LOCALITIES

OF

CANADIAN MINERALS,

WITH NOTES AND EXTRACTS,

Chiefly collected from the Writings of JOHN BIGSBY,

M. D. F. L. S. M. G. S.

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PREFACE.

THE cause which led to the presentation and publication of the following pamphlet, will be sufficiently obvious to most of our readers. It was thought, that the collecting together and arranging, under one form, all the information that could be readily obtained, from the few sources which exist on the subject, might have the effect, in a slight degree, of awakening the attention of the public to those subjects of general and scientific interest, which it is more peculiarly the province of the "Literary and Historical Society, of Quebec," to investigate.

Among the sources alluded to, Dr. Bigsby's writings stand foremost and almost alone; his name will, in consequence, appear frequently in the following pages, for which, as we have not always the authority that an acknowledged authorship in print affords, we beg he will excuse us.

The Canadian Review has been one of our books of reference, in the fourth number of which extracts appear from Dr. Bigsby's work, "On the Geography and Geology of Lake Huron." An anonymous article, from the second number, we suspect by the same individual, has been also introduced. Since these, we understand he has presented a paper to the Geological Society of London, "on the Geology of the valley of the St. Lawrence," extracts from which we hope, on a future occasion, to lay before our friends. In the meantime they are requested to remain satisfied with the present attempt, and resolve, by their own contributions to make the original portion of our next communication of far more importance; for they must be aware that it is impossible for an individual, without pretension to proficiency, in the subjects he writes upon, to do any thing more than raise a feeble pen, although it be in a strong cause. Indeed the unassisted hand of one ever so capable cannot effect much.

We have extracted largely from Gourlay, particularly on the *occurrence* of L. Stone in the Upper Province, an interesting class of rocks every where, but peculiarly so in these Provinces, as they are, in many places, found to contain, in horizontal and undisturbed strata, the organic remains of marine animals, some

of the genera of which, are unknown in our present seas, and whose race is supposed to be extinct; proving beyond a doubt the extensive dominion of the sea, at a remote period, over these Provinces. To Keating we are also indebted for some interesting observations on the Geology of that part of the Upper Province, forming the route from Red River to L. Superior. He passed over part of the same ground that Dr. Bigsby had previously visited, of whom he makes honourable mention.

The arrangement of the minerals, in the Catalogue, is after Phillips', from whom the analytical heading is also taken, although not always accurately. The corrections, where necessary, will be found at the end of the work. Different analyses of minerals, bearing the same name, are found not only not to give the same proportional results, but, frequently, not exactly the the same ingredients. It is, therefore, not always possible to say which are essential, and which are not. Among the earthy minerals, the presence of iron and mangenese is neglected, because they so generally enter into the composition of minerals without altering their essential physical characters.

Those extracts from the Canadian Review and Medical Journal, of Quebec, not distinguished by inverted commas, are republished efforts of our own.—EDITOR.

July, 1827.

LOCALITIES OF CANADIAN MINERALS.

EARTHY MINERALS.

SILEX (PURE.)

QUARTZ, in large elongated and transparent crystals, is found on Judge Taschereau's Seigniory of St. Mary's. Their form is that of a six-sided prism terminated by a six-sided pyramid. (Note 1.)

In the "Black Rock" of Cape Diamond (a carbonaceous Clay-slate,) the following varities of quartz occur : (Note 2.)

1st. Acicular, or needle shaped crystals—a new form of quartz according to Dr. Bigsby.

2nd. Very pellucid crystals of the dodecahedral form, or six-sided pyramids joined base to base—These are rare.

3rd. Also very pellucid crystals, the form of which is a short six-sided prism, terminated by six-sided pyramids.

4th. The same as the last, wanting one of the pyramids. The end of the prism deficient is generally only semi-transparent.

5th. Crystals as large as the thumb, full of cavities, seldom presenting any well defined faces, but in which the same form of a six-sided prism terminated by a six-sided pyramid, may be traced. These are common, and whenever any of the faces of the crystals are sufficiently transparent, which is sometimes the case in a remarkable degree, a fibrous acicular or striated structure, may often be seen in the interior, which, under some incidences of light, has a silver white lustre, this together with coloured impurities, renders the greater part of the crystal only translucent.—Crystals containing air and bitumen have been found. As might be expected they are much irised.—They appear in the progress of formation, and it is remarkable that the exterior of the crystal is more perfect and further advanced in its crystallization than the interior.

6th. Very irregular, discoloured and semi-transparent six-sided prisms, without pyramids, are also common; these are generally found in the most smutty and carbonized part of the rock.

AMETHYSTINE QUARTZ.—Lakes Superior and Huron.—Dr. B.

BLACK QUARTZ. St. Joseph's L. Huron. do.

GRANULAR QUARTZ. Forming an aggregate with black crystallized Hornblende—Montreal mountain.—Dr. B. (Note 3.)

TRANSITION QUARTZ. N. W. L. Huron.—Dr. B.

AVANTURINE. L. Huron.—Dr. B.

MICACEOUS QUARTZ. do.

OPALESCENT QUARTZ. A bowlder, several tons weight, was found by W. Green, Esq. at Rivière du Loup, L. C. the greater part resembles Opal remarkably, but possessing a sp. gr. of 2·6, it cannot belong to that variety of quartz. (Note 4.)

QUARTZ, forming an ingredient in the Granite about Quebec, often resembles Opal.

Do. in imperfect crystals, Township of Yonge, U. C.—Dr. B.

FEURNGINOUS QUARTZ, do. do.

POROUS QUARTZ. Its pores occasioned by the decomposition of cubic iron pyrites, which in many places has left the impression of its form. Township of Yonge, U. C. (pseudo volcanic.)—Dr. B.

SILEX AND WATER.

OPAL—in small rounded pieces, the size of a nut, in a bowlder composed of green Felspar (Amazon Stone ?) black crystallized Hornblende and oxidulous iron. (Note 9.)

SEMI-OPAL—Hawksbury, Ottawa.—Dr. B.

SILEX, ALUMINE.

CHALCEDONY—in rounded pieces, is found forming alluvium at Gaspé. It also enters into the composition of the Agates from the same place. (Note 5.)

Do. Bay of Chaleur.

CARNELIANS—forming alluvium at Gaspé.

Do. L. Superior.—Dr. B.

AGATES—like Chalcedonies and Carnelians, forming alluvium at Gaspé. The fossil vertebræ, which crowd the strata of Drummond's Island, often exhibit a passage into Chalcedony, Hornstone and Agate. (Note 6.)

JASPERS. The finest specimens come from the upper Lakes, Huron and Superior.—Dr. B.

Do. At Gaspé, forming alluvium.

HORNSTONE. The organic remains of Drummond's Island often exhibit a passage, more or less perfect, into Hornstone. The barbs of Indian Arrows found scattered over the country, are generally Hornstone.

Do. L. Simcoe.—Dr. B.

GARNET, (precious) R. Moira, L. Ontario.—Dr. B.

Do. (Manganesian) do. do.

Do. Fox Islands, do.

FOLIATED GARNET, (precious) Mal Bay, in Mica state.

Common do. do.

GARNET, (precious) St. Helens in a rock principally composed of white Felspar (bowlder ?)

Do. Hawksbury, Ottawa in Granite.—Dr. B.

Do. Isle aux Pommes, opposite the R. Saguenay, L. C.—do.

