

of stone, worn into the most fantastic shapes, in which the imagination without great exertion may trace the rude resemblance of birds crocodiles, &c. They sometimes form rings six or eight inches in diameter, and three quarters of an inch thick. Their great abundance precluded the possibility of their being the work of art.

With respect to the land west of Cape Chudleigh, as it has been but once visited, we cannot expect to learn much about it. The mountains of Torngarsuir (the evil spirit) in lat. 60° are described as rugged, barren and black, and containing a huge cavern which the heathen Eskimos fable to be the habitation of the devil. The rocks further north are light coloured but there appear to be no mountains of considerable height on this part of the coast which is called Ungava. On almost every part of it fragments of a red jasper impregnated with iron, are frequent and in some places hæmatites and cubical pyrites. It may be worth remark that the tides rise here no less than from 40 to 50 feet, while they seldom exceed 8 or 10 on the eastern coast. The current sets from west to east round Cape Chudleigh, (Geological Transactions, vol. 2.)

ART. VII.—*Lieut. Baddeley on the geognosy of a part of the Saguenay country.*

THE materials for forming this geognostical essay were procured while attached to an Exploring Party, which left Quebec in the summer of 1828, on a journey through the Saguenay Country, to collect information as to its capabilities for settlement.

Upon a perusal, it will be found to require much indulgence, partly on account of the inexperience and limited information of the

the writer, on the subject in general, and partly owing to the short period allotted for observation. This indulgence, it is hoped, will be readily granted by the reader, when he is informed, that it has been written without assistance, and by a person, as he will soon ascertain, totally unpractised in book-making.

As this is considered by the writer merely as a sort of appendix to the more important and comprehensive reports of Ensign Nixon, 66th Regt., Messrs. Bouchette, Hamel and Davis, he has omitted as superfluous, most of the distances and courses, &c., retaining only the latitudes of those places where he had reason to think his observations were correctly made for determining them, and referring the reader for the relative position of places, to the accompanying plan.

As this paper will be unaccompanied by any of the Reports alluded to above, it becomes necessary to introduce it by a rapid sketch of the country it treats of.

The country through which the following report professes to be a geognostical section, is situated at a variable distance of from 100 to 200 miles from Quebec, commencing a little west of a line due north of that place, and passing through all the points of a segment subtending an angle of about 50°, as far eastward as the mouth of the Saguenay, which lies 65 leagues north-east of that place. The principal topographical features observed while moving nearly on this segment, are embraced in the following description:—

Lake

* The term geognosy and its derivatives have been used in this essay to imply a *knowledge* of the names of the rocky constituents &c. which form the crust of the earth, derived from consulting their mineral contents, physical structure &c.

By geology &c., is meant not only this knowledge, but the still more *scientific* one which points to the relative ages of these rocks, &c. and to the probable manner in which they have been formed. The geognost informs us, for instance, that such a rock is a syenite or trap; but it is the geologist who explains whether it belongs to the primary or overlying class &c. &c. The former may collect facts; but it is the latter who must reason upon them—no man can hope to be the second until he has become the first. We do not stop to inquire if this distinction be correct but rather beg that it may be conceded to us on this occasion.

Lake St. John is a natural basin or reservoir, occupying the most northerly portion of the country alluded to, into which radiate, with generally rapid courses, several rivers. The greatest breadth of this lake is measured nearly on a due north line from the post of Metabetchuan, and is equal to a little more than nineteen minutes of latitude*. It is of a rounded form and remarkably shallow. The only outlet to this lake is on the side to the eastward of south; and here it may be considered that the Saguenay river commences, which pursuing a direct, violent, dangerous, and contracted course for about twenty-five leagues, suddenly expands by meeting the tide, into a noble and navigable river, second only in Canada to the St. Lawrence, with whose waters it ultimately mingles its own, passing in its course to the latter river over a farther distance of 25 leagues, and through a section of rocks from 200 to 1000 feet in altitude. The breadth of this river, in the navigable portion of it, varies from half a mile to three quarters of a league, and its depth is in most places considerable.

At the upper end of these navigable waters, and where the tide rises upwards of eighteen feet, the Chicoutimi river enters the Saguenay on its right bank from the southward of west. It has its source in Lake Kenwangomi, between which and its mouth there are five or six portages; it would otherwise be navigable for batteaux. By this route in canoes Lake St. John is reached, the more direct one by the upper waters of the Saguenay being impracticable. Lake Kenwangomi is about five or six leagues long and so narrow as to resemble a wide river rather than a lake. Like the Saguenay its course is generally from the northward of west. It is separated from another lake
called

* It was made much more by the Deputy Surveyor General, but as he possessed no other instrument for making observations than a theodolite, we may perhaps without arrogance prefer our own, which were made with an excellent sextant of eight inches radius, by Gilkerson, and an artificial horizon.

called Kenwangomishish by a species of dividing ridge about half a mile wide, which separates the waters flowing southward directly into the Saguenay, from these which, by pursuing a northerly course, first enter Lake St. John; a topographical feature of rather unusual occurrence.*

We will not further anticipate what will appear in the body of the essay, but without more preamble, will now proceed with the description of the rocks which were met with on the route, in the order they came under observation, trusting that it may afford the experienced geologist the means of fixing their geological position,—an attempt we have seldom presumed to make, and where made, it is with the diffidence and hesitation compatible with our want of experience and knowledge on the subject.

The rocks on the Island of Orleans, wherever we have seen them, are composed of alternating strata of clay-slate and grey wacke. At Patrick's Hole, which was reached about 10 A. M. of the 6th August, these rocks appear alternating with each other, in very distinct strata, the dip of which, when not vertical, is either to the east or west, at an angle of from 60° to 85° . Here the grey wacke predominates, and rising beyond the thin strata of clay-slate, owing to the greater resistance the former opposes to the action of weathering, forms on the shore natural low stone walls, parallel to each other. It is probable that a good building material may be procured at this place.

As the term wacke has been applied very loosely to rocks of very different characters, we will here describe the mineral contents, &c. of the one to which we have applied this name:—

Its

* For further information on this interesting tract of country, consult the reports of the gentlemen before mentioned, but particularly those of the House of Assembly, elicited through the exertions of Andrew Stuart, Esq., to which indeed we are indebted for all that is known of the country. See also article 4 of this work.

Its prevailing colour in the neighbourhood of Quebec, of which it is a characteristic rock, is greenish grey. It possesses a mechanical and granular structure, being composed of rounded grains of quartz, thickly distributed through a base of indurated clay; these are sometimes large enough to render the term pudding stone applicable to it. Small white crystals of felspar and small angular pieces of clay-slate are occasionally seen in it. It is almost always characterised by a great degree of solidity and infriability, and could never be mistaken for one of the latest sandstones. The grey wacke of Cape Rouge is an excellent building stone, and has been much employed in the scarps of the new fortifications at Quebec. Although the predominating rock, grey wacke, is comparatively rare among the *debris* or shingle on the shore, owing to its power of resisting the disintegrating action of the atmosphere; while clay-slate, for a contrary reason, covers the shore in angular fragments.

These two rocks continue without interruption, as far to the westward as the Telegraph, from the neighbourhood of which Messrs. Nixon and Bowen brought specimens of the latter, much discoloured by the red oxide of iron, and containing small rounded nuclei or nests of magnetic iron. These gentlemen report the soil over which they passed, to be sandy and much neglected, a description that will apply to most of that we saw on this island. A few yards beyond high water mark, the rocks suddenly emerge, and form a bank about fifty feet high, running parallel to the river. Having walked about a mile to the eastward of Patrick's Hole, along the shore, no important geological change was observed.

At river La Fleur, off which adverse winds obliged us to anchor, the same rocks were observed; we here learnt, however, that limestone is found in the adjoining parishes of St. François, to the eastward, and St. Laurent to the westward, at the latter of which places lime is burnt for the supply of
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the island. We here made a small excursion inland, for about two miles, on a N. W. course, without observing any thing more remarkable than an isolated ridge of grey wacke, suddenly cropping out and dipping to the S. E.* at an angle of from 50° to 60° . Upon our return we took the Sun's Meridian Altitude, and found the latitude to be $46^{\circ} 53' 40''$.

Leaving river La Fleur, we came to anchor again off La Grosse Isle, on which we passed the night. This island we were informed belongs to the Ursulines, and is about three quarters of a league long, by about 550 feet wide, but being almost entirely a bare rock, one farm only, of about 90 acres, is under culture upon it. Having reached this place very late at night, and quitting it very early in the morning, our geognostical observations were necessarily very scanty. The rock we believe is grey wacke. It is covered with a grey lichen, and bears the appearance externally of a solidity it does not possess, at least in the places examined, as it readily broke under the hammer, into tabular pieces, with oxidated surfaces. The obscurity of the weather and time at the period of observation, together with the absence of the specimens collected, which were left behind, will not allow us to describe with confidence. The outline of the island is craggy and irregular.

Passing to the southward of the island, in descending the St. Lawrence, several islands, viz: Marguerite, Cochon, &c. &c., some of them mere isolated rocks, were observed on the left hand, and which have the appearance of being also of grey wacke.

We lay off the mouth of the Saguenay on the morning of the 9th of August, at a conjectured distance of from 9 to 12 miles. The highest point of land on the western side of the entrance into the Saguenay at this distance, subtended an angle
of

* This is the prevailing dip on the northern shore of the St. Lawrence; it is frequently reversed on the southern

of $1^{\circ} 12' 44''$. No approximate height could be expected from calculating with such imperfect *data*; they were employed, however, and by one calculation, in which 12 miles were assumed as the base, the height was found to be 919 feet; by another, in which the base was $10\frac{1}{2}$ miles, 805 feet were obtained: the former agrees nearly with the result of an observation less liable to prove erroneous which was taken subsequently at the post of Tadousac.

Upon landing at this place (Tadousac) we proceeded immediately to examine a few of the geognostical characters of the country. The only place of residence here is erected on a bank of sandy alluvium, elevated about 50 feet above the river, and forming a flat terrace at the base of the mountains which suddenly emerge at a short distance behind. The rock of which these mountains is composed is granite, either of a red or a grey color, depending upon that of the felspar. It contains very little mica, but sufficient to make it a genuine granite, a rock as will be seen of rare occurrence among those about to be described. It crops out in cuboidal masses, and possesses sometimes the probably fallacious appearance of being stratified. At the foot of this granite, a small stream drains a tolerably deep section of the before mentioned alluvium, which is crowded with water-washed fragments of crystalline rocks. On the shore were seen small deposits of magnetic iron. Here bases were measured, and the requisite angles taken for determining the height of the most elevated land on either side the mouth of the Saguenay, which was found to be 912 feet on the western side, and 588 feet on that to the eastward. These results are approximations only, as the observations from whence they are derived, were not taken with the utmost precision.

Leaving the harbour of Tadousac and proceeding to the eastward round the clayey precipice of *Pointe-aux-Vaches*, which is the most southern portion of the alluvial plateau before described,

scribed, we reached a small bay, at the bottom of which the Moulin a Baude rivulet enters the St. Lawrence, at the distance of about three miles from the Post. It is here that the bed of white marble is situated, which has already excited much attention. We visited this place late in the evening, and could only spare ten minutes to its examination. It lays in close contact with syenitic gneiss, a rock composed of white felspar, grey quartz and black hornblende; the latter of which minerals it is, that by its arrangement in parallel seams and layers, makes the term gneiss more applicable to it than granite; these seams and layers indeed are sometimes so thick, and always so continuous, as to merit the name of alternating "hornblende schists" of Macculloch, if an aggregate, in other places in the neighbourhood, of so intrusive a character, and on that account agreeing better with one of his "overlying" rocks, can be admitted among that class. The fracture of the rock is effected more readily in the direction of these seams than elsewhere, and the surface thus exposed has a black pseudo metallic brilliancy, resembling some micaceous schists, for which at the first sight it might be mistaken, but the easy fusibility before the blow-pipe, into a black shining globule, of that mineral which sometimes resembles black mica, is a sufficient distinction.

But to return to the marble: At its junction with the gneiss, it is much entangled with it, and it is stained in many places of a greenish color. Conformable to the accompanying strata it dips to the S. W. at a high angle, and crops out in yellowish white water-washed masses on the shore, at the bottom of a precipitous cliff, where alone we saw it. None of the specimens examined could be considered of excellent quality, as they were much stained and bastardised by what was supposed to be either hornblende or epidote; besides they are of a laminar, and not of that granular, structure which bestows on the white Italian marbles their greatest value, by causing them

to work freely in any direction. We had no leisure to ascertain the quantity in which this marble occurs, but this deficiency of information is fully supplied by the following anonymous communication, which there is reason to think generally correct :—

“TADOUSAC, Sept. 14, 1826.

“We walked this morning along the beach to Moulin a Baude, about four miles below this Post, to see the bed of marble there. Point Rouge, forming the south-east promontory of the harbour of Tadousac, is chiefly composed of a very hard close-grained red granite. The granite alternates for a few paces with, and is then followed as far as Pointe-aux-Vaches, by several varieties of primitive rocks, principally gneiss, &c. until they are there met by a bed of clay, apparently one hundred and fifty feet thick above the level of the river, and cut down nearly perpendicularly by the beating of the waters for a distance of about two hundred yards, which is the whole breadth of the bed. This clay is of the same character as that at Pointe-aux-Bouleaux. (*) The primitive rocks of the same description which were found laying against the clay, almost immediately succeed it, and the action of the water discloses to the passenger that fantastic and beautiful intermixture of layers of different colours, so common between Malbay and the Saguenay. The shore is then indented, and a bed of gneiss, stretching out into the St. Lawrence, has been cut off by the water and forms a little island; opposite to it is a bay, and in the dry sand thrown
up

(*) “The clay at Pointe aux Bouleaux and Pointe aux Vaches, the two outermost tongues of the banks of the Saguenay at its mouth, occurs in immense beds, of which that at the first place is about thirty or forty feet in thickness above ground, and that at the last place probably two hundred feet; both together extending in superficies apparently ten or twelve miles. It is extremely fine in its texture, contains a good deal of lime and some iron. It has the property of crumbling when water is thrown upon it, as unslaked lime does, and might by being merely spread out and exposed to the falls of rain, answer as an excellent manure for a soil having an excess of acid, such as that of swamps, &c.”

up, the wild oats grow so profusely that they almost appear to be sown by man. A larger bay a little farther on is what is called Moulin a Baude; it is about one hundred and fifty or two hundred yards deep; and at its bottom is the bed of marble. This bed is nearly vertical, rising within view to the top of the bank, which is here scantily wooded and about one hundred and fifty feet high, ascending at an angle of about 70° . The direction of the bed is nearly N. (NW?); the breadth along its whole exposure varies from six to eight or nine feet, disappearing under ground without diminution. In some parts it is interlaced by the adjacent strata, (gneiss), but it is generally pure and solid. A small stream falling down the bank has intersected it, and disengaged a large block or two which have been exposed to the water and frost; they do not appear to have been much affected by this exposure; indeed they have resisted it exceedingly well. Supplies of many thousand tons might be obtained at a trifling expense. As a statuary marble it will be very valuable, for it is, generally speaking, of a pure white colour, although to the depth of a few inches from the adjacent strata it is often tinged green, and in a few parts of the mass there is a red tinge(*). This muddy bay is dry at low water, affords a protected harbour, and admits at high water vessels drawing six or eight feet. A vessel of the former draught might indeed touch the bed itself with its keel. The entrance from the St. Lawrence is not difficult. It is not more than forty-eight hours' sail from Quebec with a light fair wind. Large sound blocks of the marble, of fifteen or twenty feet in length by four or five feet wide, might, I think, be obtained: these would be fine ornaments as columns, &c. to buildings. As the marble does not take a fine polish, it would not be so

much

(*) As a statuary marble it is totally unfit; whiteness alone is not sufficient; it should also possess a granular structure. Those marbles are best for that purpose which, like the Carrara marble, resemble the finest white sugar.

much in request for chimney-pieces, &c. It well deserves to be worked. The discovery of marble at this place is not a very new one. Charlevoix, who anchored here in 1720, in the *Chameau*, a French King's-ship, landed at the small stream at the bottom of the bay, and it is probably in allusion to this very bed, which he could not have failed to see, that he says, in speaking of the place, 'tout ce pays est plein de marbre.' (‡) The marble in question was long ago known to the North West Company."

