At High Point, about three miles from the sea, is a dark-coloured porphyritic rock, occasionally amygdaloidal.

Just above, however, is a brown and reddish gritstone and slate rock, striking north-north-east, and dipping westerly for some distance. Several small undulations and contortions occur, the axes of which are parallel to the strike of the beds. At the Bishop's Falls is a pinkish-green slate rock with similar curves. These rocks, or others like them, reappear wherever there is a cliff, or the substrata are exposed to view, as far as the foot of the chief falls, mingled occasionally with beds of light-brown or salmon-coloured gritstone, or very fine-grained sandstone, intensely hard, and sometimes slaty. Similar rocks are seen just below the falls, with brown ferruginous sparry veins. Beds of bright-red slate rock are interstratified with them, precisely similar in external character to the variegated slates of Avalon. The strike of these rocks is north-east by north, with a westerly dip at a high angle, and the cleavage nearly always coincides with the stratification. The falls themselves occur in a very thick mass of dull-red sandstone, finely grained, very hard, thin bedded, and traversed by many small irregular joints with sharp jagged edges. This likewise dips to the north-

west, at an angle of 45°. The falls on the river Exploits was the most westerly point I reached on the northern side of the island. From all I could learn, however, rocks not very different in character from those now described, composed the remainder of the country as far as the Red Indian Lake, and the coast as far as Hall's Bay.

The other portion of the island of Newfoundland, the geological structure of which was actually examined during the survey, is the south-west corner, from the Burgeo Islands to the Bay of Islands.

Though I did not land on any point between Cape La Hune and the Burgeo Islands, yet from the contour of the coast, and the description I was enabled to get, I can safely assert it to be composed chiefly, if not entirely, of granite. About the Burgeo Islands granite is the sole rock, with the exception of some patches of mica-slate and gneiss on one of the headlands. Three varieties of granite were observed: one white, rather fine-grained, with abundance of mica; another of a coarse grain, with less mica, and of a reddish colour; and the third, which is by far the most abundant, a somewhat

coarse red granite with large embedded crystals of flesh-coloured feldspar. These rocks occupy the whole coast, and a wide tract of the interior, between Burgeo and La Poile Bay. Both the east and west points of La Poile are composed of the porphyritic granite mentioned above, or that which contains the large crystals of feldspar. On the east side of the bay this granite is soon replaced by porphyritic greenstone, which runs up to Galley Boy Harbour. On the western side of the bay, however, the granite runs up as far as Tooth Head, where it partly overlies and sends large veins into a mass of dark-blue and purple schistose rock with a green stripe. The changes which take place at the junction of these two rocks, in their respective characters, are worth observing. At about ten yards from this junction the imbedded crystals of feldspar in the granite become smaller, and soon cease to be conspicuous, the rock is then principally composed of crystals of quartz and hornblende. The portion from which the veins arise soon loses the hornblende, the quartz from a crystalline state becomes compact, and the veins at a short distance from the granite are entirely composed

of compact quartz rock on the one hand, while their gradation into granite on the other is well and clearly exhibited. The granite itself also becomes more and more largely granular and crystalline as we advance into its mass. (See section, No. 10.) The schistose rock at its junction with the granite is hard, brittle, and traversed by strings of quartz: as we recede from that rock, however, it passes into a compact flagstone, in thin beds of a fine grain, hard but tough, of a light-green colour, occasionally having a slaty cleavage, when it resembles the St. John's slate. Its general dip is about south, or toward the granite, at an angle of 80°. About one mile above Tooth Head, in a large cliff of regular flagstone, without slaty cleavage, two granite veins are seen four or five feet across, whitish, consisting of crystalline quartz, feldspar, and hornblende, and producing no apparent alteration in the neighbouring rocks. On the eastern side of the bay opposite this is a mass of dark siliceous schist, with brown ferruginous stains, which is succeeded towards the south by quartz rock and chloritic schist, continuing to the greenstone porphyry mentioned before. I

was informed that slaty rocks were traceable for several miles into the country beyond the head of La Poile Bay. Between La Poile and La Moine the rocks are all granite, principally red, and some of it of a rather fine grain. From La Moine to the Dead Islands and thence to Port-aux-Basques and Cape Ray, mica slate and gneiss compose the entire country. About the Dead Islands abundance of veins exist in the gneiss, some of which are thirty yards wide, and are composed of large crystals of quartz and feldspar, containing nests of mica or hornblende; thus constituting a very largely crystalline granite. These veins always run with the strike of the beds, and their sides present no well-marked line of division between the crystalline rock and the schistose mica slate and gneiss, one passing into the other by fine gradation. Some well-marked distinct granitic veins, however, were observed, which not only ran in the strike of the beds, but crossed them and enclosed masses of the mica slate. No large mass of granite appeared in the neighbourhood of these veins, but such might exist a little way in the interior. The mica slate and gneiss do not occupy

distinct tracts, but beds of each alternate with the other, and some beds partake of the character of both. The strike of these rocks is everywhere pretty uniform about the Dead Islands and Port-aux-Basques, being about east-north-east; the dip, however, is northerly at the Dead Islands, and southerly at Port-aux-Basques. At the latter place, beds of a peculiar character were interstratified with the gneiss and mica slate. They were not more than a foot or two thick, but were fine-grained, black, heavy, and crystalline, consisting almost entirely of small crystals of hornblende. Garnets occur sparingly scattered about the mica slate, but I observed none of any magnitude. These gneiss and mica slate rocks continue from Port-aux-Basques round Cape Ray, for some distance towards Little Codroy river, where they terminate. The chain of hills called the Long Range running into the country from Cape Ray seems to be throughout composed of gneiss and mica slate. The hills are found to consist of these rocks in the country east of St. George's Bay and about the west end of the Grand Pond, and also on the bank of the Humber River, in the Bay of Islands.

The south side of St. George's Bay, between this range and the sea, is occupied by the coal formation. The cliffs on the sea-shore, and a band of country, of a few miles in width, parallel to it, exhibit the lower beds of the formation, viz. the red sandstones and marls with gypsum. In the cliffs near Codroy Island is much red and green marl, with bands of white flagstone. The white flagstone and the greenish marl contain many veins of white fibrous gypsum, and interstratified with these and the red marls are some thick beds of white and grey gypsum of a singular character. These gypsum beds are not hard compact sulphate of lime, but are composed of white flakes of that substance, regularly laminated, and interspersed with small flakes and specks, or sometimes thin partings of a black substance, apparently bituminous shale. The whole mass is soft and powdery, thick-bedded, and in considerable abundance, and it might be carried away in boats with great facility. I was informed by some Indians of Great Codroy River, that they had seen a bed of coal two feet thick, and of considerable extent, some distance up the country.

Their accounts of the distance, however, varied from ten to thirty miles, and I could not induce any of them to guide me to the spot. I proceeded up the river about twelve miles from the sea, and some distance beyond the part navigable for boats, without seeing anything but beds of brown sandstone and conglomerate, interstratified with red marls and sandstones, gradually becoming more horizontal, and dipping towards the south-east. I believe, however, that a bed of coal had been seen by an Indian on the bank of a brook running into Codroy River, about thirty miles from its mouth, but the person who saw it was not in the neighbourhood at the time of my visit. About the middle of the south side of St. George's Bay, in the vicinity of Crabb's River, the lower part of the coal formation, consisting of alternations of red marl and sandstone, strikes along the coast, the beds dipping to the north-west, at an angle sometimes of 45°. About three miles from the coast, however, an anticlinal line occurs, preserving the same strike as the beds, or about north-east and south-west, and causing those to the south of it to dip

to the south-east. Thus the rocks which form the country along the coast, to the width of three miles, with a north-west dip, again occur, of the same or a greater width, according to the angle of their inclination, with a dip to the south-east, before we can expect to find any higher beds than those in the sea-cliffs; so that at least six miles of the country, formed of the lower beds, must be crossed directly from the coast, before we arrive at the higher beds in which the coal is situated. (See section, No. 11.) In ascending the brook next above Crabb's River, I found on the sea-coast beds of soft red standstone and red marl; and half a mile up the brook red and whitish sandstones, interstratified with beds of marl, chiefly red, but also occasionally whitish, green, or blue; beyond that were beds of marl, containing massive grey gypsum, similar to that at Codroy, and a bed of blue clay, containing crystals of selenite. Similar rocks, with now and then a bed of brown or yellow sandstone, occurred throughout the first two or three miles, all dipping north-west, at various angles of inclination. Beyond this point, the dip was in-

variably south or south-east, and for two or three miles farther the character of the rocks was precisely similar to those I had already passed. As, however, the banks of the brook were occasionally low, the section observed was of course not perfectly continuous, and beds which were hidden on one side of the anticlinal line formed cliffs, and were thus exhibited on the other side. Thus, as I continued to ascend the brook, I came on a cliff of red marl fifty feet thick, with some thin grey soft micaceous sandstone, beyond which were some beds of grey, hardish rock, with nodules of sub-crystalline limestone, the banks of the river being likewise covered with a crust, a foot thick, of tufa. Some distance above this, the red sandstones become more scarce, the colour being generally brown or yellowish; grey clunch, too, with bituminous laminæ, was frequent. In one bank of brown sandstone, a nest of coal, with a sandstone nucleus, was seen. Its shape was irregular, being about two feet long, and it was probably the remains of some vegetable squeezed out of all semblance of its former shape. Over this mass of sandstone there was again a good

thickness of grey clunch, and brown or yellow sandstone and conglomerate, interstratified with red and brown marl, all dipping gently to the south-east. Over these were some thin beds of red sandstone, with red marl; and a little beyond, some hard, light, brown, or greyish-yellow sandstone, with small quartz pebbles. This rock formed ledges, stretching across the river, producing a fall of two or three feet. About 150 yards above this, on the west bank of the brook, was some grey clunch and shale, on which rested a bed of hard, grey sandstone, eight feet thick, covered by two or three feet of clunch and ironstone-balls, and two feet of soft brown sandstone, with ferruginous stains, on which reposed a bed of coal, three feet thick. (See section, No. 12.) The dip of these rocks was very slight towards the south, in which direction the bank became low, as it was also on the opposite side of the river, which prevented my tracing the coal farther; neither was the bank above the coal high enough to bring in any of the beds over it, and thus give its total thickness; since it is evident the portion here seen may be only the lower part of a bed, instead of the whole.