Do. La Petite Riviere, L. C.

STAUROTIDE. L. Huron, Dr. B.

SILEX, ALUMINE, LIME.

PREHNITE. L. Superior, do.

ZEOLITES. L. Superior, in Amygdaloid, do.

ZOISITE. Fort Wellington, U. C. do.

EPIDOTE. Marmora, in a slightly porphyritic Syenite, do.

Do. Montreal, do.

Do. Lake Huron, in Greenstone, do.

Do. Do. and Superior in Amygdaloid, with Steatite.

Epidote (rolled) Falls of Niagara.—Dr. B.

Axinite. Hawksbury. The only place in America.—Dr. B.

Clay. Which will take the form and acquire the hardness of Bath brick, without baking or burning, is found in the valley of Quebec, (valley of the St. Charles?)

Clay is found at Sillery, near Quebec, of a pink colour throughout. When washed and baked it forms an excellent chalk or pigment.

Do. At Isle aux Noix, L. Champlain, a blue clay is found of the most plastic character. It is well calculated for lining the sides and bottoms of canals.

Shale—is found alternating with conchiferous fetid L. Stone at Beauport, L. C. It is sometimes conchiferous itself, and bears impressions of terrebratulæ, &c. It is said that the fossil remains of fish have been found in it.

Do. A species of Shale, often with a very glossy surface is found in thin strata interstratified with the "Black Rock." Its planes sometimes exhibit the *appearance* of vegetable organic remains. (Note 7.)

SILEX, ALUMINE, LIME, MAGNESIA.

Augite. Montreal Mountain.—Dr. B.
Do. N. W. Lake Huron, do.

Coccolite. Hull, Ottawa, associated with Magnetic Oxide of Iron and Plumbago.—Dr. B.

Brown do. St. Paul's Bay, L. C.—do.
Do. La Petite Riviére, L. C.—do.

Hornblende (Basaltic.) Montreal Mountain.—do.

Black Crystallized Hornblende—forming, with granular quartz, an aggregate, of which the Montreal Mountain is chiefly composed.

Hornblende in Porphyry, Pays Plat, U. C.—Dr. B.
Do. in Greenstone, La Cloche, L. Huron.
Do. in Syenite, L. Huron.—Dr. B.
Do. Lower St. Annes, L. C. do.
Do. Hawksbury, Ottawa, do.
Do. La Petite Rivière, L. C. do.
Asbestus—N. W. L. Huron, do.
Tremolite (White) Kingston, U. C.—do.

Actynolite? (Green) forms a large portion of the bowlder at York, U. C. said to contain Lithia. (Note 12.)

Anthophyllite—Fort Wellington, U. C. (very rare)—Dr. B.

Actynolite—in a bowlder from Ange Gardien.

MAGNESIA, SILEX.

Olivine—Montreal Mountain.—Dr. B.
Do. N. W. L. Huron, do.

Serpentine—disseminated in spots through granular L. Stone, Grenville, Ottawa, forming primary Marble.

Noble Serpentine—Falls of Calumet.—Dr. B.

Common do. associated with Talc, on Judge Taschereau's Seigniory of St. Mary's, Quebec.

GLUCINE.

Beryl—in Granite, L. of the Woods.—Dr. B.
Do. with Talc, N. W. L. Huron, do.

ALKALINO EARTHY MINERALS.

SILEX, ALUMINE, POTASH.

Mica—(brown) in large thick pieces in Granite, at Cape Tourment It is often much contorted.

Do. (silver) with Steatite, St. Joachim. (Note 8.)

Talc (silver) is found on Judge Taschereau's Seigniory of St. Mary's, L. C.

Do. N. W. L. Huron, associated with Beryl.—Dr. B.

SILEX, ALUMINE, LIME, POTASH.

Felspar (green) (Amazon Stone ?) Quebec, in a bowlder, associated with black crystallized Hornblende, oxidulous Iron and a little Mica, the whole porphyrized by occasional rounded pieces of Opal. (Note 9.)

Do. " Dans le voisinage d'un district connu sous le nom de Milles Isles on trouve une chaine de granites. Tout ces isles semblent être composées d'un granit rougeatre bien crystallizé dont le felspath est l'ingredient le plus considerable."—M. Guillemard.

Do. (yellowish white) in large rhomboidal crystals, Hawksbury, Ottawa.—Dr. B.

Felspar (red) 1000 islands, part of the Tourmaline bed.—Dr. B.

Do. St. Joseph's, L. Huron, do.

Do. (Labrador) as a large bowlder, on the shore of the St. Charles at Quebec.—It is also said to have been found under a similar form at as high a level as the Plains of Abraham. (Note 10.)

Do. At Gaspé, in small rounded pieces.

Do. Mal Bay, do.

Do. Tadousac do.

Do. L. Huron, according to Dr. B. but he does not mention if in situ or otherwise.

Green Earth, in Amygdaloid, L. Huron, Dr. B.

SILEX, ALUMINE, MAGNESIA, POTASH.

Steatite—with Mica, St. Joachim, L. C. (Note 11.)

Do. On voit a Kadanoqui (Gananoqui) entre Kingston et Milles Isles quelques especes de steatite donc on assure qu'il y a de large veines dans le voisinage."—M. Guillemard.

" Near the Gananoqui Lake there is found a soft stone of a smooth oily surface. It is called soap stone and is useful for inkstands and various other utensils."—Gourlay.

Chlorite, (earthy) Leeds, L. C. disseminated in a vein of quartz traversing Chlorite Schist.

Do. Isle la Crosse, L. Huron.—Dr. B.

Schorl (black)—Abundantly in large grained Granite on the summit of the Belœil mountain, near Chambly.—M. Guillemard.

SILEX, ALUMINE, LIME, POTASH, SODA.

Tourmaline—1000 islands, near Kingston.—Dr. B.

Chabasie. Montreal mountain, do.

SILEX, ALUMINE, LIME, POTASH, SODA, LITHIA.

PETALITE. The mineral containing Lithia in the bowlder at York, U. C. is said to be the Petalite, it agrees more nearly however with Spodumene. It is associated with Actynolite and carbonate of lime or magnesia. (Note 12.)

ACIDIFEROUS EARTHY MINERALS.

LIME, CARBONIC ACID.

CALCAREOUS SPAR. The following varities of Calx Spar, are found in the "Black Rock" of Quebec:

1st. Coloured externally with a shade of colour approaching lilac, structure distinctly lamina, easily dividing into rhombs. This variety traverses the rock in all directions in veins which vary from the size of a hair to an inch in thickness, these are sometimes so frequent as to give the rock the aspect of a conglomerate.

2nd. Large rhomboidal crystals of a yellowish colour and nearly of the primitive form—semi-transparent—sometimes iridescent in bands, resembling a plan of a ravelin or bastion in fortification—rare.

3rd. Radiating from a white translucent and calcareous base, transparent acicular crystals, finer than spun glass, are found occupying small fissures and crevices in the rock. These are always associated with quartz, crystals and sometimes with smut, by which their colour is changed from white to brown and even black. The calcareous base is sometimes wanting.

CALCAREOUS SPAR—in elongated rhombs, occurs at Nouvelle Beauce, L. C.

Do. in polyhedral crystals in compact L. Stone, near No. 4, Tower.

Do. (red) Gargantea, L. Superior.—Dr. B.