It is a curious fact, that this marble was bought for gypsum; the purchaser, as we are informed, on the most respectable authority, ground it up for cement, and found it to answer very well. If so, he must first have expelled its carbonic acid by means of a powerful heat, for there is no doubt whatever of its being a very pure carbonate of lime, and its association with granite and gneiss places it among the primary marbles. That gypsum has ever been found among primary rocks, so as to indicate its primary origin, is doubted by some geologists. It bears a strong resemblance to alabaster, and probably on that account was mistaken for gypsum. On the subject of this mistake the following extract of a letter, addressed by us to the Editor of the *Quebec Mercury*, is given;—

“Two kinds of alabaster only are known,—that formed on the floors of caverns by calcareous depositions from the roof, called stalagmites, and some varieties of gypsum or sulphate of lime. The former it cannot be, and one of the latter it is not for the following reasons:—All the varieties of gypsum except the anhydrous may be scratched by the nail, which this cannot be. None of them effervesce in acid, which this not only does but forms a clear solution in: The gypsums fall to powder

(‡) A remarkable instance of exaggeration if he alluded only to the bed in question; but it is probable that, deceived by the whitened surfaces of almost all the rocks in this place, he mistook that for marble which was only the rock it was associated with. M

der with heat—the mineral in question burns to lime. It is therefore a carbonate and not a sulphate of lime.

The translucency of this marble is remarkable, which joined to its colour (in favourable specimens a dazzling white, sometimes slightly shaded with pink) renders it, to all external appearance, well calculated for ornamental purposes, particularly for the manufacture of vases, lamps, &c.. If its abundance will allow of its being employed as a building stone, the ease with which it may be worked, its solidity and whiteness, would render it at once an economical, a durable and a handsome building material. Some have indulged the hope that it might be made an article of export; but admitting that it is in sufficient abundance, which we doubt, white marbles of a far superior character are found in many parts of Scotland, a full account of which may be found in some papers communicated by Dr. Macculloch to the Geological Society of London, and entered in the 2nd and 3rd Vols. of its Transactions. We here insert an extract from one of these papers which will be found to afford some interesting information respecting the Grecian, Italian and Scottish marbles,

“ Few substances in the catalogue of those with which economical mineralogy is concerned, have excited more interest than statuary marble, from its rarity, its beauty and its indispensable necessity in the art of sculpture. It has at different times formed an object of anxious research in this country, and premiums have been held out for it by the Society of Arts. It has consequently been found in various parts of Scotland, as well as in Ireland, but no native specimens have yet been introduced into the arts. As the causes which have impeded their introduction have hitherto been such as may be considered adventitious being of a commercial nature, and not founded on any experience of their physical defects, it has been hoped that they might by perseverance and time be removed, and that the statuary marbles of this country might at some future day supersede

cede the necessity of importing this article. It will not therefore be a misplaced enquiry to examine the several properties of those marbles which have at different times held a place in the estimation of artists, and to compare them with our own specimens, more particularly with that of Sky, now under review, the most abundant and certainly the most specious of all those which have yet been found in Britain. The enquiry is the more necessary, as the several circumstances in which white marbles differ, do not appear to have been generally attended to, and as an undue value seems in some instances to have been fixed on our own in popular estimation, although not in that of sculptors themselves.

“The value of this substance in those distant periods when the arts of Greece flourished, occasioned an industrious research after a material in which the sublime ideas of its artists could be embodied. Accordingly many quarries have been wrought in ancient times, of which little has descended to us but the names, and a few of the works which were executed from their produce. These marbles were of various qualities, and examples of them are still to be seen in ancient statues, although with regard to many of them a species of evidence often little better than conjectural, has guided sculptors and mineralogists in their attempts to determine the quarries from whence they were derived. Among these, the quarries of Paros afforded a marble, (the often quoted *lychnites* of Pliny) in which it is asserted that the celebrated *Venus* was wrought, as well as some others to which we have not access. But there are many specimens of sculpture in the British Museum which seem to have been executed in this stone or one at least of analogous character.

“Of the nature of the Parian Marble we are enabled to speak positively, since some blocks of it have been quarried during the last few years, and are now to be found in the shops of the sculptors of this city. The grain of this marble is large
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and glistening, while at the same time its texture is loose and soft, and its colour of a yellowish and watery white. It possesses considerable translucency on the edges, a quality which, however desirable in statuary marble when of a fine grain, from the softness which it gives to the outline, only increases the disagreeable aspect of the Parian by the angular reflections of light which takes place on the pellucid edge and surface from the innumerable faces of the small plates. It is certain indeed that the Greek sculptors abandoned the marble of Paros after the quarries of Luna and Carrara were discovered, the superior fineness and whiteness of these marbles, which at present cause them to excel any with the places of which we are now acquainted, rendering them also at least equal to the best of those ancient ones of which the native places are now unknown.

“Independently of the injurious effects which the large grain of the Parian marble produces on the transparent surface of sculptured works, and the false lights which it thus introduces into the contour, it interferes materially with the requisite correctness of drawing in the lesser works, and is thus inapplicable to the details of small sculptures in relief. It is, nevertheless, susceptible of a good polish, a quality, however, of little value in the eyes of the statuary, and one which in this variety only serves to render the defects of its texture more apparent. It is also said to have been deficient in size, since it was so intersected by fissures as to be incapable of yielding blocks of more than five feet in length. I may add that, in the present state of the public habits with regard to white marbles, there is no demand for modern works executed in Parian marble. Its celebrity is consigned to the metaphors of poets.

“The quarries of Luna produce a compact white marble, susceptible of a high polish, and capable of being wrought with the most minute accuracy. Hence it is preferable for
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the finer operations of bas relief either to the Parian, of which the aspect interferes with the delicacy of finish and of surface required in these works, or to the Pentelic, which was subject to accidents from veins of mica and of serpentine; or to that of Carrara, in which dark veins are of frequent occurrence. It was accordingly preferred by the ancients, and among many other works, the Apollo (Belvidere) is said to have been executed in Luna marble. We have no other knowledge of the marbles of Hymettus and of Arabia than their names.

“ Of all the marbles employed in the works of the ancients, and of which many specimens have descended to our days, that of Carrara is almost the only one which is at present held in estimation, or is now accessible to modern sculptors. This marble is of a very fine grain and compact texture; it is also susceptible of a high polish when required, and is consequently applicable to every species of sculpture, except when, as is too often the case, dark veins intrude and spoil the beauty of the work. Notwithstanding the general apparent uniformity of its texture, it offers different varieties of aspect. It is always of a fine granular fracture, yet this fracture is sometimes combined with a slight tendency to the flat splintery, in which case the stone is harder and more translucent than when it is purely granular. When merely granular, it is sometimes dry and crumbly, precisely as if it had been exposed to a high heat; it then loses much of its transparency, and is called woolly by sculptors. Its transparency is various, and in some cases nearly equal to that of alabaster, (granular gypsum.)

“ The last of the ancient marbles which I shall describe, is that of Pentelicus of which the quarries are probably still to be found in the vicinity of Athens, although they have not been investigated by modern travellers. This marble is of a loose texture, and moderate sized grain, coarser than that of Carrara but finer than that of Paros; in colour it is

exceedingly imperfect, being tinged with grey, brown and yellow, and mottled with transparent parts, which give it the appearance of having been stained with oil. But its most formidable defect is its laminated structure, and the quantity of mica with which it is contaminated; to this we are to attribute the corrosion and almost entire ruin of so many of the specimens, the action of the weather desolving those parts of the stone where the mica is most abundant, and cutting deep fissures through many parts of the work. It is peculiarly unfortunate, that the two most admirable specimens which are calculated to excite in the minds of artists a mixed feeling of wonder and despair, the horse's head, and the Theseus, should be those which have suffered most. Had they been fortunately executed in the more uniform and durable stone of Carrara, these works might still have been preserved to us in all their original perfection of drawing and surface. Even the hammer of the Turk would have rebounded with little injury from the marbles of this texture, while the micaceous stone of Pentelicus, splitting in the direction of its laminæ, has permitted the complete mutilation of many valuable sculptures.

“ We have no geological information with regard to the relation of these stones. The great resemblance of the Pentelicus to that of Glen Tilt, in aspect and composition, renders it probable, that like this, it lies in mica slate, forming beds parallel to, and interstratified with, that rock: that the others have similar relations to the primary rocks, we should have concluded on general geological principles, had we not already seen that the white marble of Sky, which has given rise to this discussion, belongs to the secondary strata.

“ We have now to examine the white marbles which have been discovered in our own islands, for the purpose of comparing their relative properties, and the value which they are likely to possess in sculpture. I am unfortunately unable to give any

account of those found in Ireland, neither having seen their places, nor being possessed of any specimens.

“ That which has been found at Cape Wrath, in-Scotland, is of a grain much larger than even the Parian, and is consequently useless for the purpose of sculpture ; and this indeed is by much the most common character of the Scottish specimens. Those of Blairgowrie, of Glenavon and of Balahulish, are all equally characterized by this large sparry texture, and are all equally unfit for sculpture, however applicable to the purposes of architecture. The marble of Iona has been long since exhausted, and consequently requires no particular notice : however, valuable from the purity of its colour and compactness of its texture, yet the uncertainty of its splintery fracture before the chisel, (that tool without which no spirited work was ever finished) combined with its great hardness, would probably have rendered it useless in the arts even if it were still to be procured.

“ In a paper on Assynt, I have already described the white marble of that district ; it is of a very close texture, and although it contains no earth but lime, is of unusual specific gravity and hardness. It is incapable of being polished, a circumstance, it is true, of no consequence in Statuary, since the polish only gives a false light to the surface, and is not admitted of in modern sculpture ; but it labours under the concomitant disadvantage of want of transparency, producing nearly the same dead effect and dry outline as is seen in a plaster cast, a fault in itself sufficient to prevent it from ever being adopted as a good material in the arts : its extreme hardness also renders it very expensive to work.

“ The marble of Sky, the more immediate object of this discussion, is of a pure white colour, and appears sufficiently extensive and continuous to be capable of yielding large blocks. The purity of its colour is seldom contaminated, its fracture is

granular and splintery, and its texture fine, less fine than that of Iona, but more so than that of Assynt ; its compactness, hardness and gravity are greater than those of the marble of Carrara, which it in fact resembles in little else than colour. It is apparently well fitted for all the purposes of sculpture as it can be wrought in any direction, and has sufficient transparency, while at the same time it assumes even a better polish than is required for statuary. With these good qualities, however, is combined an uncertainty arising from its unequal hardness. While some parts of the stone are nearly as easy to work as that of Carrara, many other specimens turn out so hard as to add a charge of near 50 per cent to the cost of working : this appears to arise from the influence of the syenitic and trap veins which traverse it, as I have before mentioned, but which, however, produce no change in its chemical composition, nor any other effect than that of induration. This addition of price to the current charge of working is sufficient in the harder specimens to counterbalance in a great degree the superior cheapness of the material, and the advantages derived from lower freight, duty and insurance. Such are the difficulties which oppose the introduction of the most perfect marble which has yet been found in Britain, difficulties which, slight as they are, ought, together with the prevalence of established habits, and of a commercial routine, to check the extravagant hopes which have been entertained in this country, of superseding by its own produce, the importation of foreign statuary marble. But it will not be rendering justice to the marble of Sky if I do not add, that it possesses a property not found in that of Carrara and one of considerable importance, at least in small sculptures. This is, that compactness of texture by which it resists the bruise which so often takes place in marble, at the point where the chisel stops, an effect known to sculptors, by the techni-

cal term *stunning*, and of which the result is a disagreeable opaque white mark, generally in the very place where the deepest shade is wanted."

It is hoped that the foregoing digression will be excused, as it affords information not generally before the public, by which the means of estimating the white marbles of Canada are readily obtained ; as well those whose localities are already ascertained as others that will eventually be so.

The rocks on both sides of the Saguenay, as high up as La Boule, (a mountain which stretches out into the river from the north eastern side, in a remarkable manner) are probably granitic, and form a continuation of the same series met with in the more immediate neighbourhood of Tadousac. They have sometimes the appearance of being stratified and of dipping to the S. E. at an angle which is nearly vertical. These rocks rise with almost perpendicular scarps to a considerable height, and their summits are barren, and in some places totally bare, in which latter case, the whitened surface of the rock, owing to the incipient decomposition of its felspar, resembles that of some limestones ; they are often also of a smoked or blackened appearance : nearly *à fleur d'eau*, a red ferruginous band characterises these rocks : Their outline is rounded and mamillary, a character they lose as the river is ascended.

It was in the La Boule that we observed for the first time those singular masses of trap, sometimes under the form of veins or dykes, sometimes under the form of interfering and unconformable beds or strata, but most frequently as isolated patches both rounded and angular, the whole so deserving the attention of the geologist. As these trap appearances are characteristic of almost all the rocks we saw, it is necessary to describe the mineral contents of that aggregate to which we have applied this term, particularly as without such a description it is almost unintelligible, owing to the loose and indefinite manner in

which it has been used. This term, wherever it may appear in this essay, is meant to imply any rock in which hornblende predominates, without any regard or reference to those theoretical notions which it has been often used to convey. It here more particularly means an aggregate composed of black crystalline hornblende, small grey crystals (or rather scales composed of an assemblage of crystals) of felspar and a little unelastic mica or talc: in short, a substance similar to what has been before described as associated with the white marble at Moulin a Baude, but essentially differing from it in the manner in which it occurs. It much resembles also a compound that is found on the Montreal Mountain, to which a volcanic origin has been ascribed. The granite with the trap here associated was of a greyish color. In it we in one place observed nodules of magnetic iron, exhibiting a very iridescent surface resembling some ores of copper, for one of which it was at first mistaken. This ore is very strongly magnetic, apparently as much so as malleable iron. Contrary to the hornblendic compound in the gneiss at Moulin a Baude, it is not easy to procure a fragment of this trap shewing the two rocks in contact, as upon being struck they separate immediately and it is then perceived that the trap has externally that smooth even surface which a mould bestows on the substance cast in it, shewing generally no appearance of entanglement or conglomeration at the places of contact. On the weathered surface of the trap the felspar is often brown and prominent. This trap is often very magnetic.

The granite of La Boule, for such we call the rock though apparently stratified, is composed of grey quartz, reddish felspar and small points of brown mica. A little above the line of junction of the river and the rock and on its south-eastern side, a thick dyke of trap traverses it nearly horizontally and at right angles to the stratification. It appears to rise out of the water at the western extremity of La Boule,

and

and, with a slight inclination, ascends towards the eastern.

We will now describe more particularly the appearances of these dykes, veins, &c.: they rise at all angles through the accompanying strata; they are frequently parallel to each other, and even to the planes of stratification; they generally either terminate suddenly in the rock at one or both extremities; in the latter case they answer the description of contemporaneous veins; these extremities are either pointed or forked.

The accompanying diagram (plate 6, fig. 1,) will afford a better idea of what it is intended to describe.

Isolated quarter moonshaped pieces and patches, varying from the size of the hand to that of the body are more common. (plate 6, fig. 2.)

It is worthy of observation that the small quarter-crescent shaped pieces occur together by twos and threes in a parallel order, and that the trap, of whatever shape, generally has angular corners, and terminations. Channels and hollows are sometimes seen in the face of the rock, which are owing to the removal of the trap formerly occupying these vacancies.

It is not, however, merely as veins, beds, and distinct concretions that this trap is observed; it occurs, particularly in the higher parts of the Saguenay, in mountain masses bearing little appearance of stratification; sometimes in masses in which its stratification will scarcely admit of a doubt, and sometimes it is rendered so evident by alternating with other stratified rocks, that no uncertainty can exist on the subject.

The La Boule, by projecting so much into the river, occasions, when the tide is falling, a strong current and counter eddy. Not being able to surmount this current, the boat dropped into the eddy, and running along the base of the mountain on its south-eastern side, turned into a small cove, where the height of La Boule was found by an observation to exceed two hundred

hundred feet, but by how much could not be ascertained in consequence of the contracted nature of the ground we were upon. The rocks on the northeastern side of the Saguenay, in the bay below La Boule, appeared to have a stratification directed east and west, with a high dip to the north, but this geognostical feature here was, as it was found to be in many places elsewhere, often of a doubtful character, owing to the contradictory appearances which some of the supposed planes of stratification assumed, and which to reconcile would have demanded more time in their investigation than could be afforded. In recording the stratification of those places where these contradictory appearances were observed, care has been taken to give the predominating bearing only. The evidence which arises from consulting alternating strata is, in the Saguenay, often inadmissible, as the trap sometimes assumes an appearance of stratification which is probably fallacious.

While seated on an accumulation of boulders covering the shore of this bay, rocks of a remarkable sterility were seen on the opposite side of the river, associated with others of comparative fertility, the former possessing an appearance of stratification in which the latter were deficient. The known infertility and constant stratification of gneiss, renders it probable that it is here associated with trap, a rock generally unstratified and of a more fertile character. A question here occurs, Is gneiss more infertile than granite? and if so, why is it the case? the only difference between them being in the arrangement of the same minerals of which they are both composed. Is it that the foliated character of the gneiss renders that rock more easily disintegrated and reduced to a state of sand, by which the soil of a country where it predominates is impoverished? The fresh water procured in this bay was strongly impregnated by iron.