The quality of the portion thus exposed was good, being a bright caking coal. The distance from the sea-shore is about eight miles; the only harbour, however, is that of St. George, which is about twenty miles from this spot. A few very rude and imperfect vegetable impressions were all I could see in any of these rocks. Many of the gritstones in this section might probably turn out good freestones. In the next brook to the east of the one I ascended there had been formerly a salt spring, which, however, I was assured had lately become quite dry, although several of the little rills which I tasted in the neighbourhood were brackish. As regards the extent of country occupied by this bed of coal, or others which may lie above it, the data on which to found any calculation are but few. If, however, the upper rocks follow the course of the lower, without the intervention of faults and irregularities, the tract so occupied would probably be an oval, forming the centre of the country, bounded by the sea-coast on the north and the ridge of primary hills on the south. From the top of the high land at Crabb's River, this ridge bounded the horizon,

at the distance apparently of about twenty miles. Allowing half of this width to be occupied by the lower beds, the tract in which it is possible that coal may exist would probably be twenty or thirty miles long, by ten miles wide. Gypsum again appeared once or twice in the cliff, between Crabb's River and St. George's Harbour.

The north side of St. George's Bay, between Cape St. George and Indian Head, is occupied by magnesian limestone, dipping at a slight angle to the north-north-west. Much shale or shaly rock was observed in the cliffs in that direction, north of Cape St. George, but there was some reason to believe that the magnesian limestone lay above the shale. Since I visited that part of the country, I have been told that coal has been found in Port-aux-Ports. I had intended to have examined that place, but having been detained four days off its mouth by continued calms, I gave it up. If coal exist there, it is probable the shale mentioned before is the upper part of the coal formation, and the magnesian limestone may lie over it.*

* There being no previous information to be obtained about this part of the country, it was of course impossible

At Indian Head a mass of igneous rocks appears, but in consequence of the lowness of the land on each side of it, no junction with surrounding formations can be observed. These rocks consist, in one part, of Labrador feldspar, in rather small crystals, aggregated together into a largely granular base, in which are embedded large crystals of bronzite or hypersthene: in another part, they pass into a basaltiform rock, very hard, dark, and heavy, the crystalline parts of which have the cleavage of hypersthene.*

In crossing from St. George's Harbour to the Grand Pond, the country was so covered by diluvial rubbish, and that again by moss and woods, that no guess could be given as to the nature of the rocks below, except from the circumstance of some angular pieces of white limestone being found in one of the brooks. On arriving at the Grand Pond, the cliffs

to say which part of it was most advantageous to examine first. The scattered settlers, north of Cape Ray, generally exhibit a great disinclination to give information and assistance, apparently from a fear of the district being more thickly populated, and taxes and customs introduced.

* I am greatly indebted to Professor Miller of Cambridge, for naming and determining some of the compound minerals in these and other instances.

were found to be gneiss and mica slate. The western end of the island, and the mainland opposite, is chiefly a chlorite schist. All the centre of the island, however, and the main on each side of it, is granite, some of which is white, with mica, some red, with or without hornblende. The northern end of the island is a conglomerate. Immediately opposite the eastern end of the island, on the north shore of the lake, are some thick beds of very white rock, dipping in various directions; and just beyond these, towards the east, some cliffs of a bright red colour, apparently red sandstone, but the bedding of which is not discoverable. The violence of the winds and waves would not admit of our small boat approaching these cliffs, either in going or returning. Two or three miles east of them, however, the continuation of the same cliffs is composed of beds of red sandstone and marl, passing upwards into brown and yellow sandstones, and conglomerate of small quartz pebbles, interstratified with beds of brown, yellow, and blue marls, clunch, and shales, and dipping at various angles of inclination but generally moderate ones towards the east,

or south-east. This series of beds is precisely similar to that previously described as forming the south side of St. George's Bay, and it forms the cliffs of all the shores of that part of the lake north and east of the island. Its general dip is easterly, and the angle of inclination becomes less as we recede from the granite and primary rocks. In the bed of a small brook, at the north-east corner of the pond, were found various pieces of coal, and at one part, where the bank was newly fallen, the following section was exposed :—

	Feet.	Inches.
Sand and boulders . . .	10	0
Softish grey and yellowish sandstone	5	0
Ditto ditto shaly .	1	0
Coal (some part like cannel coal) .	0	6
Yellow clunch	0	2
Grey bind	2	0

All these beds dipped at an angle of 30° to the south-east. Large pieces of coal were found in the bed of the brook (which is rapid and rocky) above this point, showing that more beds exist, and one Indian of St. George's Harbour assured me he had seen a bed three feet thick, in the brook, below this point, about three years ago. This was probably

true, as I saw many banks in the same brook, where such beds might have appeared, but which were then covered with wood and rubbish that had fallen from above.

It thus appears that the rocks containing beds of coal are those observed to dip towards the wide level tract mentioned before as existing north-east of the Grand Pond, and that as they approach that tract the beds become more horizontal and regular. It is, therefore, highly probable that coal may be found over the whole or greater portion of it. The extent of this low country, however, cannot be very great towards the east, as the land about Red Indian Pond and Hall's Bay is, from all I could learn, high and rugged, and composed of hard slaty rocks, instead of the soft sandstones, clays, and marls of the coal-measures. The head of White Bay is, therefore, the only part of the coast from which this coal-bearing country is at all likely to be easy of access.

The country between Port-aux-ports and the Bay of Islands is lofty and unbroken, and probably occupied chiefly by igneous rocks. Around York and Lark harbours the hills

are high, pointed, and precipitous, and consist of igneous rocks of very various characters. In one place a red sienite was seen; in another, not far distant, a dark sienitic rock, containing albite and hypersthene: this dark rock was very abundant, and associated with it was a dark-greenish rock, with dark-red and white veins. It looked, at first sight, like a conglomerate, the veins intersecting each other in every direction, and the pieces enclosed by them being easily detached. It is, however, a trappean rock. Associated with this were masses of a soft crumbly rock, almost made up of little granules, many of which were crystalline carbonate of lime: the whole bore very much the appearance of a peperino, being probably a regenerated volcanic or trappean rock.*

From the neighbourhood of York and Lark harbours, nearly to the head of Humber Sound, the rocks consist of dark brown and red schist or shale, grey gritstones, and black, grey, and red slate. They dip various ways, frequently

* I am much indebted to Professor Sedgwick of Cambridge, as well as Professor Miller, for examining and naming these and other rock specimens.

at high angles, a westerly inclination being the most frequent. The most irregular contortions occasionally showed themselves, in which not only were the beds bent, but the lamination was wrinkled and puckered up into sharp angles, like a vandyked border. From this broken condition of its beds, it is impossible to form an estimate of the total thickness of the formation with any degree of accuracy; it occupies, however, the whole length of the Humber Sound. On approaching the head of the sound, the dip of these shales and grits becomes more regular, being always to the west. Their positive junction with the next formation is nowhere seen, as the only section, that of the cliffs on the north side of the Sound, is interrupted by a low bank of loose sand, 300 or 400 yards across.