Do. (red and white) occurring as veins in transition L. Stone at Point Levi, opposite Quebec.

Do. in lenticular crystals, Montreal.

Do. (Hyaline) in light brown L. Stone, Marmora.—Dr. B.

STALACTITIC CARBONATE of Lime, Mal Bay, in calcareous S. Stone?

PRIMARY L. STONE.

GRANULAR L. Stone of a decidedly primary character, with Mica disseminated throughout, is found at Cape Tourment, associated with Granite.

Do. spotted with Serpentine (on which account also primary,) Grenville, Ottawa. (Note 13.)

Do. Fine grained, Crow Lake, L. Ontario.—Dr. B. This resembles Carrara marble.

LAMINAR L. STONE. At Tadousac, mouth of the Saguenay, a white and highly translucent marble is found, which (if the description given of it be correct, as associated with Granite) must be primary. It is in considerable abundance. (Note 14.)

GRANULAR L. STONE? "The rocks in the Township of Yonge are

composed of a white stone, with a number of sparkling particles."—Gourlay.

Do. ? " In the river Ganannoqui, there is what is called marble rock, and no doubt there is a great bed of this valuable material. No use has been made of it except in making inkstands and other trifling articles."—Gourlay.

SECONDARY L. STONES OF M'CULLOCH.

STRATA of a more calcareous character than the " Black Rock" of Quebec, are found alternating with it in subordinate, but conformable strata.

COMPACT L. STONE is found occupying a situation on the confines of and between the " Black Rock," and conglomerate, which characterizes the precipice to the north of the town.—It may be considered as part of the conglomerate bed. (Note 15.)

FETID CRYSTALLINE L. STONE, in a stratum conformable to the " Black Rock," in the ditch of the curtain, near St. John's Gate.

A very coarse and impure L. Stone, having a brownish spotted aspect, somewhat oolitic in its structure, is found crossing the Plains, outside St. Louis and John's Gate.

COMPACT INDURATED L. Stone of a grey colour, is found, in large fragments in the L. Stone conglomerate to the north of Quebec.

A TRANSITION L. Stone, traversed by white and red veins of Calx Spar is found at Point Levi.

FETID L. Stone in horizontal strata and very conchieferous occurs at Beauport. From this formation the lime used in Quebec, is obtained being the only considerable bed within the same distance. The organic remains are much the same as those at Montreal, but trilobites appear most to abound. (Note 16.)

Do. " At Montmorenci a brown often crystalline fetid L. Stone is found resting on a siliceous conglomerate, both in horizontal strata—The latter contains principally retepores, corallines and encrinites. A black L. Stone dull and compact succeeds in conformable strata containing conulariæ trilobites ammonites and scaphites ; the rest of the organics and accidental minerals, are the same as at Montreal."—Dr. B.

Do. CRYSTALLINE L. Stone, in horizontal strata, is found at Point aux Trembles, which bears a striking resemblance to that found at Montmorenci and Montreal.

Do. CRYSTALLINE L. Stone, Montreal lies at the foot of a mountain of trap, composed of granular Quartz, and black crystallized Hornblende. It contains the following organic remains—" Encrinis moniliformis, pear and staghorn encrinite, orthoceratite, trilobites, conulariæ quadri sulcatæ, trochi, encrinital columns, turbos, turbinoliæ, corallines, terrebratulæ, productæ, madrepores, retepores, &c."—Dr. B.

The following extracts, on the occurrence of L. Stone in the several Townships of the Upper Province, are taken from Gourlay's statistical account of Upper-Canada.

Western District.

MALDEN—Limestone in abundance, which sells at 12s 6d per toise at the quarry. Lime is burnt and sold at 1s 3d per bushel.

London District.

DELAWARE, WESTMINSTER AND DORCHESTER. Farmers burn Lime in log-heaps.

OXFORD. Abundance.

TOWNSEND. do.

WALPOLE AND RAINHAM. Do. at 10s per toise at the quarry.

WOODHOUSE. Do. at 25s do.

CHARLOTTEVILLE. Some L. Stone. No Lime has been burnt for sale.

NORWICH. Some indications of plenty of L. Stone in the bottoms of small brooks, but not much opened. Water sometimes impregnated with Lime. Lime has been burnt in log-heaps, sells for about 8d per bushel.

BAYHAM. Abundance. No Lime burnt for sale.

MALAHIDE. No Lime has been burnt for sale, but there are some quarries of L. Stone.

YARMOUTH. L. Stone in many places. No Lime burned.

SOUTHWOLD. Do. do.

DUNWICH. Some quarries, but very little Lime burnt.

ALDBOROUGH. Some L. Stone about the creeks and shore of the Lake. No Lime has been burnt.

Gore District.

NELSON. There is L. Stone for 5s the toise at the quarry.

WELLINGTON SQUARE. L. Stone in great plenty, made use of for building.

EAST FLAMBORO'. Do. Lime burnt only in small quantities.

WEST FLAMBORO' AND BEVERLY. L. Stone abounds.

NICHOL. The whole of the course of the River (Ouse ?) through this Township is on a L. Stone rock.

WATERLOO. L. Stone in great quantities.

DUMFRIES do.

HALDIMAND. do.

ANCASTER. do.

BARTON. What is called the mountain composed of L. Stone with very little free-stone. Runs lengthways through the Township, the breadth of the L. Stone is $1\frac{1}{4}$ mile.

SALTFLEET. L. Stone in large quantities.

Niagara District.

HUMBERSTON. Abundance of L. Stone ; it is used for building, and is got on the L. Shore for the picking up.

BERTIE. L. Stone is the only building stone—it can be obtained for 15s per toise at the quarry.

STAMFORD. L. Stone in abundance, it being the general strata of the Township, all the banks of the Niagara river being of this, as also the rock over which the Niagara waters precipitate themselves.

GRANTHAM. There is a ridge or mountain running along the southern boundary of this Township, which is composed of an inexhaustible body of Lime, free and building stone, which can be obtained at 5s per toise at the quarry.

LOUTH. Building stone, of an excellent quality, can be obtained, at 5s per toise at the quarry, from a ledge of building and L. Stone running along the south side of the Township.

GRIMSBY. On the summit of the ridge numerous specimens of marine fossils and petrifactions are to be found, all of which indicate that the country, has at some remote period, been covered with water.

PELHAM. In the northern part of the Township there are immense quarries of L. Stone. The ridge, as it is called, in this Township, being 500 feet higher than L. Ontario* ; it commences about ½ a mile east of the eastern limit of the Township, and extends westerly nearly 4 miles, the ascent on the northern side is abrupt, but on the southern it is much more gentle and easy.

WAINFLEET. A great quantity of L. Stone of the very best quality.

CANBORO' AND CAISTOR. A little L. Stone.

No reports were furnished from the Home District, and only one (Haldimand) from the Newcastle, which contained nothing respecting L. Stone.

Midland District.

KINGSTON. The whole of the Township of Kingston lays on a stratum of L. Stone, at the depth of from 1 to 6 feet. The blue L. Stone of this Township makes very handsome and durable building stone. (Note 17.)

EARNESTOWN including AMHERST ISLAND. L. Stone universal.

SOPHIASBURGH. No building stone except L. Stone.

HALLOWELL. There are various ridges which abound with L. Stone.

THURLOW. L. Stone is found in abundance and can be quarried for 50s.