Availing ourselves of the tide to pass La Boule, we ascended the Saguenay. In Passepierre Bay, the rocks were observed on
the

the north-eastern side of the river to have a bearing north and south, and at Baie St. Etienne a little higher up, on the south-western side, they were seen, contrary to their general habits, to retire from the shore and to leave a few acres of clay alluvium, on which wild grass is cut annually. Between Pointe St. Etienne and L'Ance aux Foins (another more extensive alluvial deposit higher up) the rocks are particularly worthy of observation for the numerous dykes and contorted veins of trap by which they are traversed. These rocks are stratified, and dip at a high angle to the south. In some places here the trap dykes, which exactly resemble those we have described in their mineral contents, structure, and generally intrusive or interfering character, have the appearance of alternating in strata with syenite. The opposite shore of the river offers the same appearances, but not having landed there nothing more can be said of them.

In the precipitous cliffs on the north-eastern shore of the Saguenay, in the direction of St. Marguerite's river, these dykes are very conspicuous, and from their blackness bear some resemblance to upright beds of coal. It is noticed here, as it is elsewhere, that where trap most abounds there is always a more dense growth of timber, and this character is sufficiently striking in many places on the shores of the river, as the syenite with which the trap is usually associated, affords often, by its extreme barrenness, a strong contrast. On one of the islands of St. Louis was observed a rock composed of quartz, felspar, and mica, a genuine granite in composition, but in evidently stratified masses, the bearing of which was north and south, with a high dip to the westward.

On ascending the river at Point Comfort Bay, the rocks were of syenite, in which a little quartz was perceptible; externally they had a greenish colour, owing it is believed to the presence of epidote which very wet weather had rendered more distinct

distinct and lively than usual. These rocks possessed a very distinct appearance of stratification to the north and north-east, and dipped to the east and south-east; other contradictory planes were however seen. Many of the rocks in this bay possess a porous exterior.

At nine o'clock of the 12th August the temperature in the shade was found to be 71° Far. and in salt or very brackish water 65° . With the conjectured distance of five hundred and fifty feet as a base, and nearly 45° as an elevation, a height of five hundred and thirty feet was obtained for a mountain on the north-eastern shore. On the opposite or south-western side the summit of a mountain, in a supposed base of two miles, subtended an angle with the horizon of $7^{\circ} 27' 54''$ which gives thirteen hundred and sixty feet for its perpendicular height, a result as we think much too considerable, although the land appears to rise from the mouth of the Saguenay as high up as Baie la Trinité, where it is conceived to be highest. The precipitous and indented shores of this river afford few convenient situations for measuring a base upon, in order to insure, by a calculation from true *data*, the accuracy of this sort of information.

Having landed a little above la Baie des Cascades, a syenite, composed of reddish felspar and a black hornblende, was found, and a short distance beyond, the same rock, characterized by those remarkable imbedded pieces of trap, occurs; they have here either the form of a snake or of angular fragments of an irregular figure; contorted dykes of the same substance were also seen. The trap in this instance contained no mica; in other respects it was exactly similar to that before described. About this place the river was measured by Mr. Proulx, one of the Surveyors, and found to be about fifty chains. One of the specimens of syenite procured here, appeared to be principally composed of light brownish compact felspar; its fracture was flatly conchoidal in the large, but uneven and scaly in the small,
with

with a few small glimmering points, arising from the reflection of light from the polished surfaces of minute crystals of common felspar; however, upon submitting it to the blowpipe, it was found to be infusible, but the heat it had been exposed to disclosed its really granular structure, which induced us to suppose it to be an exceedingly intimate aggregate of quartz, felspar, and hornblende, the leading mineral in excess. This has been mentioned merely to hint at the difficulty which sometimes attends an examination into the mineral constituents of rocks.

Having again put on shore in a very convenient bay, opposite Baie la Trinité, syenitic rocks were met with, or mixtures of felspar, hornblende, and very rarely quartz; the felspar was white, grey, red, yellow and greenish; the hornblende always black. These rocks, as elsewhere on the shores of the Saguenay, were in some places much stained by iron, and Mr. Proulx collected a specimen on the north side of the river, in latitude, as he ascertained by observation, $48^{\circ} 24'$, which was not only much discoloured, but the rock from whence it was taken affected the needle to the amount of $1^{\circ} 30'$. We could perceive magnetism very distinctly in the specimen in question, but it is a very common character here, and was found to exist in many of the specimens brought home, particularly in the trap and some of the syenites abounding in hornblende, to the presence of which mineral it could generally be traced. The rocks had here a dip to the south at a high angle. The fall of the tide was ascertained to be twenty-one feet.

We left the bay about eleven o'clock, p. m. to avail ourselves of the tide, and coasted along the north-eastern shore all night. In the morning of the 13th of August we landed in a bay on the left shore, called Ance aux Femmes, directly opposite to Halla Bay. Here we found a rock containing more quartz than usual, and passing into a syenitic granite, the felspar in which is flesh-coloured. This rock was observed to have the

same porous exterior as before-mentioned, nor was this character of porosity confined to the surface, as a specimen brought from the place exhibits it both internally and externally in so perfect a manner as to afford an excellent sample of a millstone; its quantity cannot be stated, but the writer believes it to be abundant. It should be generally known that good millstones are often found among syenitic rocks.

Several rocks in front of the bottom of this bay, which by the rising of the tide are converted into islets, were examined. The first met with was syenitic gneiss, having a bearing nearly north and south, and dipping to the west at a high but variable angle. It sometimes loses its character of gneiss and maintains those only of syenite; the usual imbedded masses of trap are present under all the appearances before described, and one additional: some of the snake-shaped imbedded pieces were broken through the middle apparently, and the fragments separated from each other, like the well-known shifts in veins, but no corresponding fracture in the rock was seen. (pl. 6, fig. 3.)

Almost all the rocks examined in this place were of the same description, differing only in their dip which was sometimes reversed. It was here, however, that we observed for the first time regular and conformable strata of the same aggregate as that found imbedded in the syenite, and to which, from its interfering character in other places, we are unable to affix any other name than the general one of trap, using this term here as elsewhere, without the implication of any theory to designate certain aggregates in which hornblende predominates. Water-worn fragments of compact shell limestone were here seen, the color of which was grey and fracture flatly conchoidal and sharp-edged.

Leaving these rocks, others to the south-eastward in the same bay were visited; they bore a great general resemblance to the

first in all their features ; the trap was, however, seen here to interfere with the syenite in broad dykes, and the former was occasionally traversed by veins of felspar ; these veins were observed in some instances to form a connecting link between the syenite above and the same rock below, so that it is not possible to say if they have been filled from above or beneath ; (pl. 7 fig. 4.) These veins were frequently observed in other places.

The next rock to the last-mentioned was composed of flesh-coloured light brown quartz, and black points of mica, and in which no imbedded trap was seen. To this, trap, apparently stratified, succeeded, and then a syenitic rock holding imbedded large patches of trap, (pl. 7 fig. 5.)

Further to the south, a specimen of trap was procured from a wide dyke, the hornblende in which had a remarkably shining semi-metallic lustre ; it contains no mica, and is not magnetic. Still further, an immense fragment of rock having fallen, one of its surfaces was observed to be covered with broad laminae of a beautiful felspar of a very pearly lustre ; a light green mineral, supposed to be the green carbonate of copper, was associated with it in small quantity. The latitude of Ance-aux-Femmes was made $48^{\circ} 22' 26''$.

As observations for latitude were necessary to check our courses they were taken at noon whenever the weather would permit ; at the commencement of the journey it was extremely unfavourable.

The predominating rock between Ance-aux-Femmes and Cap à l'Est, about six miles higher up the river, appears to be (for it was not touched) the same trap ; but syenite was also seen as usual with imbedded patches of the former. Having crossed the Saguenay opposite to Cap à l'Est, we entered a small bay to which was given the name of Bear's Cove ; here granite, gneiss and syenite were seen, but no trap. Coasting up

the river on the same side, it was seen frequently again under all the forms before-mentioned. Sometimes the trap, rising in black channeled precipices entirely bare of vegetation, exhibited appearances in which a very distant resemblance to architectural regularity might be traced. Sometimes a part of the rock having broken away from below, black escutcheon-shaped masses were left projecting and frightfully pendant over the fragile canoe paddling beneath near the base of the rock : the latter appearance, however, is more characteristic of the opposite shore. No columnar structure was seen, but in many other places in the Saguenay as well as here, the rocks had a tendency to break into prismatic or cuboidal fragments. We believe the trap is in this place associated with syenitic gneiss, with which or syenite it appears sometimes to alternate. On ascending still further, and within a few miles of Chicoutimi, a whitish looking rock was observed, apparently in horizontal strata ; passing at some distance nothing more was ascertained respecting it. To this succeeds an alluvial deposite of a rich marly clay, which continues on the right bank as far as the Post. On the left bank of the river the rocks continue without interruption, and without any geognostical change, as was ascertained subsequently.

Before we leave the Saguenay a few more observations upon its rock formations, which were entered in our journal while descending the river on our way home, will be here introduced, together with some additional information which Mr. Proulx's politeness has placed at our disposal.

La Baie des Foins, situated on the left bank of the Saguenay, a little below the Post, is a natural meadow of several acres extent, laying at the base of the mountains which here retire for a short distance from the river. The soil is a clayey alluvium, and, as the name of the place indicates, wild hay grows upon it which is annually cut. At Long Point, a little
below

below Rocky Point, specimens of syenite and syenitic gneiss were procured. Imbedded trap was again seen here.

Having encamped a little above Cap à l'Est, on the western side of the river, and somewhere near our former encampment at Bear's Cove, the rocks were again found to be syenitic, and traversed occasionally by veins of red felspar and quartz; sometimes the two were intermixed. Large dykes of trap occur here, and rounded water-worn fragments of limestone. In a bay, distinguished by four semi-isolated mountains, three of which are of a conical form and situated on the left shore a few miles below Cap à l'Est, the rocks were observed to be the same, and the patches of trap very distinct. The surface of the syenite was yellowish brown, and slightly porous, as if baked, and this appearance was observed in many places, both in the Saguenay and afterwards in the St. Lawrence. The three semi-isolated mountains above-mentioned are the more remarkable, because in general both sides of the Saguenay are characterized by a continuous chain of mountains whose longitudinal outline is only slightly undulated, while their precipitous sides are always towards the river, to which the chain is usually parallel.*

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* It will not fail to be observed, that this slightly undulated outline, which is characteristic of both sides of the Saguenay, is at variance with the general direction of the mountain chains in this country, and particularly with those in its neighbourhood. There is great reason to believe that at least one wide valley, running nearly parallel to the St. Lawrence, exists in rear of St. Paul's and Malbay. On ascending the Saguenay we saw no sections of vallies, nor any considerable breaks in its lofty and precipitous banks, until Ha-Ha Bay was reached. Upon referring to the accompanying map it will be perceived that this bay has a direction about parallel to the St. Lawrence; it is probably, therefore, the outlet on the Saguenay to the valley alluded to. The general course of the mountain chains in this country is, as has been before observed, north-east and south-west, that is, the same as the valley of the St. Lawrence. The valley of the Saguenay is from the north of west, and nearly at right angles to it; it is therefore a cross valley. That the rocks on either side of this valley were once united there appears very little reason to doubt, but water must have had very little to do with separating them, at least in the first instance. From the slightly undulated character of the sectional outline of this valley, it would seem to have been once filled by a continuous chain which has been severed longitudinally by some violent catastrophe, the nature of which can only be surmised. It is probable, however, that an earthquake has effected this dis-

Between this place and Le Petit Sagueuay, on the opposite shore, such a geognostical uniformity prevails as to render the collecting of specimens superfluous; indeed the same remark is so far applicable to the whole of the country we traversed, that a dozen well-chosen fragments of rock, with the necessary observations upon them, would convey to the geologist almost as much information as he would acquire by going over the same ground himself. Let it not for an instant be conceived, that our observations are believed to be the necessary ones; the writer knows them to be altogether insufficient to convey any thing more than a very general idea of the geognosy of the country.

In a small stream, a short distance below Le Petit Saguenay, the rocks were observed to be intersected in a remarkable manner by veins of quartz and felspar, sometimes alone, at others united together forming an aggregate. Frequently these veins were divided exactly in the centre by a seam of trap; they have the same bearing generally as the stratified rock they traverse, namely north-east and south west, but they are often much contorted without losing ultimately this character. The trap is seen alternating in thick strata also. The predominating rock here is syenitic gneiss. A deception arises sometimes from a source which is not suspected when attempting to distinguish, as is generally easy, by the external surface of rocks, between the trap and syenite; the syenitic rocks have usually a whitened exterior, but sometimes, though rarely, it is as black as that of the trap, in which case a fragment must be detached before the rock can be known. This sort of deception was experienced

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junction; the nature of the rocks, the recorded proofs of the violence of earthquakes on the northern shore in former times, and above all their frequent occurrence at the present day, though no longer of an alarming character, are circumstances which favour this opinion. A great wave would not have acted longitudinally but transversely, or in the direction of least resistance. The insignificant streams which enter this noble river have had little effect in forming it, and the operation of tides and maritime currents, though more effectual, can have been only partial and secondary.

between this place and Le Petit Saguenay, and it should intimate the propriety of never naming a rock in general, until at least its fractured surface has been seen; decided trap was however often met with in this interval, either in stratified masses, or intruding among other rocks.

In passing between the St. Louis Islands and the south shore, we were obliged to take refuge from the breakers, which threatened to swamp our canoe, by climbing up a projecting mass of greyish granite, on which the night was passed. The mica of this granite was replaced as usual by hornblende, it was therefore syenitic; the former mineral being in all the rocks of the Saguenay country we have seen, very rare and almost entirely confined to some specimens of the trap, in which it occurs in small quantity and minute scales, and this indeed appears to be rather talc than mica, as it is unelastic. We only remember to have seen very distinct scales of mica twice; in both cases they were isolated hexagonal crystals, and one of them occurred in a vein of graphic granite composed of beautiful large flesh-coloured crystals of felspar and large rounded, or rather oval shaped, nodules of quartz, traversing the last-mentioned rock. Our observations of the geognosy of the Saguenay river terminated here.

From an inspection of Mr. Proulx's notes, and an examination of the accompanying specimens, the following additional information has been obtained.

The rocks in the neighbourhood of Ha-Ha Bay are counterparts of those already described in the Saguenay, and the same were seen at Point au Fort, Cap à l'Ouest, Petite Pointe, Cap St. Charles, L'Ance François and Baie St. Jean. They are rocks in which felspar and hornblende are always present, in a greater or less proportion, forming syenites and syenitic traps, according as the former or the latter mineral predominates. No instance of the hornblende predominating was seen, except in
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the black aggregate that has been described, where it not only predominates but in which the felspar is very subordinate. In this aggregate the felspar is always grey and scaly, and bears a great resemblance to quartz, for which it might easily be mistaken, but its fusibility before the blow pipe into a white blebby glass is a sufficient distinction. As might be supposed, when in association with syenite, the trap usually exhibits a striking contrast as to colour, to which the weathered surface of the former rock answers as a sort of foil. No difficulty would be felt in assigning to this rock a place among the "hornblende schists" of Maculloch, were it not for its unstratified appearance in some places, and particularly for its intrusive and interfering character in others; the latter indeed seems to point out the "overlying class" of the same author as its proper position. When quartz enters, as it does rarely, among the constituents of syenite, either syenitic granite or syenitic gneiss is produced: it is the latter, when by the arrangement of its hornblende in parallel seams, that peculiar foliated structure which characterises gneiss is the result.

Neither from Mr. Proulx's nor our own observations are we able to state with certainty the prevailing dip of the strata on the shores of the Saguenay, but it lies between the east and the west round by the south. We have before alluded to the difficulty of always determining the stratification, a difficulty which is common to many stratified rocks, but particularly to the masses under consideration which, from their felspathose structure and association with trap dykes, often sufficiently continuous to resemble strata, present flat even surfaces, and other superficial and linear appearances, by which the hasty or inexperienced examiner may be frequently deceived.