Just above this, we come to some beds of limestone, belonging to a great calcareous formation, stretching across the mouth of the Humber River. This limestone is in its upper portion regularly bedded and variously coloured, and indistinguishable by mineralogical characters from many secondary lime-

stones. Its lower part, however, is white, crystalline, frequently contains veins and flakes of mica, becomes entangled with quartz rock, and seems to be so intimately associated with the gneiss and mica slate, as to leave no doubt of its belonging to that formation, and being thus entitled to the denomination of a primary limestone. The highest beds of the limestone formed a mass about thirty feet thick, of thin shaly beds, of a hard dark grey colour, with brown concretions, that, on a surface which had been some time exposed to the weather, stood out in relief. Below this were seen some thin beds of a hard subcrystalline limestone, some of which was white, and some flesh-coloured, with white veins. This series of beds had a thickness of upwards of 100 feet: they would take a good polish, and would be very ornamental, and, from the thinness of some of the beds, would be especially adapted for marble slabs. Below this portion lay a few feet of thin-bedded black marble of similar qualities. Then came some grey compact limestone, with thin beds and irregular nodules of whitish chert, which

passed down into a large mass of grey compact limestone, in thick beds and without chert, and having a thickness of 300 or 400 feet. In the lower parts of this mass the bedding became indistinct, and it passed down into perfectly white saccharine limestone without any mark of stratification, and but few joints or division-lines of any kind. The hills composed of this limestone are 400 or 500 feet high, and run nearly north and south for a considerable distance. About three miles up the Humber River, its lower portion, in which no appearance of bedding is discernible, forms lofty white precipices of pure marble, crowned and surrounded by thick woods, which, closing in upon the rapids, produce most picturesque scenery. Blocks of any size might here be procured, and by a little management floated down the river into the sound, where any kind of vessel will find excellent anchorage. A little above these limestone precipices, the hills recede from the river, and enclose a valley about two miles in width, but they are continued without any interruption to just below the second rapid, where they close

in again on the stream. Here the rocks are gneiss; and mica slate and gneiss form all the hills around the lower end of Deer Pond. At about the middle of this lake, the hills gradually slope down, exposing no cliff: at one point, however, some beds of yellowish sandstone and conglomerate of white quartz pebbles were observed. Round the upper end of Deer Pond, and thence as far as could be seen, was spread the level country mentioned before; but at the rapids just above the bifurcation of the river some ledges of light brown gritstone were seen. Both these gritstones, and the sandstones and conglomerate, were the same rocks as those found on the banks of the Grand Pond and the south side of St. George's Bay, belonging to the lower part of the coal formation. Putting these facts together, we get an east and west section, from the mouth of the Bay of Islands to the head of Grand Pond, which exposes the structure of the country in a satisfactory manner. (See section, No. 13.) The range of hills thus found to be composed, from Cape Ray to the River Humber, of mica slate, gneiss, and

their associated rocks, continues to run to the north for many miles, and, as far as I could ascertain, forms an unbroken ridge to Cape Quirpon, the extreme northern point of the island of Newfoundland. In the neighbourhood of Canada Bay, on the western side of White Bay, I have been assured that limestone exists in abundance; and a large specimen which I saw in St. John's, procured from that place, was identical in mineralogical character and appearance with the white marble of the Humber Sound. It is, therefore, highly probable that these hills are composed of mica slate and gneiss, with occasional patches of primary limestone, along the whole west side of the island of Newfoundland.

In Mr. Cormack's journey across the island, from Random Sound to St. George's Bay, he seems to have paid particular attention to the kind of rocks he met with; and though his published notes are scanty, they are in the present instance highly useful. From the hills at the back of St. George's Bay (the Long Range) to the eastern end of Jameson's Lake, nearly in the centre of the island, he

mentions no other rock than granite. This accords exactly with the structure of the coast through that space, except that there are also on the coast a few patches of mica slate, gneiss, and other slate rocks. East of Jameson's Lake an abundance of "Serpentine" is mentioned. Mr. Cormack found, north of the Bay of Despair, granite, sienite, quartz, gneiss, fine clay-slate, alum-slate, and indications of coal and iron. The alum-slate was probably shale; the indications of iron might be correct, as that mineral abounds everywhere, but no other indications of coal are to be trusted in such a locality than the exhibition of a bed of that substance itself. Granite and quartz again occurs towards the east; then basalt in flags, as at Belle Isle. If Belle Isle in Conception Bay be meant, it is not basalt, but very fine-grained dark-grey gritstone. There is in this locality probably a patch of the Belle Isle shale and gritstone. Thence to Random Sound nothing is mentioned but granite, mica slate, porphyry, and sienite. It is, therefore, evident that there is no large tract existing in the interior of the country in which the rocks to be found are

greatly different from those which come out upon the coast; and as the strike of the rocks throughout Newfoundland, wherever it is not deflected by local accidents, is universally north-north-east and south-south-west, there is clearly no room for any other formations than those already described. All that could be done, then, in carrying out the survey into minuter detail, and examining the interior of the country, would be tracing out the boundaries of the several varieties of igneous rocks and the slate formations that rest upon them, and discovering the obscure relations that exist among the latter. Such operations could obviously be of no public utility, and their benefit to the science of geology is doubtful, and would probably be small, until we are more intimately acquainted with the minutiæ of the structure of the adjacent parts of North America.

There are a few general observations I have to make on the structure of Newfoundland, and the relative age of some of its igneous rocks. The regularity of the strike, and its perfect parallelism throughout the island, is very re-

markable. It rarely varies, except for very short distances, where local disturbing forces have affected it, from a true north-north-east and south-south-west course. The only exception is about St. George's Bay, where the rocks strike generally more nearly north-east and south-west, or even in some instances east-north-east and west-south-west. As a consequence of this prevailing strike of the rocks, we find all the other prominent features of the country running in the same direction. Not only do the ranges of hills run in a north-north-east and south-south-west direction, but all the principal lakes, deep bays, and valleys lie in the same line of bearing. The ranges of hills already noticed, the Grand Pond, Red Indian Lake, great part of Gander Pond, Holyrood Pond near St. Mary's Bay, and others; the great inlets of White Bay, Exploits Bay, and Gander Bay; the sounds and inlets of Bonavista Bay, Trinity, Conception, St. Mary's, Placentia, and Fortune Bays, and of course the headlands and peninsulas between all these; the islands of Merasheen, Long Island, and others in Placentia Bay, and the

longitudinal direction of the multitudinous islands in Bonavista Bay and the Bay of Exploits, all run in a north-north-east and south-south-west direction. It may also be remarked, that in St. George's Bay the line of the coast on each side strictly coincides with the strike of the rocks; the south side running north-east and south-west; the north side east-north-east and west-south-west. The Bay of Islands is the only important exception to this general rule throughout the country. To the geologist it may seem something like tautology to speak of the shape and outlines of the country being parallel to the strike of the rocks of which it is composed. To those who are not geologists, however, it may be interesting to remark how these things depend upon each other, more especially as the example afforded by the island of Newfoundland is so clear and striking.

The cleavage of the slate rocks is another subject deserving of remark. The cleavage of the slate rocks of Newfoundland is frequently parallel to the planes of stratification, but often cuts them at all angles, and is some-

times perpendicular to them. The cleavage is best developed in the rocks of the finest grain, and becomes evanescent invariably on approaching a coarse-grained bed. In beds of the finest grain, however, it is not always present, and is frequently capricious and partial in its appearance. The strike of the cleavage is, in the great majority of instances, parallel to the strike of the beds, but not invariably so. The cleavage is much more constant, as regards its strike and dip in relation to the horizon and the points of the compass, than it is in relation to the strike and dip of the beds, or than these latter are to the horizon and the points of the compass. The dip of the cleavage never forms a less angle with the horizon than 45°, while in the majority of instances it is nearly perpendicular to the horizon. Its strike, when well developed, never, in any instance, where it was carefully observed, was found to vary more than 10° or 15° from a north-north-east and south-south-west bearing. The following list of observations will show the general position of the cleavage, and one or two instances of discordance be-

tween the strike of the cleavage and that of the beds:—

Cleavage of Slate.	Strike.	Dip.
Near St. John's	N. 35° E.	nearly perpendicular.
At Topsail	N. 35° E.	
Aquafort	N. 15° E.	
North Harbour, St. Mary's Bay	N. 15° E.	perpendicular.
*Same place (beds)	N. 15° E.	to the West, 45°.
North East Mountain, Placentia	N. 10° E.	Westerly, 80°.
Merasheen Harbour	N. 15° E.	Westerly, 85°.
*Same place (beds)	N. 50° E.	N.W., 80°.
Indian Harbour, Merasheen Island	N. 15° E.	
Long Harbour, Placentia Bay	N. 20° E.	
Chapel Arm Brook, Trinity Bay	N. 15° E.	perpendicular.
Brigus	N. 10° E.	nearly perpendicular.
Sculpin Island Cove, near Brigus	N. 5° E.	Westerly, 80°.
Spaniard's Bay	N. 20° E.	
Harbour Grace	N. 20° E.	Westerly, 75°.
Harbour Grace Island	N. 15° E.	Westerly, 45°.
Carbonear	N. 30° E.	Westerly, 60°.
Catalina Harbour	N. 27° E.	Easterly, 45°.
Clode Sound	N. 20° E.	
Morris's Island, Bonavista Bay	N. 10° E.	Westerly, 45°.
*Ditto (beds)	N.	West, 25°.
Same Island, another part	N. 12° E.	perpendicular.
*Ditto (beds)	N.	East, 20°.
Bloody Bay, Bonavista Bay	N. 25° E.	perpendicular.
Gander Bay	N. 30° E.	
Exploits River	NE. by N.	