Johnstown District.

WOLFORD. Large quantities of L. Stone at two dollars a toise.

ELIZABETHTOWN. L. Stone every where abounds excepting on the front above Brockville where the face of the country undergoes a considerable change.

BROCKVILLE. Price of Lime at the kiln 6d per bushel.

YONGE. L. Stone in great abundance.

KITLEY. do.

BASTARD. L. Stone is found in this Township.

Eastern District.

CHARLOTTENBURGH. L. Stone in great abundance ; lime from 6d to 9d per bushel.

This was the last report received. Those Townships omitted were either unreported or contain no L. Stone yet discovered. They probably form part of the main alluvial bed of the Province, and are as follows :—Sandwich, Raleigh, Dover, East and West Chatham, Camden, Oxford, Howard, Harwich, Blenheim, 1st Concession of Burford, Trafalgar, Willoughby, Thorold, Crowland.

Promiscuous Observations on the L. Stones of Upper-Canada.

A bluish L. Stone forms the upper bed at the Falls of Niagara. **Gourlay.**

* About 800 feet above tide water ?

A L. Stone is found at L. Erie, full of madrepores.—Dr. B.

The country between the Falls of Niagara and Queenstown, is a plateau elevated some hundred feet above the plain which joins L. Ontario. This plateau appears every where composed of L. Stone and Sandstone, containing marine organic remains.—M. Guillemard.

" A Kingston ou Cataraquoi, à l'extrémité sud-est du Lac Ontario, on retrouve encore la pierre à chaux de l'espèce argilleuse, à grain fin, et d'un gris foncé."—M. Guillemard.

The L. Stone of the Niagara District differs from the rest, both in colour and quality, being grey and not so easily calcined into lime.—Gourlay.

Chalk. The occurrence of Chalk in Canada, or indeed on the continent of North America, does not appear to be well established. Dr. Bigsby states, however, that Dr. Wright has a specimen of Chalk from the neighbourhood of L. Superior. In the United States several localities of chalk have been mentioned, but professor Cleaveland seems to think that Agaric mineral has been mistaken for it.

Agaric Mineral ? In the Township of Rodney (Romney ?) there is a bed of that fine calcareous earth which is known in commerce by the name of whiting, or Spanish white, and which is used in painting and for putty, and in the manufacture of fine wares.—Gourlay.

Arragonite. La Chine.—Dr. B.

LIME, PHOSPHORIC ACID.

Apatite (Phosphate of Lime) occurs in light blue six-sided prisms, sometimes truncated on the terminal edges, in white L. Stone, at Prescot, U. C.—Morton & M'Euen.

Do. Fort Wellington.—Dr. B.

Pearl Spar ? U. Canada (particular locality unknown) in a geode of Magnesian L. Stone.

LIME, FLUORIC ACID.

Fluor Spar (Fluate of Lime)—Of a deep purple colour, is found associated with Calx Spar, in a stratum of fetid L. Stone, running conformable to the Black Rock, and interstratified with it. St. John's Gate ditch, Quebec.

Do. (purple)—At Montreal, near the mountain, in L. Stone.—Dr. B.

Do. (white)—In small cubic crystals, occupying cavities formed in fetid L. Stone by the absence of Organic remains, formerly filling the vacuity.—Beauport and Montmorenci, near Quebec.

LIME, SULPHURIC ACID.

Gypsum (Sulphate of Lime)—North Shore, L. Erie, principally at Dumfries.—Dr. B.

Do. Grand River, L. Erie.

Do. (Selenite) of a red colour, Michilimachinac.—Dr. B.

Do. Falls of Niagara. (Note 30.)

Do. In abundance and of good quality in the Township of Haldimand. Gourlay.

Do. In West Flamboro' and Beverly.—Gourlay.

Do. " Plaster of Paris has lately been found in the Township of Ear-

nestown, in an *uncalcined* state, and strongly impregnated with *lime*."—(Note 18.) Gourlay.

BARYTES, SULPHURIC ACID.

Barytes. L. Superior.—Dr. B. (Sulphate ?)
Do. Sulphate. Grosse Isle, at the mouth of the River Detroit.—Do.

STRONTIAN, SULPHURIC ACID.

Sulphate of Strontian, (Celestine.) Grosse Isle at the mouth of the River Detroit.—Do.
Do. An Island near Put in Bay, in Lake Erie*.—Bowen.

METALLIC MINERALS.

IRON, SULPHUR.

Iron Pyrites (Sulphuret of Iron.) This is so common that the mention of all its localities would be both useless and endless ; a few of the most deserving notice are introduced.

Behind Mr. Cairnes' house, in Mountain street, Quebec, round bullet shaped masses of Iron Pyrites are found in the decomposed Clay-slate surrounding blocks of L. Stone. They are of the cubic variety, the faces of the cubes forming the circumference of the spheres.

Do. The hepatic and radiated varieties are found in decomposed Clay-slate, associated with compact L. Stone near No. 4, Tower ; the former partakes sometimes so much of the general decomposition of the part of the rock in which they are found, (and of which they have been probably one cause,) as to have lost their metallic lustre and sp. gr.

Iron Pyrites. Twin Crystals of Cubic Iron Pyrites have been observed disseminated through some of the Clay-slate in the district of Quebec ; one in our possession is singularly well defined, and resembles the appearance that would result from trying that seemingly paradoxical experiment of putting one cube through another of exactly equal dimensions, cut in a particular manner to receive it.

Do. Township of Yonge, near the Lake of 1000 islands. (Note 19.)
Do. Elizabeth Township.—Gourlay. (Note 20.)

IRON, OXYGEN.

Magnetic Oxide of Iron. Marmora, U. C.—Dr. B. (Note 21.)
Do. Hull, on the Ottawa, associated with plumbago and coccolite.—Dr. B. (Note 22.)
Do. In Granite, near Tadousac, L. C.
Do. St. Paul's Bay, L. C. (Note 23.)
Micaceous Oxide of Iron. Rocky Mountains.
Ochrey Brown Oxide of Iron (Yellow Ochre.) St. Augustin, L. Calvaire.

* This locality, like some others here introduced, is not strictly Canadian as it is in the Territory of the U. S. but it appears, for obvious reasons, desirable to introduce such minerals as lie near the frontier. On a future occasion we propose to do this more completely by making extracts from Cleaveland's mineralogy, of all those minerals which are found in the several States bordering on our townships.

Ochrey Brown Oxide of Iron (Yellow Ochre) is dug up in Gananoqui and in the Township of Earnest.—Gourlay.

Bog Iron Ore. St. Maurice, Three-Rivers, L. C.

The following notices of the occurrence of Bog Ore, are from Gourlay :

Do. At Charlotteville, about 8 miles from L. Erie, an Ore of Iron is found which is of that description denominated Shot Ore, a medium between what is called Mountain Ore and Bog Ore; the Iron made of it is of a superior quality. (Note 24.)

Bog Iron Ore—In considerable quantity in the Township of Trafalgar.

Do. There is said to be plenty in the Township of Bertie.

Do. In the Township of Stamford.

Do. In great plenty in the Township of Grantham. It is found in low wet lands and is raised in large lumps, the size of common stone, and is made use of for the backs of fire-places instead of stone.

Do. In the southern part of the Township of Pelham, in small quantities.

Do. In small quantities in the Township of Crowland, frequently in marshy places.