Water-worn pieces of limestone, among the earliest of the secondary class, were noticed in Ha-Ha Bay, and a singular trough-shaped mass, composed almost entirely of a grey carbon-

nate of lime, appears to have been taken from a trap rock situated in the first cove on entering the bay from the north; the length of the trough is about two inches and breadth three quarters of an inch; the sides are indurated, and of a dark brown ferruginous colour, bearing the aspect of having been in contact with trap. This trough is half filled with calcareous spar, the exterior of which is covered with a smooth yellowish silky film, as if water washed. Professor Cleaveland has the following passage, in his second volume of his System of Mineralogy and Geology, 2nd edit. :—" Real lava does without doubt sometimes resemble basalt, green stone and other trap rocks, but it may be considered as an universal fact that although calcareous spar is often found in green stone and basalt, it is never imbedded in those lavas which have actually flowed on the surface of the earth."*

Several soils collected by Mr. Proulx in different parts of the Saguenay, principally in the neighbourhood of Ha-Ha Bay, having been examined, were found to be as is shewn by the following table :—

| | | | |
|--------|--|--|--------------|
| No. 1. | Ha-Ha Bay | } A mixture of clay sand and lime, (marly clay) | } Excellent. |
| 2. | Ditto | | |
| 3. | Ditto | ditto | ditto. |
| 4. | Ditto | ditto (without lime) | Good. |
| 5. | Ditto | ditto ditto | ditto. |
| 6. | Near Riviere Pilet | } ditto and lime | } Excellent. |
| 7. | Between Ri- vers Chicoutimi & Dumoulin | | |
| 8. | Ditto | ditto | ditto. |
| 9. | Ditto | ditto, with vegetable matter | ditto. |
| 10. | Ditto | ditto, sand, clay and iron | Bad. |

* By the latter part of this sentence, which is somewhat obscure, we understand those lavas which have been ascertained positively to have flowed, because many geologists assume an igneous origin for all or most of the trap rocks.

| | | | | |
|--------------------------|---|---|-------|---------------------------|
| 11. Place not mentioned. | } | ditto | } | Light but tolerably good. |
| 12. Ditto | | | | |
| 13. Ditto | } | ditto, sand, iron, a little clay and vegetable matter | } | Indifferent. |
| 14. Ditto | | | | |
| 15. Ditto | | ditto | ditto | ditto. |
| 16. Ditto | | ditto | ditto | ditto. |
| 17. Ditto | | ditto | ditto | ditto. |

The rocks at the Post of Chicoutimi, like most of those we have described, are syenitic; the chapel stands upon a syenitic granite, passing sometimes into syenitic gneiss; this rock is traversed in a remarkable manner by veins of felspar and trap. The trap, however, is generally seen in broad bands forking into the adjoining rock, which is either syenitic granite, or syenite having its felspar greatly in excess. Weather acts more readily upon the trap than upon the granite, and in consequence many of the veins or dykes are partially empty near the surface. The same was observed in other places. To this cause are probably owing the numerous bays in the Saguenay, as trap rocks were more generally found where they occur, while syenitic granite and syenitic gneiss occupy its capes and headlands.† A few imbedded nodules of magnetic iron were observed in the rock. Sometimes the quartz is absent when it loses the term of granite, and maintains that alone of syenite, in which the felspar is red and the hornblende greenish black. There is on the shore below the residence at the Post a curiously contorted vein of trap which descends the rocky bank, as represented in plate 7, fig. 6.

Detached pieces of felspar of a very crystalline aspect and of a dark purplish grey colour were frequently seen upon the shore; the

† To this cause also may be attributed the unusual fact, that almost the narrowest portion of the Saguenay is at its entrance, where the rocks are more siliceous and less amphibolic.

the faces of the laminæ possessed a highly polished vitreous and striated surface. They have much resemblance to a felspar rock subsequently found to occupy a large proportion of the shore of Lake St. John, as also to specimens of felspar brought from the coast of Labrador, where they were observed to be associated with columnar and amorphous basalt. One fragment of a silicious limestone was also found. It appears that about twenty years ago lime was made at the Post, and the site of the kiln is shewn where specimens of a half-burnt limestone appeared. It is a very good compact shell limestone of a grey colour. Some of the burnt pieces were white, had a splintery fracture, and resembled chert or hornstone. If there be a natural deposit of limestone in the neighbourhood it could neither be heard of nor found; that in question might have been brought for the occasion from Malbay or St. Paul's Bay where limestone abounds.

It has been before mentioned, that a considerable alluvial deposit occurs here. It consists of fine marly clay, which in wet weather is so considerably plastic and adhesive, as to be traversed with difficulty on foot, when covered by no vegetable deposit. Its essential characters are the following: colour, light french gray—structure, earthy compact—fracture uneven. In water it falls to pieces rapidly and in acid it effervesces slightly. The undermost beds which are not exposed to moisture, assume the appearance of rocks stratified horizontally, and it is probably this formation which we observed, when within a few miles of the Post.

Upon crossing the Saguenay, opposite the Post, syenite and a rock composed of an intimate mixture of hornblende and felspar, the former in excess, were seen; the latter contained a few scales of mica and points of quartz: it was compact, magnetic, and more resembled basalt than any rock we had previously seen. The syenite was composed of flesh coloured felspar and

green hornblende. A few imbedded patches of trap were also seen. From the falls of Chicoutimi, a light coloured syenite was brought, composed of light red felspar and black shining crystals of hornblende. Mr. Nixon returned from a stroll up the river, on its right bank, with specimens of trap, traversed by veins of felspar, and a gneiss, in which hornblende was more abundant than either the quartz or the felspar, and to which the term hornblendic gneiss may be affixed : an aggregate of this description was rarely met with. The mean of two observations for latitude, gave 48. 24'. 9".

Leaving the Post of Chicoutimi, and its polite and gentlemanly resident, Mr. Andrews, on our route to lake St. John, a portage of nearly a league in length, was made to the Chicoutimi river, over the same syenitic rocks as those seen near the chapel, which are covered with a thin layer of the marly clay of the neighbourhood, surmounted by the usual vegetable deposit ; a good soil, but too near the rock to be very productive. The same soil, to appearance, and always accompanied by the same rock, at a greater or less depth, continues as far as the portage de l'Enfant, after which it becomes sandy and indifferent : some good positions for settlement may be expected in this interval. Although the rocks in many places are known to be near the surface, they were seldom seen, the land on either side the Chicoutimi river thus far being very little elevated. At the portage de l'Islet, however, they are much exposed to view, and consist of syenite, in which the felspar is as before flesh coloured, and very predominating. This rock has very little soil upon it and the whole of the portage is a barren waste. Before reaching the portage de l'Islet, the banks begin to assume a more elevated character and they continue to increase in height as far as lake Kenwangomi, on the southern shores of which lake, and that of Kenwangomichiche, they have attained an extreme height of from three hundred to four hundred feet. The next
portage

portage to that of Plslet is still more rocky, and on that account has obtained the name of portage des Roches : On a rounded mass of syenite in the middle of this portage, an observation for latitude was taken, which gave 48. 14. 31.

At the north western extremity of the portage des Roches, lake Kenwagomi commences. No opportunity occurred of examining any of the rocks upon this lake until we had advanced about two miles beyond Sandy Point, when a projecting point of rock afforded more specimens of syenite. A short distance beyond, a fine grained aggregate was met with, composed of gray quartz and gray felspar, slightly freckled by hornblende, of a greenish colour, the felspar being distinguished from the quartz, by the brilliant reflection of light from the polished faces of its minute crystals. Further on rocks were met with in which felspar of a flesh-red, dark grey and greenish colour was in great excess ; hornblende was also present, but in a very subordinate degree, chiefly in patches. The felspar was here in beautiful distinct crystals projecting from the rock, under its usual rhomboidal form ; these were easily detached, and their laminar structure readily exhibited by the slightest percussion. Magnetic iron was found in some parts of the rock, which strongly affected the compass : much of the hornblende was also magnetic. In one of the rocks here, a mineral was found, which possessed the following characters : colour, a dark greenish brown—opaque—structure indistinctly laminar before the application of heat ; occasionally the laminar structure is more distinct, and it then resembles mica.—When pounded in the mortar, small (four-sided?) scales are seen, having a semimetallic lustre. In its aggregated state, its lustre is glimmering and semi-metallic. It is slightly magnetic before the application of heat ; when exposed to that of a candle, it expands, opens like a fan and exfoliates, after which it is easily pressed by the fingers into small flexible but unelastic

scales of a bright golden colour. The same thing occurred, by submitting it to the exterior flame of the blowpipe, in which it also decrepitates and is difficult to be retained in the forceps. One of the golden coloured scales in the interior flame of the blowpipe fused into a shining black and highly magnetic globe. With borax it forms a transparent glass coloured by iron. The color subsides on cooling.

The rocks in this place have little appearance of stratification ; judging from the little which does appear, the bearing is north and south, and dip nearly vertical. The latitude was here found to be $48^{\circ} - 16' 22''$ and the approximate variation of the compass was also taken at the same time, viz : sixteen and a half degrees. Being very near the rocks at the time of the observation it was suspected that their magnetic character might affect it, but upon reversing the sights of the instrument upon the same right line, the slightest difference only was observed, which might have arisen from a small degree of inaccuracy in the compass.

Beyond this place a mass of rocks of a very blackened and singular aspect was observed on the northern shore of the lake ; and crossing over from the southern, a distance of about two thousand feet, we found these rocks to be almost entirely composed of yellow brown and greenish coloured felspar. In the solid scarp of one of these rocks, resembling that of a martello tower, it was easy, on a near approach, to perceive, notwithstanding its weathered surface, the pearly but subdued lustre of the felspar, and the fibrous aspect which the edges of the laminæ presented at the surface of the rock. The stratification of this rock in this place was not very apparent, but a little higher up on the same side it was observed to have a bearing to the north and dip at a high angle to the west.

The imbedded pieces of trap so common on the Saguenay, are again seen here. The land on both sides of Lake Kenwan-

gomi is elevated, but much more on the southern than on the northern. Its course, upwards from Portage des Roches, is at first to the southward of west, but its main course is to the northward of that point. Its length, numerous rocky capes and bays, and its precipitous shores, cause it to resemble the Saguenay, but its mountains are neither so high nor so barren.

About four miles above Sandy Point, a name which has been given to a low bank of sandy alluvium, stretching out into the lake from the northern shore, there is a dry green bay which appears to enter deep into the north shore and to be free from mountains and rocky precipices for some distance. It is the only place we observed between Portage de l'Enfant and that of Kenwangomi, where land fit for farming might be expected to occur in any considerable quantity.

The portage Kenwangomi is generally supposed to separate the waters flowing into Lake St. John (and subsequently into the Saguenay through Lake Kenwangomishish, La Rivière des Aulnets and La Belle Rivière) from those which pass more directly through the Chicoutimi into the Saguenay; but it is said that this is not, strictly speaking, the case, because a small stream falls from Lake Kenwangomishish into Lake Kenwangomi. Although unusual, this is not a physical impossibility, without indeed, as has been asserted, the waters of the latter are higher than those of the former. This portage is about eighteen hundred paces in length, the first half of which is sandy and the other a mixture of sand and clay. On the latter ash was observed for the first time, and it was frequently seen with elm and other woods, which indicate a good soil (though never in abundance) in our descent from this place to Lake St. John.

Shortly after embarking on Lake Kenwangomishish we touched at an angle of a rocky islet and found an aggregate composed of felspar, quartz and hornblende, a syenitic granite.

nite. The course of this lake is generally to the north of west. Its shores are low, interspersed with elm and ash and fit for cultivation, particularly the northern side. On Lake Kenwangomi the prevailing timber was white birch, and neither ash nor elm was seen. Although the immediate shore of Lake Kenwangomishish on its southern side is low, on retiring back from it the lands become ultimately as elevated as those on the northern shore of Lake Kenwangomi, of which they are probably a continuation.

The river of Alders, the outlet from Lake Kenwangomishish, flows through an alluvium composed of layers and mixtures of sand and clay. The course of this river is exceedingly tortuous, a circumstance often characteristic of these alluvial deposits, and being narrow it is much obstructed by fallen trees, and the entanglement and intertwining of the branches of alder, with which both banks are covered, rendering portages sometimes necessary where there is plenty of water and little current. The portage des Aulnets, however, is occasioned by the river tumbling over the rocks, which re-appear in this place. They are composed of flesh-coloured felspar, green hornblende, and a few scales of black mica, forming a beautiful syenite. The felspar on the surface of the rock was, as is usual, observed to be in an incipient state of decomposition. The soil examined in crossing the portages in descending the river of Alders was tolerably good. It consists, beneath the usual layer of vegetable matter which characterizes these woodlands, of clay and sand mixed, or in alternate layers, the latter frequently in excess on the surface. In some places the land is hilly, but few rocks are seen. At the north-western extremity of the Portage of Alders, a natural section affording the opportunity, a more particular examination of the soil was made and registered as follows:—1st. Decayed and decaying vegetation; 2nd. A layer of sand one foot six inches in thickness; 3rd. Clay

Clay from ten to twenty feet in depth, the whole resting on a rock composed almost entirely of grey felspar, in which were observed patches of hornblende. At this place the river of Alders forks in with La Belle rivière, passing over a picturesque fall occasioned by the felspathic rock before mentioned; the former river is only indeed a branch of the latter, which is observed to widen immediately after this junction from an average breadth of twenty to that of fifty feet.

On descending La Belle Rivière, the land was found to improve considerably in appearance, the same alluvial soil continued, but forming flat and low shores, unaccompanied by hills. Indicative of this improvement, ash, elm and poplar became more common. While on this subject, it may be observed, that although the presence of timber of a certain description may indicate good soil, its absence does not necessarily imply the reverse; for on this excursion, we met with several places in which the soil was, decidedly good, without finding it, and wherever found, it was always in subordinate quantity. On the marly shore of the Saguenay, in the neighbourhood of Chicoutimi, we saw none, and yet a better soil could scarcely be met with. To produce a growth of fine timber, something more is requisite than good soil; the land must be opened to warmth, light and air; it must be disencumbered of that heavy mass of decayed and decaying vegetation, with which our forest lands are loaded. If *apparently* under all these disadvantages, some lands produce good timber, it is only an exception, and no sufficient argument against what has been advanced, *particularly as such exceptions are probably owing to one or more of the favouring circumstances being in operation.* It should also be remembered, that good soils have a tendency of themselves, by encouraging a rank and dense vegetation of weeds and underwood, to check the growth of fine timber.

To judge of the quality of land by the growth of timber upon it merely, is to be guided by the effect, and to lose sight entirely of the cause ; a practice, the inconvenience of which, if generally adopted, would soon be felt in every department of science.

As the shores of lake St. John are approached, the soil gradually becomes sandy, until at Kouispigan, as the mouth of La Belle Rivière is called, it becomes one sheet of fine bright sand.

Leaving Kouispigan, we proceeded on lake St. John, to the northward, in the direction of La Grande Décharge, and touching at two small rocky islets on our way, collected specimens of a rock composed almost exclusively of a highly crystalline felspar, of a dark bluish grey colour, but in which a little hornblende was present. This rock was observed forming black isolated masses, both on the shore and in the water, on this side of the lake. Having encamped on one of these, at the entrance of La Grande Décharge, we had more leisure to consult the characters of this rock, which are as follows : it possesses no sign of stratification ; its surface is remarkably black, particularly when moistened, and often almost semi-metallic : it is frequently flat and tabular ; many portions of it attract the needle, although the eye can detect no magnetic iron ; its structure is compactly crystalline, in some cases passing into compact, but there are always to be seen some shining, often splendid faces of the laminæ, of which it is composed, and they are frequently striated. In many respects it bears a great resemblance to Labrador felspar, but its iridescence is wanting ; it is occasionally traversed by veins of red felspar, and rarely small portions of its surface were covered with a brownish red powder, probably an oxide of iron. One of the veins traversing this rock, exhibited a curious phenomenon ; the substance of the vein itself, composed of felspar and hornblende,

blende, was not magnetic—the sides of the vein composed of the felspathic rock we have described, were strongly so ; and Mr. Hamel further ascertained, that the south side of the vein attracted the north pole of the compass, and the north side the south pole. To remove the chances of error, the experiment was repeatedly tried, with success, both by applying the compass to the sides of the vein, and detached fragments to the compass. The vein was about three inches thick, and had a N. W. bearing. When the compass was laid on the centre of the vein, the local attraction was observed in one place, to be equal to ninety degrees ; in some parts of the same rock it was still more, even to a complete reversal of the needle : At a subsequent period, the place was again visited by Mr. Hamel in company with Mr. Nixon, and these observations confirmed. Upon our return home, the specimens which had been examined, were re-examined, and found to possess a feeble magnetism, but no polarity. The islet upon which the foregoing observations were made, forms one of a cluster at the mouth of la Grande Décharge, to which the name of Dalhousie was given ; none of them appear to be more than twenty feet above the water.

On leaving this place a northerly course was again taken until reaching a fine sandy shore, we landed for the purpose of measuring a base preparatory to a survey of the lake about to be commenced by Mr. Hamel. These sandy shores are very characteristic of the lake, and add very much in our opinion to its beauty, though nothing to its fertility. Where no rock appears, fine shining yellow sand is substituted, and where they appear together, the former rises through the latter assuming that isolated appearance which has been mentioned. This sandy girdle is not confined to the margin of the lake, but passes a short distance into the interior, bestowing upon the land forming the borders of the lake, an infertility of aspect which vanishes upon passing these sandy limits. The greater portion

of this sand is yellowish white, but a dark reddish brown variety was often seen deposited upon it in continuous ripples at different but parallel levels. On examining this sand it was found to be composed principally of magnetic iron and precious garnet. It is an analagous compound to the emery of commerce, and if reduced to a greater degree of fineness, might be employed for the same purposes. The rocks here were found to be the same as at the last place; they have externally often the aspect of old lead, and when broken the faces of the laminæ possess a lustre which is at the same time almost splendid and semi-metallic. Upon commencing operations, Mr. Hamel found between twenty and thirty degrees of local attraction, but in one spot, free from it, he determined the magnetic variation to be $16^{\circ} . 40'$ W. On these rocks *tripe de roche* is found in some abundance; it is of a deep copper brown colour, and agrees well with the drawings of it to be seen in the appendix to Franklin's quarto edition of his first Journey to the Artic Sea. When we first saw them they were mistaken for representations of some of the native copper ores which he met with among the copper mountains. To the taste it has the flavour of mushroom, and although meagre it is not unpalatable. The sandy beach here is enclosed by two rocky points, forming a bay about fifteen or sixteen hundred feet wide, the water in which shoals very gradually. A sand bank about fifteen feet high encloses this bay on the land side, beyond which there is a sandy swamp; and this is descriptive of much of the lake on this side.