*Beds.

It appears, then, that the strike and dip of *the cleavage* of the rocks of Newfoundland are not absolutely dependant on the strike and dip of the beds, the one often varying while the other remains constant. But it appears, also, that the same cause which

gave their *prevalent* and *general* direction to the mechanical forces, by which the rocks were elevated from their original position, and their strike and dip produced, likewise determined the direction in which those forces should act (whatever they were) which produced the cleavage.

As regards the relative age of the igneous rocks, it appears that the granites are generally newer than the mica slate and gneiss, which repose upon them. It is also evident that the large mass of porphyritic granite on the south coast is more modern than some of the shales, flags, and schists about La Poile, inasmuch as these latter are penetrated by veins from the granite. The phenomena seen opposite the western end of Random Island show that the red sienites, which compose much of the country in that direction, are the newest rocks of the neighbourhood, as they partly overlie and certainly have disturbed the Belle Isle shale and gritstone there, which is the most modern *stratified* rock on the east side of the island. The same, likewise, is true of the greenstones of Chapel Arm in Trinity Bay, and of Holyrood in Conception Bay, and there is every probability of the greenstones of the

latter place being of the same age as the mass of igneous rocks forming the range of hills between Conception Bay and Renews. At all events, these latter rocks are more modern than the older slate formation, which is cut through and disturbed by them. On the other hand, the red igneous rock (generally a sienite) forming St. Peter's, and the country between Cape Chapeau Rouge and Fortune Bay, is in all probability one of the oldest rocks in the country, as no veins were observed to proceed from it into the adjoining formations, and a rounded pebble of a precisely similar rock was found in a bed belonging to the older slate formation in Great Placentia. A mass of rocks, too, formed of the detritus, either of these very igneous rocks or some very similar to them, exists close in their neighbourhood in Mortier Bay, in which a pebble of sienite, precisely similar to their general character, was found imbedded.

From the absence of organic remains, no comparison can be instituted between the age of the Newfoundland rocks and those of England. It is highly probable, however, that the coal formation of Newfoundland is the same as that

of Cape Breton and Nova Scotia, which appears to be nearly or quite contemporaneous with the carboniferous series of western Europe. The coal formation is unquestionably the most modern group of stratified rocks to be found in Newfoundland, and there was certainly an interval between the deposition of the upper and lower slate formations. The mass of the granites and other unstratified rocks are more recent than the lower slate formation; some of them, at least, more recent than the upper slate formation; and they may be more modern even than the coal formation.

Drifted and Superficial Accumulations.

The greater part of Newfoundland is covered by an accumulation of drifted materials, sometimes to the depth of several feet. These, for the most part, consist of coarse rubbly gravel, with patches of sand and clay, and imbedded pieces of rock. In the town of St. John's, this accumulation is well shown in the cuttings of the roads and in digging foundations for houses. It is there found to be

a mass of materials such as those above mentioned, having sometimes a semi-stratified character, the finer parts exhibiting an approach to horizontal arrangement. The imbedded portions of rock are almost wholly slate rock, and are nearly all angular; some blocks two or three feet in diameter may be observed, but the generality are much smaller, and they are distributed indiscriminately throughout the gravel, the flat pieces resting at all angles with the horizon. On the high lands between St. John's and Portugal Cove, the drifted materials have all a similar character, except that on the higher and more exposed parts the gravel is not so deep, and sometimes is absent altogether, and the loose blocks only are found scattered over the surface. In the projecting tongue of land between the eastern coast and Conception Bay, I never found any boulders of rock different from the rocks which compose that district. The low land between Topsail and Holyrood, which consists of the Belle Isle shale formation, is covered with a vast heap of drifted materials, which have a greater thickness than usual. Near Topsail are some huge boulders. One of

these, lying in a marsh, is twenty-three feet long, twelve feet wide, and twelve feet in height, having probably several more feet buried beneath the surface of the moss. It consisted of a grauwacke conglomerate, precisely the same as is found in the hills about two miles to the east of it. Multitudes of a similar character, but smaller size, were lying about. Indeed, in all the lower lands the great difficulties in the way of forming new roads are the boulders. After the wood has been cut down, and side drains have been formed, the moss shrinks and dries up, and exposes a multitude of blocks of rock, many of which are from one to three feet in diameter, and which are frequently in as great plenty as in the bed of a mountain torrent. This may be seen in the road between the Golds and the Bay of Bulls, or between Topsail and Holyrood, or almost universally in all newly formed roads which cross the lower, and occasionally even the higher grounds.

In the neck of land connecting Ferryland Head with the mainland, a great accumulation of drifted material and boulders is shown, apparently as deep as the cliff is high, which

is about fifty feet. In patches in this mass there occurs a fine light-coloured clay, which, after drying and pounding, is used by the inhabitants for plastering and white-washing. Among the numerous boulders on the roadside between Ferryland and Aquafort, I observed some porphyry and sienite; among others, slate rock, gritstone, and conglomerate; and at one point (near the bridge over the brook which forms a cascade into the harbour of Aquafort) lay a large boulder, five or six feet in diameter, of that peculiar rock which looked like a conglomerate of angular pieces of porphyry, and which I mentioned as occurring on the top of the Butterpots Hill, near Renews. This hill may be seen from the rising ground close by, distant about eight or ten miles in a west-south-west direction. This boulder and those composed of sienite and porphyry were much rounded, and some of them quite smooth and polished, though several feet in circumference; the blocks of slate rock, however, were more angular, and occurred in greater abundance, but were generally of smaller size.

In ascending the Butterpots, fragments of

rock without gravel were observed at all heights; and on the very summit, resting on the porphyry, were loose blocks of slate rock and sienite, in some degree rounded, and about two feet in diameter. This is the highest point of the neighbourhood, about 1200 feet above the sea, no other hill being within five miles of it which equals its height within 200 or 300 feet. (See section, No. 4.) The same kind of drifted materials as those now described may be observed over all the country, thence by Trepassée into St. Mary's Bay, except that the sienitic blocks get scarcer as we leave the hills of which the Butterpots forms the southern termination. Blocks of porphyry, however, were seen of considerable size near Peter's River, in St. Mary's Bay. In St. Mary's Harbour, one or two smaller pieces of granite, perfectly rounded, were found on the beach, one of which precisely resembled the granite of La Poile: they might, however, be part of the ballast of a vessel. In the diluvial drift of the neighbourhood were some large blocks of a purple porphyry, but the majority were pieces of slate rock, identical in character with the rocks upon which they reposed,

mingled with boulders of gritstone and conglomerate, some of which resembled the Signal Hill sandstone, beds of which may probably exist in the country to the northward. Around Placentia the boulders are principally slate, gritstone, and porphyry, being fragments of the rocks in the neighbourhood. In Merasheen Harbour, on the contrary, the vast variety of the materials found as boulders is most remarkable. Within the space of a few yards, smooth and rounded blocks were seen of several hundred pounds in weight, of two varieties of porphyry, three distinct kinds of granite, and different kinds of slate rock, grauwacke, sandstones, gritstones, and conglomerates. Here the majority of the boulders seemed to be of a different composition from the rocks forming the hills at the back of the harbour, and to have been derived from the mainland, and the islands to the northward. In the brook of "Come-by-Chance," at the northern extremity of Placentia Bay, were some large perfectly rounded blocks of sienite, similar to the sienite seen opposite the west end of Random Island. As the chain of hills is continuous between the two places, the blocks of Come-by-Chance

were probably derived from the hills a few miles westward of that place.

The northern coast of Avalon is as much covered with boulders as the rest of the country, but they seem to consist almost entirely of the rocks of the immediate neighbourhood, as I never observed any granite, sienite, or mica slate, &c., among them. I frequently searched in the finer parts of the gravel about St. John's and other places for shells, or other organic remains, but could never discover any. On the top of Harbour Grace Island there is a thin bed of shingle, covered by about two feet of rather fine gravel, and the lighthouse-keeper assured me he had seen shells in it. I could not find any myself, neither could I certainly ascertain whether the shells seen had not been carried there by sea-birds, as I had often found both sea-shells and echini lying loose and recently picked of their contents on the top of the cliffs. Over the greater part of the country about Bonavista and the Bay of Exploits the superficial accumulations are abundant. They are of similar character to those already described, but the embedded rocks are more

numerous, and of greater variety, the gravel being more strictly confined to the valleys and lower lands. Granite boulders are plentiful, and frequently of large size. To enter into details would be useless and tiresome, but a few of the more striking facts may be mentioned. On the top of the hill, 400 feet high, at the head of Clode Sound, being the highest point of the neighbourhood, is a large boulder of white granite, the hill itself being a red porphyry or sienite, and no white granite known within twenty or thirty miles. On Man Point Ridge, in Content Reach, a hill 500 feet high and entirely composed of grey, fine-grained gritstone and slate rock, many large boulders of red granite, sienite, and gneiss were found: some of these were angular and several feet across. Over the granitic district of Cape Freels no other than granitic boulders were seen. Fogo Head, rising abruptly from the sea to a height of 400 or 500 feet, and steep on all sides, is composed of grey gritstone and slate rock, as is all the adjacent country for four or five miles at least: on its summit are large boulders of a red sienite, identical in character with