Bog Ore. Some in the Township of Canboro' and Caistor.

Black Hematite. Encampment Douce, L. H.—Dr. B.

Scaly Iron Ore. Do. do.

Carbonate of Iron (pseudo volcanic) Township of Yonge, U. C. do.

PROMISCUOUS IRON ORES.

Iron Ores in the Township of Westminster and Dorchester. Gourlay.

Do. An indication on a branch of the Grand River, in the Township of Barford.—Gourlay.

Do. In the Township of Woodford.—Gourlay.

Do. Strong indication in the Township of Ancaster.—Gourlay.

Do. On the River Ganannoqui are the iron works which belonged to the late Ephriam Jones, Esquire, they are in a state of ruin, and no great use was ever made of them. The height of the fall, the constant supply of water, abundance of Ore, and other advantages render it a matter of regret, that so valuable a property is not put to use.—Gourlay.

Do. In great abundance, in Leeds Township, U. C. do.

Do. Strongly indicated in the Township of Wolford, U. C. do.

Do. (rich.) The base of Long Point.—Dr. B.

MANGANESE, OXYGEN.

Manganese (Earthy Oxide.) Sillery, near Quebec. (Note 25.)

COPPER.

Copper (native) in large bowlders on the shores of L. Superior.—(Note 26.)

Do. The Muriate, Sulphate and green Carbonate have also been found, but no particular locality known.

COPPER, SULPHUR.

Copper Pyrites—N. W. L. Huron.—Dr. B. who says copper is frequently met with.

ANTIMONY.

Antimony—frequently met with.—Dr. B.

LEAD.

LEAD (native.) Au Glaize River at a considerable distance from Fort Wayne, (Stickney, Silliman's Journal, vol. 1.)

LEAD, SULPHUR.

LEAD (Sulphuret.) One mile up the eastern branch of the R. Nicolet, in the Township of Chester, L. C. from where Craig's Road crosses it. Mr. Adams.
Do. In L. Stone. Bay St. Paul.—Dr. B. (Note 27.)
LEAD ORE. Township of Patton, L. C.—Wilcox. (Note 28.)
GALENA. N. W. L. Huron.—Dr. B.
Do. Hawksbury, Ottawa. do.
Do. Fort Wellington.—Dr. B. who says Ores of Lead are frequently met with in the Provinces.

ZINC, SULPHUR.

BLENDE (Sulph. of Zinc) in L. Stone. Montreal.—Dr. B.
MASSIVE BLENDE (yellow.) Falls of Niagara. do.
CRYSTALLIZED, do. do. do.

ZINC, OXYGEN.

ZINC (red oxide.) Particular locality not stated.—Dr. B. (Note 22.)

MERCURY, SULPHUR.

MERCURY (Sulphuret.) On the shores of L. Erie and Michigan. Stickney. Note (29.)

COMBUSTIBLE MINERALS.

SULPHUR, (PURE.)

SULPHUR. In the neighbourhood of Fort Niagara, Bitumen and Sulphur are every where to be found, and as usual accompanied by the metals. (Stickney, Silliman's Journal, vol. 1.)
Do. Falls of Niagara. Hall. (Note 30.)
Do. Township of Saltfleet.—Gourlay.
Do. At the head of L. Ontario, in solid lumps in sulphur springs.—Do.

CARBON, IRON.

PLUMBAGO (Graphite) (Carburet of Iron) Occurs in nests in Magnetic Oxide of Iron, at Hull, on the Ottawa.
Do. On the shores of the Ganannoqui Lake, and in some other places, chiefly in the eastern section of the upper Province.—Gourlay.
Do. La Petite Rivière, L. C.—Dr. B.
Do. Hawksbury, Ottawa, do.
Do. In a Creek, near Kingston, do.
GRAPHITE SLATE? On Judge Taschereau's Seigniory of St. Mary's.
COAL (Anthracite?) In Greywacke, at Dr. Mills' quarry at Cape Rouge, about a bushel was collected.

CARBON, HYDROGEN.

Coal, in grains? forming a thin vein, traversing L. Stone conglomerate behind Mr. Cairnes' house, in Mountain Street, Quebec.

Do. (smut?) Common to the "Black Rock" of Cape Diamond.

Jet? occupying the crevices and natural joints in compact L. Stone, near No. 4, Tower, Quebec.

Petroleum, is found in considerable quantities on the Thames River, U. C. from whence it is taken by dipping blankets into the water. It is used for the cure of rheumatic complaints.—Mr. Hay.

Do. Near the Moravian villages, on the River Thames, there are springs of petroleum,—Gourlay.

Do. A bituminous substance (fluid?) appears on several of the waters of the north western country.—Gourlay.

MINERAL SPRINGS, &c.

Sulphur Spring. St. John's Suburbs, Quebec. (Note 31.)

Do. At the level of high-water, at the base of the clift, about 200 yards west of the falls of Montmorenci, near Quebec.—W. Green, Esqr.

Do. At the head of L. Ontario, there are several fountains strongly impregnated with Sulphur.—Gourlay.

Do. A Sulphur Spring occurs near and above the Falls of Niagara.—Howison.

Do. Near Long Point, U. C.—Howison.

The following are extracts from Gourlay:

Sulphur Spring, in the Township of Oxford.

Do. (3)	Do.	of Walpole and Rainham.
Do. (1)	Do.	of Woodhouse.
Do. (springs)	Do.	of Norwich.
Do. (springs)	Do.	of Saltfleet.
Do. (2)	Do.	of Humberston.

Do. (2) in the interior Do. of Willoughby.

Sulphur Springs (small) in the Township of Pelham. Sulphur strongly indicated in the Township of Earnestown and Amherst Island—(by springs?)

2 Medicinal Springs in the Township of Scarborough. (Note 32.)

1 do do. Townsend, of considerable note.

Sulphur Spring.—Big Creek, Charlotteville, resembling in taste the Harrowgate waters.

Chalybeate Spring—Township of Ancaster.

Many Mineral Springs in the Townsbip of Yarmouth, the qualities of which have not been ascertained.

Saline Springs abound on the northern and western shores of L. Ontario, in the Township of Oxford and Camden.

Saltlicks. Do. of Norwich.

Salt Springs—A few of an inferior kind in the Township of Trafalgar.

Do. in the Township of Flamboro' and Beverly.

Do. equal to those of Onondago in the Township of Haldimand.

Do. in the Township of Ancaster.

SALT SPRING (trifling) in the Township of Barton.

2 do. Springs, Township of Saltfleet.

SALTLICKS, in the Township of Stamford, on the banks of the Chippawa.

SALT SPRING (excellent) near the Village of St. Catherines, in the Township of Grantham.

Do. (several) Township of Louth.

Do. (frequent) do. of Crowland.

Do. (1) do. of Canboro'.

SALTLICKS (many) Township of Canboro' and Caistor.

SALT SPRINGS. Do. of Earnestown.

Do. (Sulphate of Soda ?) Lyon's Creek, Township of Crowland.

Do. Near the centre of the Township of Brockville.

Do. On the Penninsula of Prince Edward, in the Township of Sophiasburgh.

Do. SPRINGS—on the River Trent.

It appears from Capt. Phillpott's report of work performed at York in the Engineer Department, that a Salt Spring had been met with in boring a well.

The upper Districts of the Province are still supplied with Salt from the salt works at Onondago, in the state of New-York.—Gourlay.