On leaving this bay and proceeding again to the north, we doubled the rocky point, which was found to be composed of the same felspar before met with, as was also another we rounded soon after, situated at the entrance of an inlet up which we ascended mistaking it for the Koucouachime river, and where we found a very good soil consisting of a yellowish loam, about one foot six in thickness, resting on plastic clay. As the term
loam

loam, like that of marl, is often used without conveying any very distinct idea of what is meant, either to the person who uses it or to the person to whom it is addressed, we will here explain, that wherever it has been used in this report, it has relation to mixtures of clay and sand (the former in excess) generally coloured by iron, but containing no lime; in short an earth of which bricks are made. To avoid misconception, however, the term has not been often introduced. Mere deposits of clay are often called marls, by which an erroneous idea of a country may be conveyed; it should not be forgotten that the presence of carbonate of lime is necessary to constitute a marl or marly clay, which is known by its effervescence in acid; such a soil is of the best quality, whereas clays are proportionably infertile as they approach to a state of purity.

Returning to the mouth of the inlet, our northerly course was resumed, and several hundred yards of a coast, composed of rocky points, jutting out into the lake, and enclosing fine sandy beaches between them, were examined. This, as has been before said, is the character of the lake here. The remarkable uniformity and simplicity of the rocks, hitherto met with, are worthy of notice. We could only make the following observations which differ from what has been described—viz: kidneys of the rock, coated with the brownish red powder we have before mentioned, were seen imbedded in the rock itself; they were at first mistaken for pieces of magnetic iron—and a bed or broad vein of compact felspar, of a light yellowish green colour, was seen traversing the rock, contrasting strongly with its dark associate. It differed from those minerals which it most resembles, by yielding to the knife and fusing before the blowpipe, into a white blebby glass, like the rest of the felspars. The surface which had been exposed to the atmosphere, was decomposed, carious and of a reddish or yellowish white colour. An observation for latitude was here taken, and gave 48°.-37.-59".

ON

On leaving the mouth of the Koucouathime river, which is situated about one mile to the north of the place of our last observation, a fine sandy shore marking the interval, our course was north west ward to the northernmost point of Koucouathime Bay, where the shores begin to be swampy ; but sandy beaches were still occasionally observed, with partial deposits upon them of the same admixture of garnets and magnetic iron before mentioned. Putting on shore in one place we observed low parallel ridges of this sand several inches in width and depth, giving a character to the spot. Embarking again the same course was followed, and the shores became lower and more swampy as we advanced, indeed there appears to be very little difference of level between the lake and the land. In this portion of the former, and from one to two miles from the shore, you are surprised to find no more than three feet of water. This extreme shallowness is common to the lake (the depth of which in no part of it bears any proportion to its extent) and is the cause of the sea-like turbulence its surface assumes after the least wind, occasioning a violent ground swell and lofty breakers, to which, at a distance from the shore, the hardiest *voyageur* is frequently unwilling to expose himself. Upon placing the hand in the water on these occasions it felt very decidedly tepid. This shallowness and unusual temperature, by occasioning a more rapid evaporation, may account for a fact which it might otherwise be difficult to do, viz : six tolerably large rivers and several smaller ones fall into lake St. John, while only one of moderate dimensions runs out of it.

Continuing a northerly course the mouth of the Peribonea river was reached, where the latitude was found to be $48^{\circ}42'37''$, and this was the greatest that was made on the lake.

In about three hours after leaving the Peribonea river we reached a bay, at the bottom of which we encamped, and found

a considerable deposit of a very fine admixture of clay, silex and lime (an excellent marl) underlying the sand. Finding deep water close to the shore, and a current setting from the northward out of an angle in the bay, it was conjectured that the river Mistassiny lay in that direction, which proved to be the case, and another observation of the sun's meridian altitude having been taken at its mouth, gave for latitude $48^{\circ}38'55''$.

Ascending the Mistassiny a short distance, the land though sandy appeared to improve, but neither here nor in any part of the lake, nor in the whole of the country we traversed was very good timber, remarkable for its abundance, perceived. Reasons have already been advanced for not considering the absence of fine timber as any proof of a bad soil.

On leaving the Mistassiny we proceeded to the Assuapmousoin on a southerly course. On crossing the mouth of this river we encountered a violent tempest; there was however no danger being near the shore and in shallow water. Upon the tempest abating we landed and encamped. Here we again fell in with rocks which had entirely deserted us since we left the bay to the southward of the Koucouathime river; they are of a different formation, and consist of clay-slate and fetid limestone in conformable strata. The clay-slate which was first met with is composed of an indurated schistose clay, exceedingly fissile, and assuming many of the characters of roofing slate. It occurs on the shores of the lake, and dips beneath its waters to the N. N. W. at an angle of 25° . The laminæ of the clay-slate are parallel to the planes of stratification, which is probably the cause of the extreme fissility of the rock in that direction; but perpendicular to these planes, or nearly so, are others which serve to perplex the examiner when wishing to ascertain the bearing of the stratification of this rock; however their want of continuity and particularly the conformable position of the clay-slate with regard to the limestone, remove the difficulty.

The

The surface of the rock is strewed with its weathered fragments, which exhibit no other change from the rock itself than that weather has rendered its fissile character more apparent; these fragments when slightly struck on their edges break into smooth rectangular slates. Solid slates five feet long, one foot wide, and one or two inches in thickness are seen; fragments of this description are very sonorous when struck.

After traversing this clay-slate for about one quarter of a mile, the fetid limestone before-mentioned was met with *underlying* the other conformable strata. Much of this limestone contains fossil organic remains, chiefly corallites and encrinites; productæ were also seen, and a singular fossil similar to a variety found in Drummond's Island, Lake Huron, of which there is a drawing in the sixth volume of the Geological Transactions, plate 30, fig. 5, from which that in question appears to differ chiefly by having the disks of which it is composed obliquely set on, whereas in the figure alluded to they have a rectangular position. That from lake St. John also tapers more than the other. The cross fracture exhibits a structure which is partly compact and partly laminar; the former appears to prevail towards the parietes, and to be composed of chalcedony or of a carbonate of lime passing into chalcedony; the latter occurs towards the centre, which is a calc-spar. Between the two there is also perceived a tendency to the formation of agate, chalcedonic rings and curves being distinctly visible. Sometimes the centre has nothing of the crystalline aspect whatever, but shews a rounded spot of a reddish-brown and opaque substance, apparently of the nature of the imbedding rock, which is a dull fetid limestone of a dark colour, and full of fossil remains. Close to the one here drawn, but at the back of the specimen, there is a producta. This character of becoming siliceous is common, but in a much greater degree, to the fossils from Drummond's Island, Lake Huron, with the species of which those found on
 Lake

Lake St. John appear to correspond. The fossils however of the former are not only more siliceous, but the limestone itself in which they are embedded has been in some places metamorphosed into a chert or hornstone.

For the accompanying very accurate drawing of this fossil, (pl. 8,) we are indebted to Lieut. Ditmus, 66th Regt., ample justice to which has been done by the engraver, Mr. Smilie.

This limestone appeared to be separated from the clay-slate *above* it by a thin black shaley calcareous stratum, full of short undulations and rounded concavities occasioned by corresponding projections and spherical knobs in the limestone. These knobs or balls could sometimes be detached, and were found to be composed of a very compact dark grey limestone, having a glimmering lustre arising from the reflection of light from a few crystalline points, and a *water-worn* aspect. In these no vestige of organic remains could be perceived, although a slightly fetid odour indicated their presence originally. The stratum of limestone in which they were imbedded appeared equally free from organic remains, but was of a more earthy texture. The thin black shaley stratum is itself a limestone, as its free effervescence in acid declares, but it appears to contain much clay and to be passing into clay-slate. The position of these balls we conceive is corroborative of the inferior level of the limestone with regard to its planes of stratification.

It is with much hesitation that we have ventured to state our opinion that secondary limestone here underlies clay-slate, because we know that such a position, if not altogether new, is at least of very rare occurrence. But as our province is to describe and not to theorize, we should have advanced still more improbable suppositions if, after the same unprejudiced research, there had been cause in our opinion to entertain them. The knowledge of natural history is very little likely to be extended if her votaries restrict themselves in their reports to what the
exist-

existing knowledge on the subject may render probable. Having taken the trouble to examine, if an opinion be advanced (with humility proportioned to the degree of information) which is strongly opposed to experience, no censure is justly due though it prove erroneous. Some beautiful specimens of encrinal marble of a fawn colour are found here which would polish well and prove highly ornamental.

The limestone continued in visible strata for above one hundred and fifty feet, after which it appeared only in angular fragments for about a mile and a half further, when it again was seen in regular strata, forming a projecting point in the lake, the intermediate portion of the shore being characterized by a numerous collection of boulders consisting of granite, trap, mica-slate and angular fragments of clay-slate. Having seen no mica-slate before while in the Sagenay country, we may have mistaken trap for it, the pseudo-metallic lustre of which, as we have before said, causing it often to resemble that rock. Two or three semi-rounded masses of the felspathic rock near La Grande Discharge were also seen.

The stratification at the above-mentioned point is obscure, but it appears to dip gently to the east. Much of the limestone had a very conglomerated aspect, or at least it appeared to be made up in a confused manner of pieces of itself, though no distinct imbedded fragments were seen. It contains imperfect fossil remains of corallines and orthocera.

Proceeding beyond this point the shore became gradually crowded to excess with fragments of various rocks principally of limestone. Rocks under the form of boulders were also very common, and as before, angular pieces of clay-slate. The number of these boulders, generally about the size of the head, rendered our walk over them painful in the extreme, the beef-skin mocassin being by no means a sufficient protection in these cases to the foot unaccustomed to wear it.

Embarking and crossing over to a cliff about thirty feet in height, called Pointe Blue, it was found to be composed of the same fetid lime-stone in distinct horizontal strata. Organic remains are found in this rock, but they are generally indistinct. Embarking again for the south-eastward, the limestone was observed to continue on the shore, and at another point resembling Pointe Blue it forms a similar precipice on the lake. A little beyond this we put on shore, and found the same limestone forming a low beach. A cedar was measured here the girth of which was twelve feet, it was, however, by no means characteristic of the place, although the soil appeared to be much improved since meeting with the lime-stone and clay-slate, a circumstance that was to be expected. At the bottom of a bay beyond this place the same horizontal lime-stone forms the shores and bed of the Little or Ouitchouanitch river which, as a rapid here falls into Lake St. John.

Running once more to the south-eastward we encamped on a bare limestone point opposite L'Isle des Couleuvres. Some of the *voyageurs* had the greatest disinclination to visit this island on account of the number of snakes which were reported to exist there, and many wonderful stories of their forming festoons, knots, and lying together like a string of sausages, were told; but after traversing the whole island one shrivelled skin only was seen. Pears too (probably under the guardianship of the snakes) were said to be abundant with equal foundation. The shores to the north-westward were abundantly strewn with many fragments of corallines, among which we recognized caryophylliæ, chain coral, madrepores, retepores, millepores, and particularly that corallite so much resembling a bee's hive, and called favosite. The varieties of caryophylliæ resembled those to be seen in the sixth volume of the Geological Transactions. Some of the madrepores might easily be mistaken for the fossil eye-teeth of some animals, but their internal radiated structure

distinguishes them. (*turbinolæ* ?*) All these fossils have been probably washed up from the bottom of the lake, the island being apparently a mere sand bank. There is another island near it which, judging from description, is probably composed of clay-slate.

On leaving the former island we stretched across to the main, and entering a bay reached the mouth of the Ouitchouan, where another deposit of clay-slate was noticed. This slate differs from the other in the following particulars:—the strata are horizontal or nearly so—it is not observed to be here associated with any other rock—its weathered surface is white, whereas that of the other is black.—it effervesces in acid very slightly, and contains slight traces of organic remains, neither of which characters was observed in the other—it is in greater abundance and more easily quarried.

A person unacquainted with the deceptive appearances which rocks sometimes assume, would without hesitation pronounce this rock to be horizontally stratified, and in our judgment he would be correct; but there are other surfaces which have a parallel arrangement among themselves, and which might easily be mistaken for planes of stratification, particularly as their position is vertical and one which agrees better with the high dip the clay-slates so generally exhibit. However upon a closer examination of these planes they are found to suffer constant interruption and not to be continuous. The horizontality of the strata being here assumed as the fact, of which we entertain no doubt, the laminæ of the clay-slate are as before parallel to the surfaces of stratification. This rock is divided often, owing

to

* We have seen specimens from Drummond's Island, Lake Huron, the structure of which is nearly as compact as ivory, owing to the infiltration of siliceous particles into the original interstices of the coral. This, together with their yellowish white fractured surface, render the denticular resemblance still more striking.

to these counterseams, into cuboidal masses and longitudinal frustra of pyramids, the latter sometimes resembling the blade of a stiletto. Whether you strike the rock on the edges of its laminæ or across the surface, a fracture in the direction of these laminæ is effected, accompanied of course in the latter case by the cross fracture. Above and in immediate contact with the clay-slate, is a remarkably fine bed of compact marly clay, to which cause the slight effervescence of the former is probably owing. Fragments of clay-slate are abundant on the shore in this place, and those of any other rock are rare. The latitude of the Ouitchouan river at its mouth was determined to be $48^{\circ}-243-5''$.

Between the Ouitchouan and the Post of Metabitchouan we observed the same formation to continue for a considerable distance, beyond which we again came upon the limestone, possessing the same characters as before, but dipping to the northward at an angle of 45° . This appears to be a further corroboration of our opinion, and to infer the additional conjecture that the two rocks alternate with each other, otherwise the limestone must suffer a violent contortion to appear in the interval, between the two deposits of clay-slate, in horizontal strata at nearly the same water level, as has been described.

This alternation with fetid limestone suits the habits of the shales far better than those of the clay-slates to which they sometimes bear a striking, and to the eye an indistinguishable, resemblance, a fact which is remarkably exemplified in the present instance if this rock should prove to be a shale, which, after consulting its mineralogical characters, we are strongly of opinion it is not, although it cannot be concealed that the case appears a doubtful one. That the reader may be better able to form his own opinion on this point we here introduce those characters:—Colour, brownish black—opaque—structure really schistose, but apparently compact—cross fracture, uneven,

some-

somewhat conchoidal—hardness about the same as clay-slate—color of powder and streak, reddish-odour slightly bituminous when struck—specific gravity 2.4. In water its surface is covered with minute bubbles, *but it neither falls to pieces in it nor derives additional weight even after a long immersion.* A specimen from the last-mentioned place effervesces very slightly in acid, a character which is supposed to be owing to the proximity of the marly clay. Before the blowpipe it fuses readily into a globule of glass, having a dirty green or brown colour. Experiments alone can determine whether this rock is calculated to answer the purpose of a roofing slate; this must depend upon its possessing a requisite degree of fissility, and upon its power of resisting the action of the atmosphere: our opinion upon both these points is favourable, but it is only derived from a hasty view of the quarry. With regard to our geological dilemma, without wasting more time in the attempt to reconcile apparent contradictions, which a more intimate acquaintance with the *locale* would probably clear away, we will continue to relate facts. The limestone at the last-mentioned place forms a bluff precipice on the shore of the lake, and contains corallites, encrinites and productæ. The encrinites were as before in a fawn-coloured variety, well calculated for an ornamental marble; some of it has the conglomerated aspect before described.

Pursuing our route, we reached the post of Metabetshuan, which we found by observation to be in latitude $48^{\circ} . 23' . 11''$. Like the Post of Tadousac, that of Metabetshuan is situated on an alluvial bank, though differing in the materials which compose it. It is here a soil in which clay predominates, but contains sufficient sand to give it fertility. Boulders of the rocks of the neighbourhood, and among them water-worn fragments of the secondary limestone we have just described with their imbedded fossils, are frequent. The fossils are generally of the same class as those found on the Manitouline chain of islands

in Lake Huron, and have been mentioned. The most remarkable of the fossil remains we saw, was a trilobite (entomolites paradoxus of Linnæus.) (See, plate. 9) It is believed to be one of the largest that has ever been seen, and is deserving of notice, belonging as it does to a class of animals with which naturalists are totally unacquainted, and of which Parkinson says, "We must content ourselves, I believe, with allowing that no animal resembling it is known." It is supposed to be a species of crab. A drawing of the same animal, though not precisely of the same variety, may be seen forming the frontispiece to the 3d edition of Bakewell's "Introduction to Geology." Although the trilobite is very characteristic of the limestone in the Lower Province, it is the small species; no other gigantic specimen has been noticed; Dr. Bigsby, however met with it on Lake Huron. Some sections of the pigmy trilobite (if such an expression may be allowed) from Beauport and Montmorenci, bear a strong resemblance in form to moths. We have in our possession an organic remain from the latter place, which appears to represent a trilobite inserted in the siphuncular cavity of a small orthoceratite. If this conjecture be correct, it is worthy of attention, because it agrees with the known habits of the crustaceous tribe of animals which seek their food by entering into shellfish. Univalves have been brought up to Quebec from the Gulf of St. Lawrence, in which when partly mutilated, may be seen small crabs that have probably perished in an ineffectual attempt to retreat. A suitable punishment that should await all murderous intruders who steal upon the privacy of others, whether their object be to destroy life or to kill time.