that found in Hare Bay, five or six miles to the south. In Toulinguet, on the road to Back Harbour, a large block of white granite, three or four yards in circumference, may be seen, identical with the white granite on the east side of the harbour, none of which rock is found *in situ* on the west. Over all the country traversed by the River Exploits the granitic blocks are large and numerous, the bed of the river being full of them as far as the falls, and for some distance above them. On the top of Camelin Island, on the south shore, which consists entirely of red porphyry or sienite, a large block of grey rock, composed chiefly of radiated zeolite, was found. Over the south side of St. George's Bay, resting on the soft sandstones and marls of the coal formation, lie multitudes of blocks of granite, gneiss, and mica slate, derived in all probability from the hills of the Long Range. In the beds of the rivers these were especially abundant, and I was assured by an inhabitant of the neighbourhood of Crabb's River that immense blocks were brought down by the ice every spring. At the entrance of the little creek of Crabb's River, one block lies in the

sand in mid channel, and any craft drawing more than six feet of water is liable to strike upon it. This was probably brought there by the ice on the breaking up of the river in the spring. From these details no very decided conclusions can be drawn. The blocks seem to have been moved in various directions, and in some instances they have evidently travelled northwards, at least for short distances. All that can be said is, that fragments of rock, frequently of great size, have been removed from their original position in all directions for a few miles; and that where other blocks have been found, apparently derived from a more distant source, that source and its direction are unknown. No diluvial grooves, or scratchings of the surface, were observed, but such markings might easily exist under the general coating of moss, and where the surface was exposed they would probably soon be obliterated by the weather. At the northern end of the Grand Pond, and over the low country beyond, and generally in the valley of the Humber River, there was found a bed of red or yellow sand. This was loose and incoherent, but regularly stratified with lines

of small pebbles. It exhibited everywhere the same character, and had generally a thickness of twenty or thirty feet. It had evidently been deposited very tranquilly. It is highly probable that, before the Humber had worn so deep a bed in the rocky channel of the valley by which it escapes to the sea, the waters of the Deer Pond stood at a higher level than they do now, and it certainly is not improbable that all the low country between and about the Deer Pond and the Grand Pond may have been one large lake, in the waters of which the bed of sand now under consideration was deposited. An obstruction of twenty or thirty feet high, and sixty or seventy yards long, in the valley of the Humber, at the upper rapids, would in a few months again cover much of this low country with water, and form an immense lake.

In the banks of the River Exploits, from the falls to the sea, a fine unctuous clay was observed. It is perfectly plastic, and would make very fine bricks. It is generally fifteen or twenty feet thick, lying in thin layers, usually of a slate colour, but with a reddish band here and there. It occasionally con-

tains a line of very small pebbles, but no sand, and is found immediately on the brink of the river, and in all parts of the valley where the subjacent rocks do not rise to a greater height than twenty or thirty feet above the present level of the water. Above this clay rests a bed of fine sand, two or three feet thick, passing upwards into a coarse rubbly gravel. Over this comes the diluvial drift of coarse gravel and large boulders. The River Exploits now deposits little or no sediment in its bed, which is full of pebbles of all sizes, with no admixture of sand. At its mouth, however, about the head of the bay, are great banks of soft fine mud, and occasionally higher up the river than the mud are beds and projecting points of sand. It appears, then, from these facts highly probable that the country once stood at a lower level; that the arm of the sea formerly extended much farther up, probably receiving the river at the point which is now the entrance of the ravine at the foot of the falls. The clay bed would then be deposited in the still water below the then mouth of the river, as the mud and clay is now in the still water below the present mouth.

As the water became more shallow, the silt, mud, and sand would of course be drifted farther and farther out. If under such circumstances we suppose an elevation to take place, either gradually or at once, the river would begin to cut back its channel in the hard rocks forming the present ravine below the falls, and, after sweeping a channel in the soft materials it had previously deposited, would attack the hard rocks below, forming the present rapids and lower falls. Under no other hypothesis will, I think, the formation of the clay in its present valley be intelligible.

I regret that both in this instance, and in that of the sand of the valley of the Humber, my search for organic remains was unsuccessful.

Similar facts might be observed in regard to the beds and valleys of several others of the brooks of Newfoundland, more especially Rocky River in St. Mary's Bay, where beds of fine clay also occur. In a country like Newfoundland, where nothing like a beach can be seen, except a small pebble bank at the heads of the coves and small bays, raised beaches can hardly be expected. Neither were any lines

of cliffs over or behind the present ones, nor water lines along their sides, in any case observed. On the north side of St. George's Bay, however, a little valley near Ship Cove, running out on the sea, was filled up with a large mass of diluvial sand and boulders; and near the top of the low crumbling cliff of these materials, fragments of shells were found: they were covered sometimes two or three inches by clay, were in a rotten, decomposed state, and were at a height of about thirty feet above high-water mark. They belong to Mya arenaria, and two or three other species common in other parts of the bay, but no recent shells could be seen on the beach below, which was covered with pebbles. The circumstances were altogether too doubtful to enable one to say whether the presence of the shells was due to the agency of birds or the elevation of the bed of the sea.

PRACTICAL RESULTS.

It is to be regretted that the practical results of this survey are but few, and, in the present state of the colony, rather of a negative than a positive character. They may at least, however, be useful, in restraining rash speculation, if not in encouraging prudent enterprise.

Building Materials.

Stone.—The stratified rocks of the country offer few tolerable building-stones. The grit-stones of the Bell Isle shale formation are too hard and splintery to be easily worked, even with the chisel, and although they are often divided by natural joints into regular blocks, the smooth faces of these are not easily bound together by mortar. The Signal Hill sand-stone often forms admirable materials for rough work, such as walls, &c.; and the conglomerate beds, in which the pebbles are small and numerous, are so heavy, hard, and durable, as scarcely to be excelled for the construction of

sea-walls, breakwaters, and similar purposes. Some beds, each about five feet thick, divided by thin partings of marl, and squared by natural joints into blocks of two or three tons weight, occur at Flat Rock, in a situation where their removal would be comparatively easy. Some of the sandstones of the coal-measures in George's Bay would form good flagstones, but I did not see any beds sufficiently hard and durable to deserve mention for their building qualities. The limestones of the Humber River, probably those also of Canada Bay, White Bay, and perhaps at some other points of the "Long Range" of hills, would make good, and very handsome, building-stone. It would be easy to work blocks of any size; and any shade of colour, from dark grey to white, might be procured. Ornamental marbles also, especially marble slabs of a black, grey, mottled-grey, red, and white colour, and possibly also blocks of pure white marble fit for the statuary, might be found, the former sorts in abundance. Of the unstratified rocks, granite and sienite are those which are best adapted for building. The sienite at the head of Conception Bay would make a very fair building-stone, though of rather a bright-red colour. Similar stone

occurs in several parts of Placentia Bay, and is marked on the map by a bright-red colour with the letter S. The same colour with the letter G indicates granite, and wherever that occurs good building-stone may be found, though frequently difficult and expensive to be procured. Along the west side of Bonavista Bay, in the district of which Greenspond may be taken as the centre, there is abundance of excellent granite, some of which cannot be exceeded in its qualities as a building-stone either for beauty or durability. In some places loose blocks of this are now lying on the surface, as for instance about Chalky Cliff, near Locker's Bay, Bonavista Bay, and near Cat Harbour, north of Cape Freels.

Slate.—Very good roofing-slate may be procured in abundance much nearer the capital and more thickly-peopled parts of the island. Close to St. John's, in its western outskirts—as, for instance, at the back of the hospital, or between that point and Rennie's mill, or anywhere along the same line of bearing, and in the banks of the brook above Waterford bridge—very good slate rock shows itself, which, though rotten and brittle at the surface, would in all probability be of superior quality below.

Some few trials must of course be made, and some little money expended perhaps in the search, before the best spots are hit upon, as the cleavage in all slate rocks (on which their goodness as roofing-slate depends) is a little capricious and uncertain. On the west side of Conception Bay, from Brigus to Carbonear, and probably farther to the north, no trials are needed, as the slate rock is exposed in the cliffs, and the best spots are obvious to the most inexperienced eye. Harbour Grace Island, especially, is one mass of the most excellent roofing-slate, where slabs of any size might be procured, and split to any required degree of thinness. It must always be borne in mind that the rottenness of the present exposed surfaces is due to the action of the weather. Wherever the colour of the map indicates the occurrence of beds of the inferior slate-formation, roofing-slate may be found in all probability somewhere in the neighbourhood, should it be considered worth the search.

Minerals in Beds.