Several inflammable Gas Springs which ooze out of the bank of the Niagara River, from the mouth of Chippawa River, and extend about 1½ miles down. The air from some of these, when confined in a tube, will burn constantly.—Gourlay.

Note.—In Bakewell's tour through the Tarentaise and Savoy, a description is given of a very economical method of obtaining Salt from the Saline Springs of the country.

NOTES ON THE LOCALITIES OF CANADIAN MINERALS.

Note 1.—From this part of the country most of the crystals are procured which are used by the Lapidary in Quebec for necklaces, brooches, crosses, &c. and the larger ornaments. Those obtained from the "Black Rock" of Cape Diamond are only large enough for pins, &c.

Note 2—By some this rock has been considered a L. Stone. M. Guillemard writes that the rock of Cape Diamond is composed principally "des couches calcaines." There certainly are conformable strata, more calcareous than others, but the most so, and those only that can be considered as L. Stones, are very subordinate to the others. Some uncertainty exists in the method generally adopted of ascertaining which are L. Stones and which are not, and effervescence in acid is a character to which too much attention is given. Many of the magnesian carbonates effervesce very slowly and reluctantly, while some of the Clay-slates, Shales and Sandstones effervesce violently for a short time. Such is the character of these last mentioned rocks about Quebec; and if effervescence in acid, be considered a decisive character, we run the risk of having them confounded with real L. Stones. As respects the "Black Rock," however, Professor Silliman appears to have decided the question, as he speaks of it both in his tour and in his system of Mineralogy, as a Clay-slate or Argillite.

The following is an attempt to delineate its characters, both Geological and Mineralogical:

Geological and Mineralogical Characters of the "Black Rock" of Cape Diamond.

The rock of Cape Diamond, commonly called the "Black Rock," has been sometimes denominated a Limestone. With the view to expose its claims to that distinction, we shall give, to the best of our ability, its Geological and Mineralogical characters. The Strata, as they lie naturally and artificially exposed on the northern shore of the St. Lawrence, between Cape Rouge and Sillery Cove, are of that variety of argillaceous schist, called Grey Wacke, associated, in conformable order, with that finer variety denominated Clay-slate or Argillite. The dip of the Strata is to the S. E. at about an angle 35°, its consequent bearing N. E. and S. W. with a slight inclination of its upper edge below the horizon, towards the N. E. It is probably owing to this inclination, that the Grey Wacke is lost before it reaches Quebec, by descending below the level of the St. Lawrence: indeed the last of it is seen at Sillery Cove, very near that level, and 3 miles from Quebec. Here the Clay-slate, which has been running in parallel strata at the back of the Grey Wacke, is alone visible. It forms a low ridge, but continues to rise towards Quebec with

the interruption of a valley or two, until at Cape Diamond it forms a precipice about 320 feet above the level of the river. All this distance, it preserves much the same dip and bearing as the Grey Wacke, with which, in some places on the opposite shore, it may be seen alternating. Although no geological difference, thus far, appears between the Clay-slate at Sillery Cove and the "Black Rock" at Cape Diamond, a very evident chemical one exists. At the latter place the rock has become often of a sooty blackness—exhaling a bituminous odour when struck or scratched, and sometimes soiling the fingers. The cause of this is the presence of carbon, which has been found in the rock in the proportion of 20 per cent. There appears also to be a difference in the effect of weather, or other destructive agents. On the Clay-slate, between Sillery Cove and Cape Diamond, they exert their influence by covering the base of the rock with a crumbling deposit of small wedged shaped fragments, sometimes highly ferruginous. At Cape Diamond they act by displaying a continuous schistose structure of little tenuity or tenacity, parallel with the plane of stratification.

The general bearing of the "Black Rock," is to the N. E.* However, in some places the strata may be seen running North, the dip being reversed to the N. W. In some cases the strata are vertical, or nearly so. All this may be occasioned by the bending or waving of the strata.

The thickness of the strata varies from three feet to three inches. The former are often, to all appearance, of a very compact structure, breaking with conchoidal surfaces and sharp edges. In most of these, however, weather effects what the hammer fails of doing, and displays its really schistose structure. It is on account of this, and its absorbent character, that the "Black Rock" is not a good building stone. The thin strata are generally very schistose, apparent to the eye. They are sometimes compact and break into long prismatic pieces, which yield a ringing, metallic, sound when struck: these separate the thicker strata at certain intervals and often determine the planes of stratification when they might otherwise be doubtful, from the resemblance which the whitened and even surfaces of the natural joints sometimes bear to them. The latter are never continuous—another useful test.

Among the peculiar appearances common to the "Black Rock," and displayed by fracture, is a ribbed aspect; another is a glossy convexity, of surface resembling polished shoe leather. The effect of weather is also sometimes remarkable.—In most cases it exhibits the schistose nature of the rock; in others more compact, it shows a rounded and whitened surface forming a striking contrast with its sooty interior. While again in others, by the rounding of successive laminæ, a series of concentric irregular ovals are formed, much resembling the grain of fir; and when the surface is browned or reddened, a singular imitation of wood is produced.

In excavating, strata are met with, the colour of which is a lively green: these have, for the most part, undergone a considerable degree of induration and resemble flint in fracture, translucency, hardness and effect of the blowpipe (hornstone ?); spheroidal concretionary lumps of the same, and of a dark grey variety, are common.

Some of the strata are decidedly more calcareous than others; and two instances of an unquestionable Limestone have met our observation. The first is fetid and somewhat crystalline: the other compact. Both are

* The general bearing of all those rocks whose strata are inclined, in Canada, is to the N. E.

situated on the same plateau, and bordering on the local and conformable conglomerate, which characterizes the precipice to the N. and N. W. of the town. The last mentioned stone is of an excellent quality, and dissolves in acid almost totally, with violent effervescence, and burns to a to a white caustic lime. Unfortunately for the the inhabitants of Quebec, who procure their lime at Beauport, a distance of five miles, on the other side of the St. Charles, it does not preserve these characters for any considerable distance, but becoming suddenly impure, it is lost by abruptly dipping under the "Black Rock" in the direction of its bearing. The trace of one solitary bivalve was observed in it. (Note 7 and 15.)

The minerals found in the "Black Rock" are

1st. Iron as an oxide and as a sulphuret: the former, in a state of solution, often bestows a red or yellow stain on the surface of the rock. The latter is not so common and is generally found with a soft greenish variety of the rock.

2nd. Quartz sometimes in fine acicular crystals of considerable transparency, as are also others approaching the form of the double pyramid, applied base to base; more frequently in ill formed semi-transparent prisms. They vary in size from drusy, to crystals as large as the thumb. The latter are never transparent throughout, and often appear in the progress of formation.

3rd. Calcareous Spar, in white and brown acicular crystals, finer than spun glass, radiating from a white calcareous base, often enclosing ill formed crystals of quartz; also in perfect rhombs. But its most common appearance is in veins of a laminar structure, traversing the rock in all directions; these in some places become so numerous as to give the rock the aspect of a conglomerate; they often traverse each other, and in that case, one vein appears to have dislodged that portion of the other it met with in its progress.*

4th. Petroleum, in soft translucent pieces of a green and yellow colour, sometimes surrounding the root, more rarely insinuating itself into the interior, of a crystal of quartz.