The accompanying copper-plate impression is by Mr. Smillic, from another accurate drawing with which we were favoured by Lieut. Ditmus. In both cases the engraver had also the advantage of consulting the specimens.

This trilobite is upon very schistose limestone, of a dark grey color internally, and yellowish white weathered surface. The fragment in which it was found is angular and detached ; it had been used as a stepping stone to one of the outhouses at the Post, and probably had been brought by the ice to this shore from a place on the lake about three miles to the westward, where we found a limestone very similar to it, having a variable dip to the northward of from 10° . to 45° . and underlying a very schistose black limestone containing the impressions of small terebratulæ, and giving out a very fetid odour when struck. Although schistose in the large, this latter rock was very compact in the small, and would probably afford beautiful black slabs of marble. The schistose character, together with its black color, might occasion it to be mistaken for clay-slate, particularly as we have before described that rock as holding a similar position with regard to the limestone ; but that position itself, the violent effervescence of the rock in acid, its imbedded organic remains and fetid odour, remove all doubt on the subject. The fawn coloured limestone was again observed here ; it appears to be in considerable abundance. A large angular mass of white laminar marble was seen upon the shore ; the rock itself must be near but probably at the bottom of the lake, from whence the mass in question has been thrown up.

From the Post of Mitabetshuan, conceived to be the most southerly point of the lake or nearly so, the River Peribonea, about its most northerly point, bore north—La Grande Decharge, N.E., and nearest point to the eastward, E.

We ascended the Metabetshuan River a short distance as far as some rapids ; the right bank or that to the eastward, was found to be composed of a mixture of clay and sand, forming an alluvial ridge from fifty to eighty feet high. The western side of the river is low. Wheat, barley, oats, kitchen stuff of various kinds, cucumbers and melons, grow here to perfection ;
neither

neither soil nor climate can therefore be bad. Having broken the thermometers in the early stage of our journey, all our reports are deficient in thermometrical observations. Judging from our feelings and the agricultural facts above mentioned, there appears to be no difference between the climate on Lake St. John and that at Quebec. Mountains bound the view to southward of the Post, and at no great distance among these, we heard that a large deposit of a mineral, which from the description given of it, must be steatite or soapstone, is found. It probably marks the primary character of the mountains in which it occurs; near them the junction of the primary and secondary rocks may be expected to take place. We did not see it, for the clay-slate, although usually a primary rock, is here, by its alternation with fetid limestone, evidently of the transition or secondary class.

After crossing a turbulent sea, we arrived once more on our way back, at the mouth of La Belle Rivière, having completed the circuit of Lake St. John.

Before we take leave of this lake, we will here introduce a few remarks upon the general fertility of the land in its neighbourhood, which have occurred to us as explanatory of the cause of it.

When first the reports* of the House of Assembly respecting the Saguenay Country came under our observation, we were at a loss to account for this fertility. We imagined Lake St. John and the surrounding country to be, as it really is, a large basin, of which the lake is the lowest portion, with rivers running into it from all points of the compass save one, and bearing

* With regard to these reports, it is only justice to say, that after having attentively examined them, we think they are as creditable to the individuals who collected them as they are to the persons from whom they were obtained. We have, generally speaking, found them to be correct, and it will be seen that the latest reports rather confirm than afford any new information respecting the fertility of the soil and its capabilities for settling. Both Mr. Tasche's and Mr. Panet's plans also, considering they are mere sketches, are very faithful.

ing with them the drainage of the lands they traversed. Supposing these lands to be composed almost entirely of rocks of the most infertile characters, such as granite and gneiss or aggregates in which silex abounds, they could not be looked to as the sources of the fertility in question. In this dilemma the action of a violent deluge was had recourse to, which by bringing soils from distant quarters, had accumulated here the materials of future fertilization. With this impression, we visited the country. It was found to be composed, instead of granite and gneiss, for the most part of rocks which, however infertile some of them may be as such, are made up of minerals almost exclusively, the decomposition of which furnishes the best soils; such are syenite and trap rocks. On casting our eyes over the fine alluvial soils which characterize the country about Lake St. John and Chicoutimi, they exhibited no indication of the action of a violent deluge; on the contrary, they were found to be composed of the finest particles, which could only have been deposited in quiet waters.

On visiting Lake St. John, we found a rock forming a large portion of the shores and of its neighbourhood, the decomposition of which forms the finest clays. A little farther on the same lake, clay-slate and limestone are found to occupy a still larger portion, the former rock almost always associated with fertile soils furnished by its desintegration, while the latter, with few exceptions, need only be named as forming a portion of any country, to convey at once the fertility of that portion.

Examine the limestone: you find it the depository of the exuvizæ of animals, tenants only of the ocean which now form a part of almost every one of its generally horizontal strata. The inference is obvious:—they and the limestone have been deposited here together, when Lake St. John and the surrounding country were covered by the sea; and it is almost equally obvious

obvious to us, that the fine clays and marls, in which this country abounds, are the washings of the decomposing rocks, which, being first suspended in the water as an impalpable powder, afterwards subside at the bases and on the gently sloping sides of the rocks from whence they are derived.

Mr. Nixon, upon his return, kindly furnished the following specimens of Rocks and Earths, with the information as to where they were procured :

ROCKS.

No. 1.—Of felspar alone, similar to all the rocks from the Grand Décharge to Koucouathime river.—From the second rapid on the Peribonea river this specimen was taken, and Mr. Nixon describes the same rock as extending from the foot of the first rapid to the foot of the third fall, forming rocky banks on both sides ; what soil there is in the distance is sandy. This rock was traversed by a vein of granite, the felspar in which was in large crystals and greatly predominating.

2.—A detached mass of magnetic iron near No. 1.

3.—Like No. 1—From the great falls on the Peribonea.

4.—This is an equable mixture of hornblende and felspar, the latter having a glandular arrangement in the former bearing some resemblance to porphyry. In naming rocks composed of hornblende and felspar, we have invariably in this report called those traps in which the former mineral predominates, while the term syenite has been restricted to those in which the felspar is the most abundant mineral. In the present instance therefore in which there is no predominancy of either, both terms are equally applicable, but we have chosen that of trap because the felspar in it, by its resemblance to quartz, bestows upon the specimen in question a character of coincidence with the

trap we have described, which character is wanting in the syenites—From David River.

- 5.—A mixture of hornblende and felspar, the former predominating—consequently a trap—from the falls of the River Ouitchouan, two hundred and thirty-six feet high, according to Mr. Bouchette.
- 6.—Similar to No. 1.—From La Petite Décharge—a vein of white felspar traverses this rock.

EARTHS.

- No. 1.—A mixture of sand, clay, vegetable matter and iron—The sand in excess—indifferent soil—River Peribonea.
- 2.—The same as No. 1—with little or no iron—R. Peribonea.
- 3.—A loam or brick earth—good soil—Lake Nohaduito—taken from under the vegetable matter.
- 4.—Sandy bad soil laying beneath No. 3, a foot deep and resting on No 5.
- 5.—A good marly clay—same thickness as No. 4, and resting on No. 6.
- 6.—An excellent marly clay.
- 7.—A fine dark vegetable mould, twenty paces from the edge of a rivulet running into Lake Nixon.
- 8.—Mixture of clay and sand—tolerable soil—do.
- 9.—Sand, clay, vegetable earth and iron—light and sandy—do.
- 10.—Ditto ditto ditto—River Baddeley.
- 11.—Sand and vegetable earth—poor soil—ditto.

Upon reaching Tadousac, on our return home, its latitude was made, $48^{\circ} . 6' 35''$ —and immediately afterwards we entered the St. Lawrence, on our way to St. Paul's Bay, passing Pointe aux Bouleaux, of which some account was given

in the early pages of this report. Between Pointe aux Bouleaux and Echaufaud des Basques, nearly isolated masses of what was considered to be granite, were seen; they are shaped like a dome or rounded hay-cock, but generally the outline of the mountains on the coast, did not differ materially from that of the Saguenay; the former are not however so precipitous. Having landed at Echaufaud-des-Basques, the predominating rock was found to be syenitic granite, in which trap was observed, forming dykes or veins. A vein composed of red felspar, quartz, hornblende and magnetic iron, traverses this rock. Flesh red crystals of felspar, and white masses of quartz, forming large distinct concretions, were seen under the same circumstances. From a detached mass of syenitic granite, large kidneys of a fine black hornblende were taken, and also a beautiful specimen of light blue felspar having the lustre of satin.

The surface of the rock here, was observed to have the same baked and porous aspect as before described. This appearance is not in all cases confined to the surface. A specimen brought from Ance-aux Femmes, in the Saguenay, has been already described, as possessing the character of porosity, both internally and externally, in so perfect a manner, as to be a fair sample of a mill-stone.

It would prove a mere repetition to be as circumstantial in our description of the rocks, on the north shore of the St. Lawrence, between Tadousac and Mal-Baie, as we have been between the former place and Chicoutimi—We will therefore confine ourselves to a few remarks which will embrace those striking or important differences observed.

Though trap was occasionally seen, forming dykes, veins and imbedded pieces in the predominating rock (a syenite, syenitic granite, or syenitic gneiss,) no rocky masses of it, whether stratified or unstratified were perceived. It is not meant to assert, however, that they may not be found, but only to imply, that they are by no means so common as in the Saguenay

Saguenay river, particularly in that portion of it between Chicoutimi, and La Buole, from the last of which places, towards the mouth of the Saguenay, the rocks become more quartzose and less amphibolic or hornblendic, and pass from trap and syenite into syenitic gneiss and granite. To this latter cause may be attributed the comparative narrowness of the river at its entrance.

As Mal-Baie is approached, the rocks are observed to be crowded with veins of trap, felspar, quartz and granite, to an excess. These veins are generally parallel to each other, frequently contorted to a degree that is scarcely credible. In some places they are absolutely countless, and being composed of different coloured minerals, as white quartz, black hornblende, red felspar, &c., they bestow on the rock at once a singular and beautiful appearance, to which an artist alone could do justice, as it is totally beyond the power of description to convey.

It is worthy of observation, that the granite veins which have been described as traversing the rocks, both in the St. Lawrence and Saguenay rivers, were found to be composed, whenever examined, of large flesh coloured crystals of felspar, large pieces of grey or white quartz, and mica in hexagonal plates, about the size of a farthing, the whole forming a variety of graphic granite, differing widely in appearance from those fine grained granites, which have been described as occurring in apparently stratified masses in the Saguenay and elsewhere, and among the constituents of which it is often difficult to say whether mica or hornblende is to be ranked, or whether they are not both of them present, the small black specks disseminated through the aggregate, resembling either of those minerals. The plates of mica in these veins, were "few and far between:" the rarity of this mineral in the rocks under description has been before alluded to.

A number of recent shells principally echini or sea-eggs are found upon the rocks, and sometimes at an elevation, to occa-

tion a false inference to be drawn as to the height of the spring tides. These are probably brought by birds, as the elevated position they occupy, is far beyond the reach of any tide in the St. Lawrence.

On entering Mal Baie, a rock was observed, forming a long precipitous scarp, which had the appearance of being horizontally stratified. It is of a greyish colour. This we afterwards found to be a limestone and is the same that Dr. Bigsby describes as a calcareous conglomerate full of organic remains, and having gneiss and mica slate abutting against it.

Partaking of the well known hospitality of Mr. and Mrs. M^cNicol for one day, we had leisure to examine some of the rocks in this place, which are particularly interesting, as it is here that the primary and secondary formations occur together. On the shore near the house we observed black fetid limestone, and we believe gneiss, but this spot was not particularly examined. Crossing a bridge over the Mal Baie river, we proceeded across an alluvial ridge, towards Dr. Fraser's house on the eastern side of this bay. Pursuing our walk on the shore, and down the river, we first came again on the black fetid limestone observed on the other side of the bay. Then examining a block which had fallen from the precipice above (the same noticed on entering the bay) it was found to consist of an indurated limestone of a greyish colour and the conjecture before entertained respecting its horizontal stratification was confirmed. It forms a perpendicular scarp, perhaps one hundred and fifty feet high. Beyond the black fetid limestone, micaceous schist was met with, for the first time, containing veins of quartz, sometimes of a slight rosy hue, and common garnets. We saw none of the beautiful foliated garnet, which is known to occur in this rock. The dip of the mica slate is gently to the west. Continuing our walk, we came upon a rock, which appeared to consist of stratified masses of pure quartz; after which we met with syenitic gneiss. All the baser edges of these rocks, from the black limestone downwards, crop out on the shore, in conformable strata,

the dip of which is to the westward. Between the horizontal limestone, which lays over the basset edges of these rocks, and the black limestone, a sort of calcareous sandstone is observed, of a light green colour possessing the compactness of fine grained grey wacke. We do not remember to which of the two rocks it is conformable, but believe it is to the uppermost; its effervescence in acid is slight.

Mal-bay and its neighbourhood have long been remarkable for the frequency of earthquakes; it was not probable therefore that we should omit to make enquiries respecting them, connected as they are with the subject under examination. Through the politeness of Mr. and Mrs. McNicol the following information was obtained. Shocks are most frequent in January and February; their direction appears to be northwest; the duration of the movement is about one minute, and notice of the coming motion is generally given by a noise like a chimney on fire, sometimes accompanied by two distinct blows. The weather is sometimes sultry, previously at others, cold; in the former case, the weather becomes cold after the shock, and in the latter, mild: in short, it is always accompanied by a change of weather. They occur about nine or ten times a year, and are more generally observed in the night than in the day. When they happen in foggy weather it clears up subsequently. About thirty-six years ago shocks were much more violent. Dr. Fraser of Malbay, to whom this account was shown, agrees generally with it, but thinks the number of shocks annually underrated.

Mal-Bay or, Murray Bay, as the inhabitants prefer calling it, enters deep into the north shore, and the greater proportion becomes dry at low water. The land which encloses the bay is rather elevated and rocky, but between it and the high water-mark on the western side, there is a flat or gently undulated alluvial soil. The character of most of this is sandy, but that on which Mr. McNicol's farm is situated is of a superior description, composed of clay, sand, and probably lime
derived

derived from its vicinity to limestone. We were informed that the general character of the soil improves on advancing into the interior, and that a broad fertile valley similar to the one which accompanies the St. Paul's Bay River, and with which it is connected by a cross valley, also accompanies the Mal-Bay River in rear of the settlement. Walking through the fields at the back of Mr. M'Nicol's house, we observed several small cone-shaped hillocks from fifteen to twenty feet high composed of alluvial soil, which from their form and isolated appearance were supposed to be in some way connected with the cause of the earthquakes.

Availing ourselves of the high tide we left this bay, but were detained a few hours at its westernmost point by the roughness of the river. This interval was occupied in examining the limestone rock of which the point consists. Like that on the eastern side of the bay it is one of the oldest of the secondary class, and contains numerous organic remains, principally orthoceratites. The weathering of the rock exhibits many longitudinal sections of these fossil multilocular univalves, giving them something the appearance of fish-bones for which they have been mistaken. It is well known to those who interest themselves on the subject, that the fossil corallines of the *genus huronia*, of which there are some beautifully correct drawings among the plates to the sixth volume of the Geological Transactions, bear a remarkable resemblance to vertibræ, so much so as to have deceived professional men; of these however we saw none. Some of this limestone is of a very siliceous character and appears to pass into sandstone; some again is conglomerated, and holds imbedded rounded fragments of white quartz; in this the fossil organic remains appear most to abound. In the upper portion of this limestone there is a small cavern into which you may descend for a few yards. The sides and roof are in many places coated with a white incrustation, having none of
the

the crystalline aspect of stalactite, but softer and more resembling analogous appearances on the roofs of old brick or stone arches. This cavern descends very rapidly, but we were soon arrested by its narrowing suddenly to a mere crack, through which however the boy who accompanied us said he had passed, and found that the cavern on the other side becomes more spacious, but his fears would not allow him to investigate further. This part of the passage might be excavated at a trifling expence, which might be fully repaid by the extent, beauty and singularity of appearance which these caverns often present. Dr. Fraser has been spoken to on the subject, from whom more information is shortly expected.