Coal.—The beds of coal on the south side of St. George's Bay, as well as in the coun-

try north of the Grand Pond, do not seem to be of any great thickness. It is perfectly possible, however, that more important beds may be found, should the districts ever be thought worth working. This can only become the case, either from the exhaustion of the present mines of Cape Breton, or from the settlement and increased population of the districts themselves. In no other part of the island of Newfoundland can coal ever be found. This will at once be obvious to the geologist from the mere inspection of the map: to others the reasons will be apparent when they consider that coal does not occur in detached veins or masses, or appear indiscriminately in all rocks, but that it is an integral part of one particular formation* of great thickness and extent, which wherever it occurs must occupy a considerable tract of country. As the beds of coal bear but a very small proportion to the whole mass of the formation, large tracts of country might be occupied by part of the formation in which there was no coal, but it would be highly im-

* This assertion, of course, is not meant to apply universally, as in some countries coal is found in formations different from those which contain it in others.

probable that beds of coal should exist without some considerable part of the formation to which they belong.

Gypsum.—The gypsum of Codroy Harbour, and in several parts of the south side of St. George's Bay, might very easily be extracted and shipped in large quantities, as it comes out in abundance on the sea-cliffs. As it forms part of the coal formation, the same reasoning will apply to the extension of these beds as to those of the coal.*

Lime.—Besides the beds of limestone mentioned above, a few thin beds of very inferior quality are found in Mortier Bay and Chapel Cove, in Holyrood, and in Conception Bay. In the former place some beds of marl also occur, and calcareous concretions are occasionally found in the variegated slate rocks, but rarely in sufficient quantity to be useful. The calcareous nature of that formation, however, increases its value in an agricultural point of view.

Minerals in Veins.

In the Signal Hill sandstone of Shoal Bay,

* Gypsum occurs in various formations, but very rarely if ever in hard slaty rocks, such as are found in the remainder of Newfoundland.

south of Petty Harbour, is a small vein containing crystals of sulphuret and green carbonate of copper. It was worked during the middle of the last century to a slight extent, and some attempts to renew the work have lately been made, but, I fear, without success. It appears to be a small and irregular vein, without any band of ore, having small nests and strings of the minerals above mentioned disseminated in the stone about it. As this stone is intensely hard, it does not appear that it could be worked to profit, unless the ore were much more abundant than it has been found at present to be. On the western side of the Harbour of Great St. Lawrence, a small vein or string was seen in the sienite, containing crystals of galena or lead-ore, and fluate of lime: they were very trifling, and did not promise to lead to anything more abundant.

These are the sole examples I have met with of mineral veins; and in a country where bare sea-cliffs are so abundant, it does not appear likely that such veins can exist (near the sea at least) without being discovered.

In the interior of the country, search for such uncertain things would be endless, and, should they exist, their discovery must be left to chance.

Agricultural Characters.

Coal Formation.—The materials of which this is chiefly composed, soft sandstones and rich marls, generally form very fertile districts. Accordingly, in the tracts occupied by this formation in Newfoundland grass will grow without cultivation, and the timber is of a somewhat different and better character than that generally met with. The thick coating of moss, however (the curse of the country), spreads even here, and it is only in the small spots cleared by the few settlers of the south side of St. George's Bay that the superiority of the soil is strikingly manifest.

Upper Slate Formation.—The Agricultural character of both portions of this formation, namely, the Bell Isle shales and the variegated slates, is superior to that of the lower rocks. Bell Isle itself, and the small spots about the points of the headlands at the bottom of Conception Bay, are instances of this. The same thing may be inferred from the timber of Witless Bay, and the natural grass and clover found occasionally along the east shore of Trinity Bay, from Heart's Desire to Chapel Arm.

Wherever the colours of this formation appear on the map, the soil may be safely taken as above the average Newfoundland value.

Inferior Slate Formation.—The upper part of this, namely, the Signal Hill sandstone, is sterile in the extreme. The St. John's slate rock varies greatly, and the quality of its soil depends much on its situation, slope, and drainage, as also on the kind of gravel by which it is covered: the valleys of the formation often afford good garden-ground.

Gneiss and Mica Slate.—This is generally utterly sterile and desert. Where, however, it contains limestone, as in the Humber River, its character is greatly altered, and the timber growing upon it is found to excel that of the rest of the island both in size and quality.

The igneous rocks are generally hard, and, where not covered by gravel or other débris, are hopelessly barren. This character may be stated, with very few exceptions, to attend all those districts coloured bright red in the map. The districts in which tolerable timber may yet be procured are, the Bay of Islands, the neighbourhood of the Grand Pond, some parts of the south side of St. George's Bay, the neigh-

bourhood of Rocky River, and the head of St. Mary's Bay, Witless Bay and Random Sounds in Trinity Bay, the country on the south-west side of Bonavista Bay, from Goose Bay to Freshwater Bay,* the Bay of Exploits, about the head and along the banks of the river a mile or two from the sea, and, I believe, also Green Bay and White Bay.

In speaking of the agricultural characters of the different formations, it must be borne in mind that, after all, a low and sheltered situation (in the climate of Newfoundland), good natural or artificial drainage, and the kind of gravel and other detritus interposed between the rock and the surface exercise the most important influence on the relative fertility of different spots. Anything approaching to rich soil can only be found in the alluvial strips of land about the larger brooks and rivers, and there only in scattered spots. The country is generally entirely destitute of vegetable mould, and can never, therefore, under any circumstances, become an extensively agricultural one. There

* All the good timber within a mile or two from the shore of Bonavista Bay has been already exhausted, but large woods stretch into the interior.

is at the same time no doubt, that, were roads opened between the richer and more populous districts (as between the different bays of Avalon and St. John's), quite enough beef, mutton, and vegetables might be produced to supply the wants of the population. For the production of this supply, the upper parts of St. Mary's and Trinity Bays are the most promising.

Roads.

On a subject so intimately connected with the present one as the construction of roads, I may perhaps be pardoned, and not considered officious, if I offer a few observations.

After the completion of the proposed line from the head of Holyrood in Conception Bay to Salmonier, and thence by Colinet to Placentia, it appears to me that a road along the valley of the Rocky River, branching at the bifurcation of that river, and continued to Dildo Cove in Trinity Bay on the one side, and along the bank of the Hodge River to Snow's Pond, and through the valley of the Golds to Port-de-Grave on the other, would be a very advantageous line. By keeping

along the valleys, the roads would be naturally level, cheaply constructed, and, besides these advantages in a commercial point of view, would lay open the most sheltered and thickly-wooded portion of Avalon, that in which the timber is of the greatest size, and the soil probably of the best quality. The eastern bank of the river seems the most level and accessible.

In some of the new lines of road everything seems to have been sacrificed to straightness of direction. It is evident that a straight road can only be the best when traversing a plain. In a hilly country a straight road is sure to be the most difficult, tiresome, and expensive, and may even be longer than some other line that can be found. For in a steep hill the curve of the road over the hill may possibly be as long as the curve round its side, while there is no comparison in the labour, either of construction or conveyance. I met with two or three instances, in which short and sudden pitches, rendering the road quite impracticable for wheel-conveyances of any kind, without much cutting away and filling up, might have been easily avoided by a gentle deflection of the road for a few yards. One or two hills of

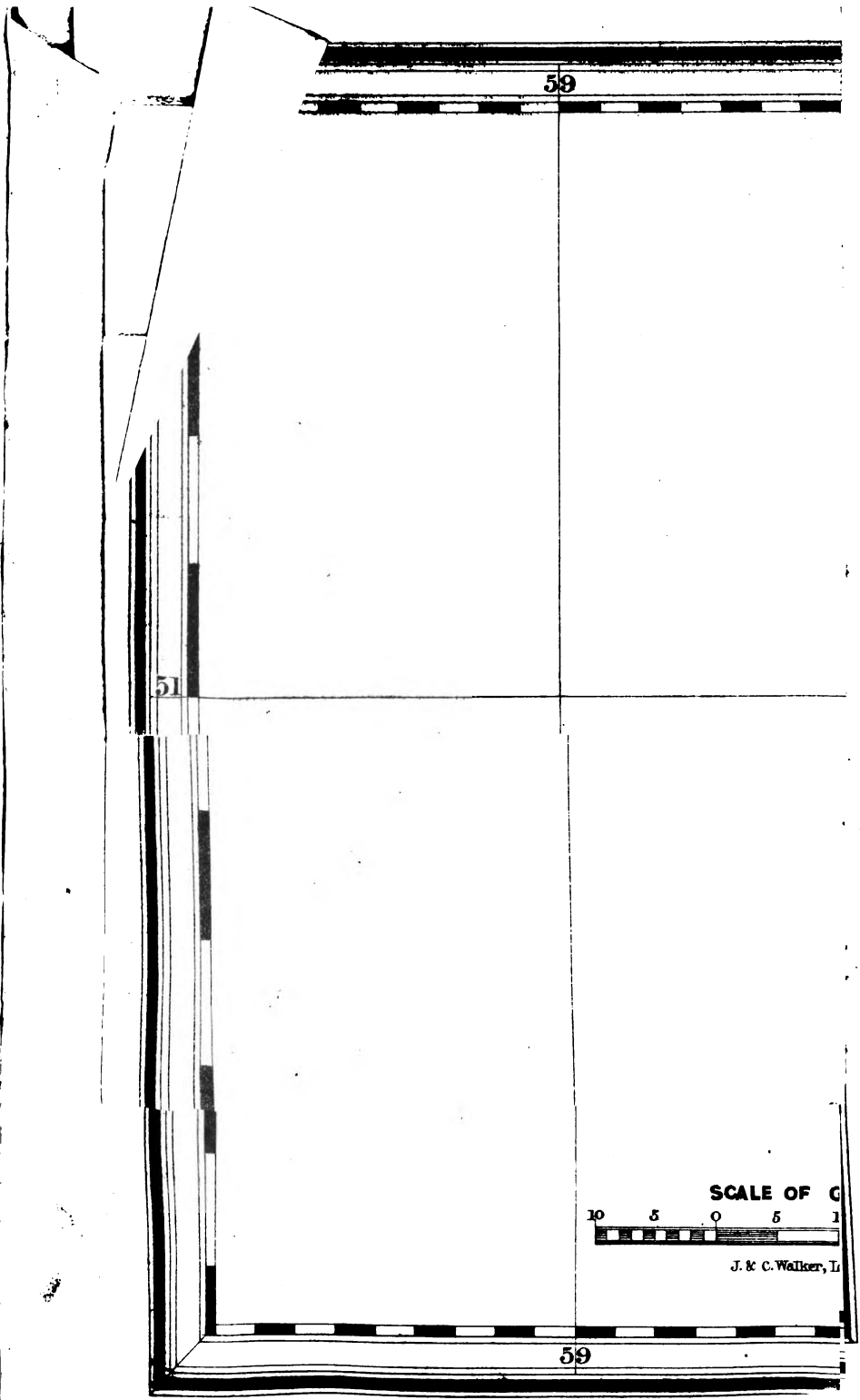
considerable length and elevation were in like manner uselessly surmounted.