5th. Coal-dust or soot, often investing the surface of quartz crystals, in drusy cavities.

6th. Flour Spar. As far as we can learn, this is by no means common. One specimen of an imperfect crystal we have met with. Its colour is a deep purple, so intense as to render the crystal scarcely translucent. Its form is that of half a cube divided diagonally. It was found associated with calx spar in a crevice of the "Black Rock," on which it is sometimes found in thin crusts or plates, slightly shaded with purple.

The earthly minerals above named, occur for the most part, in crevices and small fissures in the rock.

Of two specimens of rock, one procured from Wolf's Cove, between Sillery Cove and Cape Diamond—the other from Cape Diamond, the following is a comparative minerological description.

Wolf's Cove.—Colour, dark ash grey—opaque—structure compact—fracture uneven, somewhat conchoidal with sharp edges—easily scratched by the knife—receives a trace from copper—colour of powder, reddish—streak dull light grey. Sp. Gr. 2. 57. moderate effervescence in acid with or without being powdered, which soon subsides, leaving considera-

* The same thing has been observed of veins of granite in gneiss—the former is owing to the infiltration of calcareous spar, through the agency of water, into fractures of the rock across older veins of that mineral. The latter does not probably admit of so satisfactory an explanation.

ble sediment. Before the blow pipe it forms a yellowish or brownish enamel ; the part furthest from the flame is whitened.

Cape Diamond.—Colour brownish black—opaque—structure compact —fracture uneven, somewhat conchoidal, with sharp edges,—scratched by the knife, but not quite so easily as the foregoing—colour of powder, reddish ash grey—streak reddish grey—exhales the bituminous odor when struck—effect in acid the same as the last, with the addition of the solution being discoloured. Sp. gr. 2. 54.—effect of the blowpipe precisely the same as in the last instance.

Such is a very imperfect sketch of the geological associations and mineralogical characters of the "Black Rock" of Cape Diamond; from which it appears to be an argellite and not a L. stone. The only characters it possesses in common with any of the varieties of the latter, are a slight effervescence in acid, and its bituminous odor. But as the Clay-slates, Sand-stones, and Shales, in this neighbourhood, possess one or both of these characters, as they do often elsewhere, they are liable to be confounded with L. Stones, if the "Black Rock" be considered one. —CANADIAN REVIEW, No. 5.

SUPPLEMENTARY.

This attempt to shew that the "Black Rock" of Cape Diamond is geologically the same as the Clay-slate at Sillery Cove, is founded rather upon the similarity of physical character between the two, than upon a strict geological base. That two rocks may be precisely the same, physically and even chemically, and at the same time diametrically opposed as to age, is well known ; witness the resemblance which some of the "overlying rocks" of Macculloch, bear to the primary granites, &c. It is only, as in the present instance, when they are found in close association, or admit of being shewn to be so by strict geological deductions, that geological identity, follows from an approximate identity in composition and physical character. It is somewhat singular that in the extensive formation of Clay-slate which characterizes the south shore of the St. Lawrence, above and below Quebec, none has been found bearing the peculiar characters of the "Black Rock." The extent of this formation is not known, it forms the whole of Caldwell's Seigniory, and is found under the form of a good roofing slate at Tategouche, N. B. It is associated, as before said, with L. Stone conglomerate at Quebec, and with transition L. Stone at Point Levi. Green Island is composed of it, where it appears associated with Siliceous Schist. All the islands above and some distance below this Island, are probably of Clay-slate. It is believed that it does not in any ~~other~~ place ~~than at~~ Quebec, cross to the North Shore of the St. Lawrence, which appears to be, with few exceptions,* from Cape Tourment downwards, of a decidedly primary character. At Rivière du Loup it forms a natural banquette, or raised platform, running parallel with the shore, sometimes appearing on one side of the road, sometimes on the other, sometimes on both. The rusty colour of the road often betrays the presence of this rock when its concealment might render it doubtful, as it is characteristic of the Clay-slate about Quebec to be highly ferruginous, its iron passing through all the stages of oxidizement, from

* One exception is mentioned by Dr. Bigsby, he says : "at Mal Bay, 90 miles below Quebec, gneiss and mica slate dip from and abut against a horizontal calcareous conglomerate full of organic remains and among others, of three species of orthoceratite."

white the least so, to red the most. In some places on this road the Clay-slate, at a distance, resembles a L. Stone formation, owing to the whitened and powdery aspect of its exposed surface, this is probably the 1st stage of its oxidizement? In the 2nd, as a green oxide, it often enters into the composition of strata of a very friable character, of which it is no doubt the cause? The 3rd stage is the black, and may be seen, in association with carbon, imparting a glossy, often semi metallic blackness, to some parts of the rock; it sometimes bears a remarkable resemblance to polished shoe leather? The 4th or red oxide has been mentioned, like the green, it also, often, gives a friable character to the rock, and sometimes a glimmering semi-metallic lustre? A yellow stain is often observable on the planes of stratification, but as Chenevix himself only allows of four stages, it is not presumed here to hint at another. Indeed, that celebrated chemist is not supported in his opinion by the majority. As in general chemists are disposed to allow of only two states of oxidizement, the black and the red, considering the other colours to be the results of the various combinations into which the two oxides enter, (see Parke's Cheml. Chatm. p. 321.) The grounds upon which this opinion is founded, it would be interesting to see illustrated, as it does not appear easy to conceive how the combination, to produce such remarkable changes, takes place. It must be of a chemical nature, and water probably the channel of communication? It is to be regretted that Dr. Bigsby, has not yet published his Geological notes on Lower Canada, or if published that they are not circulated in the Province. They no doubt contain much valuable information on this part of the Province, the publication of which would have rendered such an imperfect, perhaps erroneous sketch, as this not only unnecessary but absurd.

Note 3.—This mountain has a remarkable action upon the magnetic needle.—While surveying on its summit last summer, we observed a variation of 4°. in a distance of 172 feet.—At first some error was suspected in our method of operation, but by frequent trials and with different instruments, the existence of this phenomenon was placed beyond all doubt.

It was a somewhat singular coincidence that while employed ascertaining the fact, Mr. Shand, the overseer of Works in the Engineer Department, who had been occupied running a straight line by compass on another part of the mountain, joined us to make a similar report. We were afterwards obliged to work without any reference to a compass, which is probably the best plan at all times.

Lieut. Luxmoore, R. E. while measuring a base on the ice opposite Montreal a few winters ago, found a variation of 1°. in about 2500 yards; probably the effect of the same cause though weakened by distance.

It is the character of many of the Trap Rocks, like the Montreal mountain, to affect the compass. The Basaltic range in Ireland, called the Giant's Causeway," does so in a remarkable degree. This phenomenon is not owing to these rocks containing beds of Magnetic Iron, but to the iron entering into the composition of the rock, being magnetic; and as these rocks in most cases are decidedly secondary, their supposed igneous origin appears to receive additional support from the fact that Magnetic Iron is found in association with a class of rocks with which it is unusual to find it, but which may be accounted for by the purifying nature of the heat which some of the Trap division of the secondary class of rocks, are supposed to have undergone.

Note 4.—As this is considered a remarkable rock its characters are here introduced :

Description of a Bowlder found at Riviere du Loup.

GENERAL CHARACTERS.