The shore between Murray Bay and St. Paul's Bay is by no means so precipitous as that between the former place and the mouth of the Saguenay, although it gradually retires back into lofty hills, over which, on account of the crowded state of the canoe, Messrs. Bowen and Goldie passed. They describe the road as one continued succession of abrupt rise and fall. Some rocks, the surfaces of which are white, were observed forming much of the shore, but as we did not touch them, it remains doubtful whether they were felspathic or limestone. Beyond these, a black rock, traversed by veins of white calcareous spar, was seen; probably the transition limestone of some authors, and the same as that observed at Murray Bay.

On passing Les-Eboulemens, we looked in vain for the cause of that part of the country being so called; Isle aux Coudres also, which Charlevoix represents as having been detached from the main by a violent earthquake, exhibits no other character, on passing, to indicate such a catastrophe, than a whirlpool between it and the main, which at low water becomes dangerous for boats, and canoes by the risk they run of being thrown by it on the limestone rocks to the right of the entrance into St. Paul's Bay: appearances indicating some event.

event of the kind are said to be seen, however, in many places on the shore between Port au Persil and St. Paul's Bay, such as the roots and trunks &c. of prostrate trees, being covered with soil and loose masses of rock.

The limestone mentioned last is of an excellent description; it occurs in dark compact strata, dipping to the westward at an angle of about 45° . It has all the appearance of being an excellent building material, in great abundance and easily quarried.

At the entrance into St. Paul's Bay, the mountains which form the back ground have a very picturesque appearance, rising in cone-shaped peaks and in alpine ranges; they are, however, not very elevated.

It is not perhaps generally known that there exists highly respectable evidence of a volcanic eruption having happened somewhere in the interior in the rear of St. Paul's Bay. No one we think will feel disposed to doubt the fact after perusing the following account of it with which, through the politeness of Mr. Gagnon and Mr. Chaperon, we have been furnished. It is the former gentleman who writes:—

“ Au deficit du journal que se trouve ecarté, daignez recevoir ce que suit :

“ Samedi, 6 Oct. 1791, à la Baie St. Paul, et autre lieu circonvoisin, vers les sept heures et quart du soir, se fit sentir un fort tremblement de terre : toute la nuit fut troublée par de petits repetés, et entre par un tremoussement courant dans l'est. Les quarante et un jours suivans tremblèrent, depuis deux coups jusqu'à cinq par jour. Le Lundi 8 Oct. fut d'un bon tiers moins fort que le premier (du 5) les autres furent que des petits, ou brouissemens ; le tems toujours obscur. Avant la nuit du 26 au 27, je n'avais pas encore remarqué d'éruption de fumée épaisse, par fois ondoyante de flamme ; la temperature a $7\frac{1}{2}$ heures du soir était à 11° au dessous de zero du thermo-

metre de Reaumur (plus $7\frac{1}{4}$ of Fahr.) et le lendemain au matin à $6\frac{1}{2}$ heures la chaleur se trouve montée à 21° (plus $79\frac{1}{4}$ of Fahr.) Deux montagnes près de ma demeure ouest-quarante quelques degres-nord laissent un passage à la vue entre elles pour laisser voir loin. C'est par cette passe que je vis une continuelle eruption, mêlée de fumée et de flamme, qui jetoit fort sur l'horizon ; d'autres fois se tourmentaient entre elles comme trop gênées dans leur issue. J'ai remarqué plusieurs fois que cette éruption est presque toujours suivie de tremblement pour le même jour ; et quand il manque il s'ensuit un jour obscur et jaune. Quand le tremblement arrive, on peut prédire qu'il va être d'autant plus proche que cette agitation de boucanne force pour sortir. Quelques personnes auxquelles j'avais montré ces préparations du tremblement m'ont prévenu à leur tour que dans un moment la terre va trembler, et l'effet le confirma, Enfin cette nuit du 26 au 27 forma un grand spectacle d'admiration, toute l'atmosphère fut en feu, et agitée ; la face souffrait de la chaleur, le tems étant fort calme ; l'éruption fut continuelle toute la nuit avec des flammes. L'approche certaine du tremblement se connaît quand par la passe entre les deux montagnes, on voit un nuage, ou boucanne, arrêté, ou agité, et qu'à droit et à gauche l'horizon est parfaitement clair,"

This description, as far as it extends, agrees so well with the known phenomena of active volcanoes, that little doubt can be entertained of the flame seen by Mr. Gagnon proceeding from any other source than that of an eruption. Mr. Andrew Stuart was aware of the existence of a similar well founded report when he gave us discretionary authority, upon discharging our canoe, to proceed in search of the volcano, provided after having ascertained particulars, there should exist in our judgment any probability of finding it. We were decided to give up the attempt by the following circumstances :—

1. It might lay at a greater distance than could be reached at so late a period in the season, (12th September.)

2. The known fertility of volcanic countries would, in the interval of thirty seven years of inactivity, have caused those parts once ravaged by an eruption, to be covered by a deep and dense mass of both living and dead vegetable matter, concealing all the rocks, and obliterating all the traces of a crater by which only an extinct or long inactive volcano could be recognized.

3. We were anxious to examine an extensive deposit of magnetic iron which lay up the river in a different direction.

Upon an examination of the greater portion of the rocks we have attempted to describe, a Vulcanist or follower of Hutton, would we think suspect that the country of which they are characteristic had been the theatre of volcanic activity in very ancient times, and upon finding his conjectures supported by the inferential evidence which these *local** earthquakes afford, and that of the more direct and positive description contained in Mr. Gagnon's communication, his doubts on the subject, would entirely vanish. For ourselves, being neither Neptunian nor Vulcanist, we leave these interesting but often vague enquiries to those who are better qualified to indulge in them, being satisfied with the more humble, though not less useful task of describing facts.

Although it is believed that no one now living, except Mr. Gagnon himself saw the flames, &c., many were witnesses to the comparative violence of the earthquakes of 1791. The first is accounted for by saying that there were few settlers at St. Paul's Bay at the time, and fewer whose habits or education would lead them to take notice of a phenomenon which among the vulgar might be supposed to be merely a fire in the woods, had they seen it.

A

* They are not felt on the southern shore of the St. Lawrence nor at St. Joachim, to the westward, nor Tadousac to the eastward.

A fall of ashes covering the snow is also within the remembrance of many, but of this interesting fact we have no further particulars. Earthquakes at St. Paul's Bay do not appear to be so frequent nor so sensibly felt as at Malbay.

Three or four leagues up the St. Paul's Bay river, or la Rivière du Gouffre as it is called, there is at the distance of from one hundred yards to two miles from its banks, an extensive deposit of magnetic iron * of which we are able to afford some information from actual inspection.

The river itself is not easily ascended being full of rapids, but the goodness of a road on its right bank renders this inconvenience lighter. Over the road, composed of a sandy alluvium, we proceeded and entered a beautiful valley through which this river circuitously takes its course. The sandy nature of the soil at the mouth of this river opposes little resistance to the action of the current, which where strongest steals upon the shore contiguous, leaving a proportionable space dry on the opposite side, and in this way one proprietor of land finds himself possessed of the property of his neighbour. When property in this place becomes more valuable, and this natural encroachment more aggravated, it will probably become a subject of litigation. Mr. Chaperon of St. Paul's Bay will soon have to remove two store-houses which the current threatens to undermine.

On advancing, the river retires from the road to the right, and while the former preserves, as is obvious, the lowest level of the valley, the latter pursues a more direct course over a sandy bank. As we passed this bank and cast our eyes on the
valley

* This deposit was known in the time of Charlevoix; for according to that author a miner was engaged by Mr. Talon, the intendent to explore these mines, who reported favourably of them. This man is said to have observed wherever he worked, traces of the earthquake of 1663. We saw nothing of this kind. Previous to our visit to the place, the Surveyor General had brought to Quebec specimens of the ore and information as to its being abundant.

valley below, we were reminded of the vale of Clwyd in North Wales. It is however neither so wide nor so long. The mountains on each side are tolerably elevated and of course rocky, but the valley is gently undulated land of a fine quality, being a mixture of clay, sand and probably carbonate of lime which abounds in the neighbourhood. This valley continues for about six or seven leagues, and is perhaps half a league wide. The road (an excellent one) extends about five and a half leagues up this valley, beyond which a pathway leads to the remotest settlements. There is a cross valley on the left bank of the river which is said to communicate with the valley of the Malbay river.

The parish of St. Urbain is situated towards the upper end of the valley, and it was here that we stopped to examine the deposite of iron. One bed lays westward of Vincent Tremblay's house on the summit of the hill, and about two miles from the river. Having crossed the valley a distance of about a mile, we came to the foot of the hill which rises at an angle of from 10°. to 15°. Here we found large detached masses of this ore, and ascending the hill for about another mile we reached the summit. When we arrived at this place it was found to be characterized by the total absence of trees, and looked like a piece of cleared land of about three or four acres in extent. Near the centre of this, and where the ground began to fall, the ore was seen cropping out of the ground, in one black metallic mass of considerable size. We traced it without excavation for about sixty yards in length, and perhaps three in width, here and there covered by moss or a few shrubs only. The rock with which the ore is associated is a pale syenite; in it the felspar is very predominating, the weathering of which gives a cream colour to the rock externally. That we saw was not solid but in loose angular rotten pieces, and this we found to be the case upon subsequently probing to

ascertain the comparative abundance, of the ore as appears from the following satisfactory account of some work Vincent Tremblay had been instructed to perform during our absence on an excursion to the northward.

No. 1.—Excavated a hole on the north side of the visible iron ore and at about two perches distance, where the same ore was found about two feet below the soil consisting of rotten rock.

2.—A second hole was formed on the south side of the visible ore, and about ninety feet distant, here the same ore was again found at the depth of one foot six inches of the same soil.

3.—About six yards farther to the south of the last, and at the depth of two feet and a half of rotten rock the same ore was found.

4. North west of the visible ore and about ninety feet distant the same ore was found at the depth of two feet of the same soil.

From this it appears that there is here a considerable supply almost at the surface ; indeed we suspect that the whole of the cleared patch before mentioned is occasioned by its immediate presence. We were informed that several places in the neighbourhood were equally abundant in ore, and when about to descend the La Gouffre on our return to St. Paul's Bay, Mr. Bowen discovered a deposit of this mineral which appeared abundant ; it is situated in the left bank, about a mile below Vincent Tremblay's house, and about two hundred feet from the waters' edge. Having left instructions with Vincent Tremblay to investigate further, we lately received from him the following information accompanied by specimens.

No. 5.—“Ces deux morceaux ont été pris sur les terres de Damase Fortin et de Vincent Tremblay, fils, environ douze arpens plus au nord que la mine que vous avez vue et

en-

environ quinze arpens plus près de la rivière du Gouffre.

Il se trouve un cap continu du même metal et il est parallel à l'horizon. Il se trouve environ un pied en terre à l'endroit ou je l'ai examiné, mais comme c'est dans un endroit ou le terrain est pendant, il doit se trouver à une plus grande profondeur à mesure que l'on avance.

6.—“ Ce morceau à été pris au nord-est de la rivière du Gouffre, environ dix arpens au-dessus de l'endroit ou vous êtes embarqué pour la descendre, et à un arpent de la dite rivière. C'est un cap coupé perpendiculairement de la hauteur d'environ vingt pieds sur une largeur d'environ quarante.

7.—“ Ces quatre morceaux ont été pris sur la terre d'Augustin Tremblay au nord est de la rivière du Gouffre vis-a-vis l'endroit ou vous êtes embarqué pour la descendre et environ six arpens de la dite rivière. Il sort de la côte un cap de même metal dont j'ai découvert environ trois perches.

8.—“ Ces morceaux ont été pris sur la terre d'Antoine Pagé à environ quinze arpens de la rivière du Gouffre, et environ une lieue plus sud que celle que vous avez vue. Il s'en trouve un cap plein.

9.—“ Ces morceaux ont été pris entre Moïse Tremblay et Elie Fortin, environ huit arpens plus nord que celle que vous avez vue, et vingt-sept arpens plus près de la rivière du Gouffre. J'ai decouvert de ce metal sur environ un demi-arpent quarré, mais je crois qu'il y en a un plus grand etendu.”

Before any observations are made upon the foregoing ores, we will here introduce an account of our journey northwards adverted to. The object of this journey was twofold ; to see a little more of the interior, and to examine another deposite of

magnetic iron. In the first part of our journey we met with tolerable land, although by leaving the valley to our right and ascending the hills we got among the rocks and an inferior soil. These rocks are universally felspathic, and of a cream-coloured external surface. After proceeding about two leagues we came to the rounded brow of a hill which afforded us a beautiful view of a part of the chain of mountains which we had seen on entering the bay, and in which the St. Paul's Bay river has its source. The summits of these mountains were rounded, perfectly bare, whitened and precipitous. We were informed by our guide that after crossing these mountains a wide fertile plain is reached, through which the Malbay river takes its course; he was in the constant habit of crossing this plain with Indian hunters, with whom he was associated. Continuing our route a little further we came to the flat surface of a rock several yards of which were totally bare and whitened. All we had before seen in our route were so covered up with vegetation, presenting only an angle to the eye, that it was not easy to decide with certainty whether they were in place or not, but here no doubt could exist on the subject. It was one of those tabular masses so common in felspathic rocks, composed of brown felspar, quartz and hornblende; the quartz was very distinct on the weathered surface, from which it projected in grey grains, owing to the greater resistance it opposes to the action of the atmosphere.

Distinct concretions of a very laminar hornblende, possessing polar magnetism, were observed in this rock.

We reached our encampment for the night at the foot of the chain, having passed over in the course of the day much tolerably good land, well watered by small brooks and streams issuing from lakes, along the side of one of which we passed. Rising early in the morning we commenced the ascent of the chain, and on the summit of the lowest part of its ridge, we

saw projecting from the side of the mountain iron ore similar to that before seen at St. Urbain, but of a purer quality, though not by any means in such abundance. It here occurs in a visible patch about one foot wide and perhaps three feet long. As it is in solid rock it would not be easily extracted if found upon excavation to form a continuous bed or vein. The rock in which this ore is imbedded is as before a pale syenite, in which the felspar only is very distinct. It is worthy of remark that the extensive deposit of iron ore at Marmora, Upper Canada is, according to Dr. Bigsby, in the immediate neighbourhood, though not in contact with a pale syenite. The metallic blackness of this ore contrasts strongly with the whitened surface of the rock in which it is imbedded.

Knowing that the forests in this country are extremely liable to spontaneous or accidental ignition, the whitened exterior of these rocks is often naturally enough attributed to that cause, particularly, as was the case here, where other less questionable traces of fire appear; but weather, acting upon the alkali, which the felspar in these rocks contains, causes an incipient decomposition to take place on their surfaces, by which an imperfect kaolin or porcelain clay is formed, and hence arises this whitened aspect. Fire would certainly assist this decomposition, but from the quantity of iron in these rocks their surfaces would, we think, be rather reddened than whitened by it. Other deposits of iron ore in these mountains were heard of, but they were not visited, satisfied of its abundance in places more conveniently situated. It may be stated, however, that a Canadian of the name of Baptiste Bridet, gave us on our return to St. Urbain, the following information. Between the pass of the mountains and Lake Bicene, about a league asunder, he observed at short intervals great quantities of iron ore jutting out of the rock; also between Lake Bicene and a place called *Le Grand Bris*, about ten acres further, he saw the same appearance.

pearance. Being questioned as to its abundance more particularly, he said that it occurs in veins from six inches to two feet wide and in rounded blotches from six to eight feet thick.

The highest mountain in that part of the chain where we were, commands a most beautiful and extensive view of the surrounding country.

We will now give the mineralogical characters of that deposit of ore which we first met with at St. Urbain; after doing which, only a few further remarks on the others will be necessary, as they differ from each other principally by being more or less mixed with impurities. They are almost all of them remarkable for the want of the magnetic character, although possessing the metallic blackness, structure, and other points of agreement with the magnetic oxide of iron to which species they undoubtedly belong.

MINERALOGICAL CHARACTERS OF SPECIMENS.

Nos. 1 to 4.—Colour, iron black, but break into fragments, the surfaces of which are much tarnished by rust; no particular structure could be observed; some parts were indistinctly laminated, but the general mass appears to be compact granular. The fracture when not effected in the direction of a rusty seam is uneven. They cannot be scratched by the knife, but are easily broken, and do not give fire under the hammer; their powder is quite black; specific gravity about 4.5. Some portion of the ore from this deposit had a vitrified and porous aspect on the surface like cast iron. They are not magnetic before the application of heat. Before the blow-pipe they do not alter in any other respect than by becoming magnetic. With borax they fuse into

a glass of either a yellow or very light muddy green colour; upon cooling the colour subsides or nearly so. These ores were associated with a mixture of mica, carbonate of lime or iron, and what was conceived to be epidote.

5.—These specimens have a very good appearance, and are more free from foreign substances than some of the others; one of them, however, has coccolite of a yellowish brown colour, disseminated throughout it. Their specific gravity varies from 4. to 4. 5.