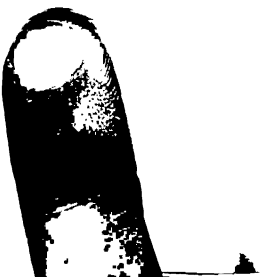
In laying out a road, moreover, round a harbour, the great advantage seems to have been neglected of taking the road at some little distance from the beach, so as to secure three frontages, namely, the two sides of the road and the beach, instead of merely removing one, namely, the beach, a few feet farther back. The present convenience of individuals ought surely to give way before the prospective advantage of the whole community.

In taking a road across a marsh, I observed that the simple expedient of laying a matting of boughs and branches across the road, before putting on the gravel, was frequently neglected. I can speak, from actual inspection, of the sound and durable nature of roads thus constructed in other localities.

THE END.

London: Printed by WILLIAM CLOWES and SONS, Stamford-street.





RECENT WORKS.

I.

ILLUSTRATIONS
OF THE
LITURGY AND RITUAL OF THE UNITED CHURCH OF ENGLAND AND IRELAND;

Being Sermons and Discourses selected from the Works of Eminent Divines who lived during the Seventeenth Century. By JAMES BROGDEN, M.A., Trinity College, Cambridge. 3 vols. post 8vo. 27*s.*

II.

EDWIN THE FAIR. A TRAGEDY.

By HENRY TAYLOR, Esq., Author of "PHILIP VAN ARTEVELDE." Fcap. 8vo. 7*s.*

III.

NORWAY AND HER LAPLANDERS IN 1841;

With a few Hints to the Salmon Fisher. By JOHN MILFORD, Esq., Author of "PENINSULAR SKETCHES," &c. 8vo. 10*s.* 6*d.*

IV.

EXERCISES IN LATIN ELEGIACS;

Or, a Collection of English Notes, admitting of Easy Version into Latin Hexameters and Pentameters. By the Rev. W. OXENHAM, Assistant Master of Harrow School. 12mo. 4*s.*

V.

BOTANY FOR LADIES;

A Popular Introduction to THE NATURAL SYSTEM OF PLANTS. By MRS. LOUDON. With 150 Illustrations. Fcap. 8vo. 8*s.*

VI.

THE SPEECH OF LORD ASHLEY

On moving for leave to bring in a Bill to make Regulations respecting the MINES and COLLIERIES of the United Kingdom. 8vo, 2*s.*

VII.

REMARKS ON MEDICAL REFORM,

In a Letter to the Right Hon. Sir JAMES GRAHAM, Bart. By Sir JAMES CLARK, Bart., M.D., Physician in Ordinary to the Queen, and to Prince Albert. 8vo, 1*s.*

VIII.

LOCKHART'S SPANISH BALLADS.

Embellished in a new and perfectly original manner. Quarto, 2*l.* 2*s.*

"A more appropriately as well as beautifully embellished Volume never was offered to the world."
—*Edinburgh Review.*

IX.

CHILDE HAROLD'S PILGRIMAGE.

BY LORD BYRON.

With Sixty Engravings by Finden, from Drawings made on the spot; and a Portrait never before engraved. Royal Octavo, 2*l.* 2*s.*

X.

MR. MURRAY'S CHEAP AND POPULAR EDITION OF

LORD BYRON'S TALES, POEMS, AND DRAMAS,

Now Publishing Weekly at Sixpence each.

1. THE GIAOUR. A Fragment of a Turkish Tale.
2. THE BRIDE OF ABYDOS. A Turkish Tale.
3. THE CORSAIR. A Tale.
4. LARA. A Tale.
5. THE SIEGE OF CORINTH.
6. BEPPO. A Venetian Story.
7. MAZEPPA. A Tale.
8. THE ISLAND; or, Christian and his Comrades.
9. PARISINA.
10. PRISONER OF CHILLON. A Fable.
11 to 15. CHILDE HAROLD'S PILGRIMAGE. A Romaunt.
16. MANFRED. A Dramatic Poem.
17. MARINO FALIERO. An Historical Tragedy.
18. HEAVEN AND EARTH. A Mystery.
19. SARDANAPALUS. A Tragedy.
20. THE TWO FOSCARI. An Historical Tragedy.
21. THE DEFORMED TRANSFORMED. A Drama.
22. CAIN. A Mystery.
23. WERNER. A Tragedy.
24, 25, 26. HOURS OF IDLENESS.
27. ENGLISH BARDS AND SCOTCH REVIEWERS.
28. HINTS FROM HORACE.

&c. &c.

XI.

ESSAYS AND ORATIONS,

Delivered at the College of Physicians. By Sir HENRY HALFORD, Bart. M.D.
Third Edition. Fcap. 8vo, 6*s.* 6*d.*

XII.

NUGÆ METRICÆ.

Latin Poems and Translations. By Sir HENRY HALFORD, Bart. M.D.
Fcap. 8vo, 3*s.* 6*d.*

XIII.

HYMNS FOR CHURCH SERVICE;

Written and adapted for every Sunday in the Year. By the late BISHOP HEBER.
Eleventh Edition. 16mo, 2*s.*

XIV.

AN ESSAY ON THE GOVERNMENT OF DEPENDENCIES.

By GEORGE CORNEWALL LEWIS, Esq. 8vo, 12*s.*

XV.

FRAGMENTS IN PROSE AND VERSE.

By the late MISS ELIZABETH SMITH. With a Memoir by H. M. BOWDLER. New Edition. Post 8vo, 10*s.* 6*d.*

XVI.

THE PEASANTRY OF THE BORDER.

An Appeal in their Behalf. By the Rev. DR. GILLY, Vicar of Norham, and Canon of Durham. *Second Edition.* With Plans, Estimates, &c. 8vo, 4*s.*

"Give them good Cottages, and help them to educate their children."

XVII.

INCIDENTS OF TRAVEL AND VISITS TO THE RUINED CITIES OF

CENTRAL AMERICA, CHIAPAS, AND YUCATAN.

By JOHN L. STEPHENS, Esq. With 78 Plates. *New Edition.* 2 vols. 8vo, 32*s.*

XVIII.

A RESIDENCE AT CABOOL.

By the late SIR ALEXANDER BURNES. With numerous Plates. 8vo, 18*s.*

XIX.

PALESTINE, MOUNT SINAI, AND ARABIA PETRÆA;

A Journal of Travels, undertaken in reference to Biblical Geography. By EDWARD ROBINSON, D.D. With New Maps and Plans. 3 vols. 8vo, 2*l.* 5*s.*

XX.

THE ANCIENT EGYPTIANS,

Their MANNERS and CUSTOMS. Derived from Sculptures and Monuments still existing, compared with ancient Authors. By Sir GARDNER WILKINSON. 6 vols. 8vo, 6*l.* 6*s.*

*** A *New Edition* of the FIRST SERIES has just been published, and may be had separately.

XXI.

THE HISTORY OF ENGLAND,

From the DEATH OF QUEEN ANNE to the REIGN of GEORGE THE SECOND. By the Right Honourable LORD MAHON. *Second Edition.* 3 vols. 8vo, 36*s.*

XXII.

THE HISTORY OF CHRISTIANITY,

From the Birth of Christ to the Extinction of Paganism in the Roman Empire. By the Rev. H. H. MILMAN. 3 vols. 8vo, 36*s.*

XXIII.