6.—This is the same description of ore as that found by Mr. Bowen, and comes nearly from the same place; it is not quite so good an ore as either of the preceding, being more mixed up with foreign substances, particularly epidote, by which its specific gravity is reduced to 4.

7.—These four specimens differ much among themselves, and do not bear the aspect of having been taken from the same place; one of them has a crystalline structure, and appears to be composed of octohedral grains, while another is earthy and possesses less of the metallic aspect.

8.—Magnetic with polarity; an excellent ore.

9.—This is a very good specimen of bog ore, and valuable if abundant. It probably occurs in greater quantity than has been yet ascertained, as generally where there is a large deposit of rock ore (as the magnetic oxide of iron is called) occupying elevated situations, there is also a deposit of bog ore beneath in the low swampy lands, the latter originating with the former.

It does not appear easy to account for the want of the magnetic character in these ores before they have been exposed to heat. Cleveland says, that “according to the observations
of

of Werner and Gibbs, this oxide of iron is not magnetic while remaining at a considerable depth below the surface of the earth, but soon acquires this property after exposure to air and light." We must seek other causes to account for the magnetic deficiency in the present instance, as the specimens in question were taken from the surface and possess no more magnetism at the present moment than they did at first. It may be owing to one or more of the following causes; the presence of oxygen above 30 per cent, of sulphur above 40, of carbon, of phosphorus, of arsenic, of manganese and of antimony; of these sulphur, phosphorus, arsenic, manganese and antimony injure the ore, by either rendering it difficultly fusible or its cast-iron brittle, often both. Carbon, on the contrary, improves the quality of the cast-iron, renders the ore more easily fusible and diminishes the consumption of fuel. We cannot say to which of these, or if to any of them is owing the magnetic deficiency, we can only observe that before the blowpipe no fumes of sulphur, arsenic nor of antimony were perceived. From sixty to seventy per cent. of cast iron may be expected from the magnetic ores, and from thirty to forty from the bog ore.

The vicinity of limestone as a flux bestows additional value on these deposits. It is probable that the limestone that was seen at the entrance into St. Paul's Bay may extend thus far. We saw two or three varieties of an excellent description near a small kiln in front of the chapel at St. Urbain, which were said to have been taken from the bank on the opposite or left side of the river; some contained organic remains, while others had more the aspect of a compact marble, and were free from them. We were informed that lime stone was also to be seen on the summit of the hill opposite the chapel, where indeed it was ultimately found, but our guide took us first to several felspathose rocks deceived by their whitened surfaces.

Wishing to ascertain the capabilities of the river we descended it in an old wooden canoe. This river may be considered as one continued rapid, though of moderate violence ; the only obstacles in which to its free navigation arise from an accumulation of boulders in several parts of its channel, over which it is difficult to pass without striking. This we did repeatedly, and once or twice were nearly swamped, but more owing to the unskilfulness of our guide than from any other cause ; however the inconvenience of a good ducking would have been the only penalty had the canoe actually filled, for the river is in most places shallow. If there were any sufficient object to warrant the expence, such as the establishment by Government of an iron foundry, there is no doubt that the river might be rendered navigable for batteaux by removing only such of the boulders as are most in the way of the channel : for we believe that no rock in place offers any obstacle. To drown these boulders would not be easy, and would occasion a great loss of excellent land, without expensive banks were formed to retain the waters. This river is very circuitous in its course, surprisingly so, considering the rapidity of its current ; it owes this character to the alluvial bed it traverses. By it the river is rendered perhaps one-third longer than the road, between St. Urbain's and the bay, so that whatever capabilities might be given to the river, it is probable that all materials for the supply of an establishment, such as we have named above, would be transported over land from the bay, while the articles manufactured would be sent down by the river. Such is the practice at Mr. Bell's well-conducted establishment on the St. Maurice river, up which the returning boats always poll empty. With numerous stoppages we were only five hours descending.

The height of the banks on either side the river varies from one foot to fifty. Rock in place was observed forming the bank in a few places. It was said to be limestone. Our

examination of all parts of this river was necessarily hurried, for the expectation we were in every moment of being upset, as we moved rapidly down the stream, would not allow us to improve to the utmost the short period we had to observe at each turn of it. Near the entrance into the bay from the river one small limestone* rock was observed lifting its head above water in mid-channel.

Previously to leaving the bay on our journey into the interior we had been hospitably received at the house of Mr. Chaperon, and on our return his reception of us was even if possible warmer. But the fear of abusing his civility was an additional motive to depart, which we did the night of our return. Failing in our attempt, however, to reach Quebec by water, on account of contrary winds, we proceeded overland through the *Capes*, which afforded us the opportunity of seeing a country unexpectedly well calculated for settlement, the existence of which a person would have some difficulty in believing who had only seen that barren section of it exposed on the northern shore of the St. Lawrence, between Cape Tourment and St. Paul's Bay. It has already attracted some attention and in our opinion deserves much more; for, independently of its own capabilities, it is connected by an uninterrupted broad band of cultivable land, with Quebec on one side and St. Paul's Bay, Malbay and the still broader tracts behind them on the other. A bounty has lately been offered to induce individuals to settle on this land, and a road has been opened, at the expence of the Colonial Government, connecting St. Joachim with St. Paul's Bay. Over this road we passed, and found a good log hut built or building, with a few acres
cleared

* Specimens of a white granular limestone have been brought to Quebec from St. Paul's Bay, containing threads and seams of a very argentiferous galena. If some of this galena be powdered and dissolved in nitric acid, a bright copper-wire inserted in the solution will after some time be coated with a thick muddy deposit. If this be collected and exposed on charcoal to the blowpipe a bead of pure silver will be obtained.

cleared around it, at every league or thereabout. The land through which the road runs is always tolerably good, in many places excellent, and it is intersected frequently by small rivers and streams, favouring its drainage, the want of which many portions of the road attest, particularly towards St. Joachim.

This road possesses two excellent characters ; it is remarkably straight and remarkably level ; for, excepting at the two extremities of it, St. Paul's Bay and St. Joachim, at the former where it passes over limestone, and at the latter granite, we do not remember any other rise of any consequence. The first part of the road is over the same alluvial deposits through which the river du Gouffre passes, and which continues in one level plain to the foot of the limestone ridge. On ascending this the soil becomes more sandy, but it soon after improves and is then a mixture of clay, sand and iron, to the latter of which it owes the yellow or red colour it sometimes possesses. The road is excellent for a distance of four leagues ; it then becomes very boggy and in some places quite impassable for carts. It is only, in such places, by sinking up to the knees in a stinking mass of mud, loaded with carburetted hydrogen, that the pedestrian is able to proceed. This character, which continues more or less to the foot of Cape Tourment, is owing to the retentive nature of the soil, and its nearly horizontal position. In a short time the money which has been expended on the road will have been uselessly employed without an additional sum be advanced, to prevent it from being completely broken up.

There was nothing remarkable in the quality of the timber, which consisted principally of white birch, until we reached the ridge separating St. Joachim from the Cape lands, where we met with some of the finest description that had been seen during the whole journey, among which were some well-grown elms. The granite of Cape Tourment is known to be the depository

pository of large pieces of brown mica, which are dug out the size of the foot from crevices in the rock ; some of it is exceedingly contorted. The rarity of mica in most of the rocks described in this essay renders this deposit the more deserving of attention.

Having closed our geognostical observations at the foot of Cape Tourment, we will now introduce a short recapitulation by way of summary which will include some remarks on the geological position of the rocks we have described. The rocks seen on our journey were the following :—

Nos. 1.—Granite.

2.—Micaceous Schist, (Mica Slate.)

3.—Quartz rock.

4.—Primary limestone ?

5.—Syenites—including syenitic granite and syenitic gneiss.

6.—Trap rocks—or aggregates, in which hornblende predominates.

7.—Felspar rock—(sui generis.)

8.—Magnetic iron.

9.—Clay-slate.

10.—Grey wacke.

11.—Sandstone.

12.—Secondary limestone—including the transition of some authors.

Of all the granitic rocks we met with, perhaps that of Cape Tourment is the only one, free from an admixture of hornblende ; for although we collected some specimens elsewhere, which appeared to be so, it might very well have been present, without our being able to detect it, on account of the smallness of the grain of those specimens, and the resemblance

blance of the hornblende to mica, which latter circumstance may indeed have occasioned one mineral to have been mistaken for the other. We cannot positively assert that the granite of Cape Tourment is free from hornblende, but we think so.

Micaceous schist was met with only at Mal-bay, where it has been already described as dipping to the west, having black fetid limestone above it, and quartz rock and syenitic gneiss below. It is here that the three classes of rocks (admitting the transition to be one) are seen together, and the geologist derives from their inspection assistance in his subsequent researches in the neighbourhood. Micaceous schist being in all cases a primary rock, the syenitic gneiss below it, must also be primary, which it appears necessary to establish, because the same rock was not found elsewhere, to be associated with a similar proof of its superior antiquity; rocks in which hornblende and felspar abound, being common to the "overlyin class" of Macculloch, with which many of the rocks in the Saguenay and elsewhere, have other points of agreement besides mere mineralogical identity.

The syenites and traps are the only rocks met with from the mouth of the Saguenay to the falls on La Belle Rivière, and they are likewise most characteristic of the north shore of the St. Lawrence, from Tadousac to Cape Tourment. Mr. Nixon met with syenite on David's River, a branch of the Peregonea, and with trap at the falls of Ouitchouan. A pale syenite is the predominating rock in rear of St. Paul's Bay; with this no trap is associated, and it is the deposite of extensive beds of magnetic iron, all of which is in favor of its primary character; it possesses no traces of stratification.

Quartz rock was seen only at Mal-bay, underlying micaceous schist, and between it and syenitic gneiss.

Primary limestone? associated with syenite gneiss and trap, occurs at Moulin à Baude. A loose mass of a similar descrip-

tion was found on the shore of lake St. John, near and to the westward of the Post of Mitabitshuan: it was angular and of an untravelled aspect.

The felspar rock (*sui generis*) alluded to, is one, many of those characters resemble those of Labrador felspar from which it differs principally by its want of iridescence. It forms the north eastern shore of Lake St. John, and its islands from the mouth of La Grande Décharge, to within a mile of the Koucouathime river, and was met with by Mr. Nixon in La Petite Décharge; also uninterruptedly forming a rocky bank from the foot of the first rapid in the Peribonea river, to the great falls on the same. We can say nothing of its rock associations, as they were not seen. It will probably fall under the general term syenite, although hornblende is a very rare ingredient in it.

Magnetic iron occurs in such extensive beds in rear of St. Paul's Bay, as to entitle it to be considered as a rock. It was met with in abundance in no other place.

Clay-slate, in association with grey wacke, was met with on the Island of Orleans. Both are well known to be very abundant in Lower-Canada, particularly in the neighbourhood of Quebec, and from thence towards the mouth of the St. Lawrence, but they are principally confined to the southern side of the river. Clay-slate was also met with on Lake St. John, for we still persist in calling by that name the rock we met with there, apparently alternating with fetid limestone.

Sandstone was met with only at Mal-bay, underlying horizontal limestone. The position of this sandstone answers to that of the old red sandstone, which, if it be, it is another instance among many of the absurdity of affixing such a name to a rock, which in the present instance is of a light greenish colour.

Secondary limestones, among which, for convenience, we include,

include, after the example of MacCulloch, the transition class, were found at Mal-bay, St. Paul's Bay and Lake St. John. The fetid limestone which overlies micaceous schist at St. Paul's Bay, we have conjectured to be a transition rock. On Lake St. John, secondary limestone (of the carbonifereus order?) forms, with clay-slate, the southwest portion of the shore of the lake, from Pointe Blue to within three miles of the Post of Metabitsshuan.* At page we have considered this to be a secondary rock in the limited sense of the Wernerians, and were surprised in consequence, to find it alternating with clay-slate. This opinion is now no longer entertained, as the very circumstance of the existance of such an alternation, together with its characteristic imbedded fossils, prove the rock to belong to the transition class or earliest of the secondary class of MacCulloch. It is thought that no secondary limestone (in the limited sense) was met with, without the horizontal rock at Mal-Bay be of that class, which is not improbable.

Information indeed has just been received, that a large deposit of bituminous coal, in association with limestone, has been discovered in the parish of St. Urbain, in rear of St. Paul's Bay, but we do not know what degree of credit to attach to the report. Believing the latest rocks in that neighbourhood, to be of the transition class, and consequently below the coal fields, we think it not likely that any considerable quantity of
that

* Sir Alexander McKenzie states that the narrowest part of Lake Winnipeg is not more than two miles broad, at which place the west side is faced with rocks of nearly horizontal limestone about thirty feet high, while the east side is more elevated, and is composed of a dark grey granite. Immediately afterwards, he observes, that all the great lakes of the country are to be found between these extensive ranges of granite and limestone. Keating appears to think it probable that the excavation of this lake was occasioned by the easier decomposition of the strata at the junction of the two formations. It is certainly deserving of attention that the Lakes, Slave, Bear, Arthabasca, Winnipeg, Superior, Huron, Ontario, St. John and Mistassiny, have large deposits of secondary limestone on their shores, whilst some portion of these lakes is either granitic, syenitic or trappose. The limestone of Lake St. John must be either isolated or connected with the same formation at St. Paul's or Murray Bay. A considerable degree of probability is given to the latter conjecture, by the existence of a fine level country at the back of these settlements.

that mineral will be found there. Partial insignificant collections of coal have been found in several places about Quebec, but they are no indication of its occurring in abundance.

It has been before said, that no appearance of the operation of a violent deluge was observed; on the contrary all the soils, in many places very deep, consisting of clays, marly clays and sand, were generally composed of the finest particles, without the trace of a boulder or even a pebble. The surface of the land was so far free from them, that we do not remember to have seen one that was waterworn, and evidently a travelled fragment, the position of which did not point directly to the route by which it came. It must not be omitted to mention, however, that with the exception of the several portages, our observations were confined to the shores of the rivers and lakes, which were met with in the Saguenay Country.

With the exception of those entering among the constituents of the rocks we met with, minerals were rarely seen. We did expect particularly to have found some of the numerous family of zeolites, tenants as usual of amigdoloidal trap; but neither of these nor of that rock, were any traces perceived; the pores of the vesicular syenites that were occasionally observed, being entirely empty. The following are the names of the few minerals we met with.

Calcareous Spar—Principally in the fetid limestone on lake St. John, and more particularly filling original cavities in its fossil organic remains.—The only instance of its being associated with trap, was the one stated while describing the rocks on the Saguenay.

Epidote? (earthy)—Apparently entering into the composition of some of the syenites in the Saguenay. Also associated in some abundance with magnetic iron in St. Paul's Bay.

Augite?

Augite ? probably enters into the composition of some of the traps, but it is not easy to distinguish it from hornblende.

Coccolite—Disseminated through magnetic iron, in rear of St. Paul's Bay.

Garnet (common)—Forming distinct nodules in micaceous schist at Mal-Bay ; the beautiful foliated variety of precious garnet, known to occur here, was not seen.

Magnetic Iron—In extensive beds in rear of St. Paul's Bay. Also forming veins and small distinct concretions in the syenites, and disseminated in small grains through some of the traps of the country we traversed.

Green Carbonate of Copper ?—In small traces among some of the syenites we met with.

It must be obvious to those instructed on the subject, that an individual rapidly traversing a country, will acquire a knowledge of its geognostical features more readily than he can hope to obtain of its mineralogy, because rocks, unlike minerals, occupy large spaces, and a specimen struck from one place is characteristic of many others ; but minerals, with the exception of those which enter among the constituents of rocks, are very partially deposited, and either chance favors the hasty tourist, or they must be very abundant in the places he seeks them, if many be met with.

Passing Cap Pillard, near St. Joachim, Mr. Nixon observed a vein of a green and white substance from three to six inches in thickness traversing the rock. Upon landing, specimens were procured which being examined subsequently, were found to be mixtures of carbonate of lime, under the form of calcareous spar, and a variety of fluato of lime, denominated chlorophane,

chlorophane, the characters of which are given below. The rock it was associated with, has not been examined.

Colour.—A lively light green.

Translucency.—Deeply translucent on the edges.

Structure.—Laminar, sometimes indistinctly so, approaching compact ; intimately associated with calcareous spar.

Lustr.—Dull, or none.

Hardness —About that of fluor.

Powder.—Whitish green, and rough.

Specific Gravity.—3. 0.

Effect in Acid.—Throws out a few bubbles, owing probably to the calcareous spar it is associated with ; *when sulphuric acid is poured upon it, in a state of powder, it gives out white fumes which corrode glass.*

Phosphorescence.—Placed on a heated poker it phosphoresces in a dark room with a beautiful green and purple colour. In boiling water it emits a palish light. This phosphorescence was observed after the mineral had been exposed to acid.

Effect of the Blowpipe.—When exposed to its exterior flame it *does not decrepitate*, but phosphoresces with a beautiful blue colour, like the interior flame of the blowpipe, and becomes white. When exposed to the interior flame it forms a white dull enamel.