SIR SAMUEL ROMILLY'S LIFE AND DIARY.

Edited by his SONS. Portrait. *Third Edition.* 2 vols. fcap. 8vo, 12*s.*

XXIV.

THE FACTORY SYSTEM;

Illustrated in a Series of Letters to the Right Hon. LORD ASHLEY, M.P.
By WILLIAM DODD, a Factory Cripple. Fcap. 8vo, 5*s.*

XXV.

THE ELEMENTARY PROPERTIES OF THE ELLIPSE,

Deduced from the PROPERTIES of the CIRCLE, and GEOMETRICALLY DEMONSTRATED.
By the DUKE OF SOMERSET. With 80 Diagrams. 8vo, 9*s.* 6*d.*

XXVI.

THE NESTORIAN CHRISTIANS

Settled in the Mountains of Koordistan, Ancient Assyria, and Media. By ASAHEL GRANT, M.D.
With a Map. 8vo, 8*s.* 6*d.*

XXVII.

LETTERS FROM THE BALTIC.

By a Lady. With Etchings. *Second Edition.* 2 vols. Post 8vo, 20*s.*

XXVIII.

A RIDE ON HORSEBACK TO FLORENCE,

Through FRANCE and SWITZERLAND. In a Series of Letters. By A LADY.
2 vols. Post 8vo, 18*s.*

XXIX.

THE AGRICULTURAL CLASSES

Of GREAT BRITAIN and IRELAND; with the Parliamentary Reports and Evidence, from 1833 to 1840; and Remarks by the French Editor. Published at Vienna. With a Preface by HENRY DRUMMOND, Esq. 2 vols. 8vo, 21*s.*

XXX.

AUSTRIAN LOMBARDY, THE TYROL, AND BAVARIA.

By JOHN BARROW, Esq. Post 8vo. 10*s.* 6*d.*

XXXI.

THE YEAR-BOOK OF NATURAL HISTORY

FOR YOUNG PERSONS.

By Mrs. LOUDON. With 45 Woodcuts. 16mo, 4*s.*

XXXII.

CAIRO, PETRA, AND DAMASCUS.

From Notes during a Tour in those Countries. By JOHN G. KINNEAR, Esq.
Post 8vo, 9*s.* 6*d.*

XXXIII.

THE JAPANESE.

Described from the Accounts of Recent Dutch Travellers. Post 8vo, 9*s.* 6*d.*

XXXIV.

FRAGMENTS FROM GERMAN PROSE WRITERS.

With Biographical Notices. By SARAH AUSTIN. Post 8vo, 10*s.*

XXXV.

TRANSLATIONS FROM THE GERMAN.

By HENRY REEVE and JOHN EDWARD TAYLOR. Fcap. 8vo, 2*s.* 6*d.*

XXXVI.

CHARACTERISTICS OF PAINTERS.

By HENRY REEVE, Esq. Post 8vo, 4*s.*

XXXVII.

LETTERS FROM ITALY.

With Sketches of History, Literature, and Art. By a Lady.
Second Edition. 2 vols. Post 8vo, 17*s.*

XXXVIII.

HAND-BOOK OF NEEDLEWORK.

By MISS LAMBERT (of New Burlington Street). With Woodcuts. Post 8vo, 10*s.* 6*d.*

XXXIX.

THE TASMANIAN JOURNAL

OF

NATURAL SCIENCE, AGRICULTURE, STATISTICS, &c. No. II.

CONTENTS:—

IRRIGATION IN TASMANIA. By Capt. A. F. COTTON.
ON THE BLOOD OF THE ORNITHORHYNCHUS PARADOXUS. By E. C. HOBSON, M.D.
A COLLECTION OF FISH FORMED AT PORT ARTHUR. By JOHN RICHARDSON, M.D.
VOCABULARY OF THE ADELAIDE TRIBE. By J. P. GELL, Esq.
TERRESTRIAL MAGNETISM. By Lieut. J. H. KAY, R.N.
REMARKS ON THE PHYSALIA PELAGICA. By ANDREW SINCLAIR, Esq., R.N.
THE BIRDS OF AUSTRALIA. By JOHN GOULD, Esq.
MISCELLANEA, &c.

MR. MURRAY'S HAND-BOOKS.

I.

HOLLAND, BELGIUM, PRUSSIA, NORTH GERMANY,

AND THE RHINE TO SWITZERLAND.

New Edition thoroughly revised. Map. Post 8vo, 10*s.*

II.

SOUTHERN GERMANY, BAVARIA, AUSTRIA, TYROL,

SALZBURG, STYRIA, AUSTRIAN AND BAVARIAN ALPS, THE DANUBE,
FROM ULM TO THE BLACK SEA.

New Edition thoroughly revised. Map. Post 8vo, 10*s.*

III.

SWITZERLAND, SAVOY, AND PIEDMONT.

New Edition, thoroughly revised. Map. Post 8vo, 10*s.*

IV.

DENMARK, NORWAY, SWEDEN, AND RUSSIA.

Maps and Plans. Post 8vo, 12*s.*

V.

MALTA, THE IONIAN ISLANDS, GREECE, TURKEY,

ASIA MINOR, AND CONSTANTINOPLE.

Maps. Post 8vo, 15*s.*

VI.

PUBLIC GALLERIES OF ART, IN & NEAR LONDON.

Containing—

THE NATIONAL GALLERY; WINDSOR CASTLE; HAMPTON COURT; DULWICH GALLERY;
MR. SOANE'S MUSEUM; BARRY'S PICTURES.

Post Octavo, 18*s.*

VII.

ITALIAN PAINTING:

FROM THE AGE OF CONSTANTINE THE GREAT TO THE PRESENT TIME.

Post 8vo, 12*s.*

VIII.

WINDSOR AND ETON:

A GUIDE TO THE PALACE, PICTURE-GALLERY, AND GARDENS.

Fcap. 8vo, 5*s.*

IX.

HAMPTON COURT AND NEIGHBOURHOOD;

A ROAD-BOOK TO THE PALACE, AND A GUIDE TO ITS PICTURE-GALLERY,
GARDENS, &c.

New Edition thoroughly revised. Fcap. Octavo, 2*s.*

X.

WESTMINSTER ABBEY;

ITS ART, ARCHITECTURE, AND ASSOCIATIONS.

Fcap. 8vo, 2*s.* 6*d.*

*** THE ABOVE ARE ALREADY PUBLISHED.

WORKS IN THE PRESS.

THE UNITY OF THE CHURCH;

A Treatise. By HENRY EDWARD MANNING, Archdeacon of Chichester. 8vo. 10*s.* 6*d.*
(*Ready.*)

MEMOIRS AND CORRESPONDENCE OF FRANCIS HORNER, M.P.

Edited by his Brother, LEONARD HORNER. 2 vols. 8vo.

THE BIBLE IN SPAIN.

By GEORGE BORROW, Esq., Author of the "GYPSIES IN SPAIN." Post 8vo.

HISTORY OF JOSIAH.

By the Author of "Gideon, the Man of Mighty Valour." Fcap. 8vo.

THE JEWESS:

A TALE FROM THE SHORES OF THE BALTIC.

By the Author of "LETTERS FROM THE BALTIC." With a Plate.
Fcap. 8vo.

CHEMICAL MANIPULATION;

Being INSTRUCTIONS TO STUDENTS IN CHEMISTRY, on the Methods of performing Experiments of Demonstration or Research with accuracy and success.
By M. FARADAY, F.R.S. *Third Edition, revised.* 8vo.

EXCURSIONS IN NEWFOUNDLAND;

With an Account of the Cod Fishery—Fog Banks—Sealing Expedition, &c.—and a Geological Survey of the Island.

By J. B. JUKES, F.G.S. 2 vols. post 8vo.

FOOD AND ITS INFLUENCE ON HEALTH AND DISEASE.

By MATTHEW TRUMAN, M.D. Post 8vo.

ASIA MINOR, PONTUS, AND ARMENIA:

Being Researches in those COUNTRIES; with their ANTIQUITIES and GEOLOGY.
By W. I. HAMILTON, M.P. Map and Engravings. 2 vols. 8vo.

HAND-BOOK FOR NORTHERN ITALY,

THE STATES OF SARDINIA, GENOA, AND THE RIVIERA, VENICE, LOMBARDY, AND TUSCANY.
With a Map. Post 8vo. (*Just ready.*)

HAND-BOOK FOR SOUTHERN ITALY,

THE PAPAL STATES, ROME, NAPLES, AND SICILY. With a Map. Post 8vo.

HAND-BOOK FOR FRANCE.

NORMANDY, BRITTANY; THE RIVERS LOIRE, SEINE, RHONE, AND GARONNE; THE FRENCH ALPS, DAUPHINÉ, PROVENCE, AND THE PYRENEES. With a Map. Post 8vo.

HAND-BOOK FOR LONDON,

PAST AND PRESENT. Arranged in Alphabetical Order to facilitate use and reference.
Post 8vo.

BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.