Quartzose—Translucent, often seml-transparent, sometimes with a chalcedonic cloudiness—Hydrophanous and opalescent in a high degree. Hardness equal to quartz—Brittle, but strikes fire under the hammer—Fracture in the large, *tumulated*, in the small, flat conchoidal or even—Lustre, vitreo-resinous often greasy. It is traversed by cracks or seams in all directrons, which are sometimes coated with the red or yellow oxide of iron, at others, with a green substance resembling chlorite. Indeed a scaly variety of what is supposed to be chlorite, with silver talc, is so thickly disseminated through the mass that it is almost impossible to break off a piece the size of a nut, which does not contain a blackish looking speck of one of these minerals.

It is a rock sometimes resembling quartz, at others opal in a remarkable degree.

The general structure of the mass is foliated.

PARTICULAR CHARACTERS.

Small fragments are either rounded, sharp-edged or scaly—Colour either yellowish white or bluish white, the yellowish white fragments, are generally not so translucent as the other, the first is often semi-transparent.—By transmitted light, the bluish variety is yellow—An iridescence appears on the surface of some fragments, but it is not general. It adheres to the tongue slightly—A mean of 4 trials gave 2. 7, sp. qr.. A specimen very free from any admixture, and of a buoyant form, gave 2. 5, which was the lowest to be obtained.

A fragment weighing 30 dwt. was not fonnd to be any heavier after immersion in water 48 hours, although its translucency and opalescence were much increased. Before the blowpipe it loses colour but does not fuse.

Note 5.—The chalcedonies, carnelians, jaspers and agates, so thickly distributed over the beach at Gaspé, are particularly worthy of notice for the beautiful varieties they afford. Among the most remarkable of the latter, are those whose shades present, after passing through the hands of the Lapidary, strong resemblances to well known characters. Mr. Smilie has an agate exhibiting, it is said, a striking likeness to the Duke of Wellington. In the British museum there is a similar resemblance to Chaucer.

Note 6.—Some observations on the organic remains of Drummond's Island, read before the Literary and Historical Society of Quebec.

Four main deposits have been mentioned by Dr. Bigsby, where specimens in this branch of Natural History are to be found, viz :—Drummond's Island, Montreal, Beauport, and Montmorenci. It is by no means meant that they are to be found only in these places, but from natural or artificial causes, that they are there easily observed. Of these four, Drummond's Island presents the most interesting suite, and the importance attached to them at home, has occasioned such a rage among collectors that (indulging in a little hyperbole) the topographical outline of the Island, may be almost said to have been affected by it. They are now, in consequence, proportionably scarce, but fame lingers long round departed worth, and the unskilful amateur never fails, on visiting the Island, to

bear thence a quantity, more than he can conveniently carry, of a very impure L.Stone. When first they were noticed the possession of the Island would have been a little fortune to a private individual, who chose to make a profit by the sale of its singular contents.

These organic remains consist principally of teeth, vertebræ bivalves, univalves (particularly of that singular genus the orthoceratite, a multilocular univalve.) Of the class alcyonium, madrepores, millepores, chain coral, favoisites and other polypifer bearing substances ; also sponges, at least such appear to be the prevailing species or genera upon an inspection of those now presented, which if not all from Drummond's Island, are probably in part from some other of the Manitouline chain or neighbourhood of L. Huron.

Many of these fossil remains have undergone a complete change of mineral substance, particularly the shells, having parted with their lime in favour of silex, whereby they have been converted into a chert or hornstone. The abundance of vertibræ is astonishing—of all sizes—these also exhibit the influence of silex—the interior of the vertebral column often passing into agate or chalcedony.

In order to form some idea of the period it would take to produce a change of this description, it will be interesting to mention what Dr. Kirwan says in his Geological Essays. " About the year 1760, the Emperor of Germany being desirous to know the length of time necessary to complete a petrifaction, obtained leave from the Sultan to take up and examine one of the timbers that supported Trajan's Bridge over the Danube, some miles below Belgrade. The outer part of this timber to the depth of half an inch, was found to have been converted to an agate, the inner parts were slightly petrified, and the central were still wood." In the instance before us the agatizing principle is advancing from the centre to the circumference, which is accounted for by the cavernous nature of the bone in its original state, admitting freely water holding silex and alumine in solution.

The organic remains of Drummond's Island, are remarkable also for exhibiting genera unknown in a recent state and among others that extraordinary shell the orthoceratite, a many chambered univalve. The only one of this class, not microscopic, which is known to exist in our seas, is the nautilus. As the structure of this class illustrates the rise or fall of bodies in a fluid by a change in their Sp. Gr. and at the same time affords one splendid proof, among the many Natural History unfolds, of the wonderful provision of Providence. We beg leave to read what Parkinson says on the subject in his " Introduction to the study of Fossil Organic Remains."

"The larger tribe of Multilocular Univalves has been separated into twenty-two genera, all of which have been found in a fossil state : whilst one genus only, *Nautilus*, is known to exist in a recent state. Two opinions are entertained respecting this great disproportion between the number of fossil and of recent shells of this tribe. Some suppose that those genera, of which only fossil shells are found, have become extinct ; whilst others believe that these shells are still existing in a recent state ; but are pelagian shells, their inhabitants constantly residing at the bottom of the deep. This opinion is entertained by some of the latest French writers, particularly by Mons. de Montfort.

"But an examination of these shells proves, that, so far from their inha-

bitants having been destined to a constant residence at the bottom of the ocean, they possessed, beyond all other testaceous animals, the power of rising up to, and remaining at, the surface of the sea. Supposing them still to live, they would occasionally, as the *Nautilus* is, be seen at the surface; but not a single instance being known of a shell of these genera having been thus seen, their existence may be reasonably doubted.

"The apparatus enabling the animal to raise or sink himself at pleasure is plainly discoverable in the fossil of the *Nautilus*: but the most important part of this organ, the continuous siphuncle, is not discoverable in the dried specimens of the recent shell. The shell in the *Nautilus* (*Pl.* VI. *fig.* 1.) is formed of a number, more or less, of chambers, divided by pierced septa. The animal resides in the largest and last formed chamber; an elastic tube, proceeding from the animal, passes through the pierced septa and the several chambers, and terminates in the first. Now, assuming that the office of this tube is analogous with that of the swimming bladder of fishes, it is by no means difficult to conceive how the required changes of situation may be produced. The weight of the shell is so counterbalanced by the empty chambers, that the siphuncle passing through these chambers, accordingly as it is dilated with gaseous or with aqueous fluids, will alter the specific gravity of the whole mass, and cause it either to swim or to sink. Supposing the animal to be lying at the bottom of the sea, saturated with food, and the siphuncle filled with a fluid; as the food is digested and decomposed, detached gas may pass into the siphuncle, and gradually take the place of the water; when, in proportion as the specific gravity of the whole mass is thus diminished, it will rise, probably into that region of the waters in which the food of the animal most abounds. Here, on obtaining sufficient food, or on alarm from an enemy, the animal admits water into the siphuncle, and immediately sinks.

"In all the other genera of this tribe, an apparatus, formed of vacant chambers and a membranous siphuncle, exists, capable of producing similar effects with those produced by that of the *Nautilus*; but necessarily differing in some respects, from variety of modification of the form and structure peculiar to each genus. The siphuncle is often very well displayed in sections of the *Orthoceratite*, and in these this tube will be found to have been capable of being dilated to a very considerable extent."

Although a hacknied illustration, we cannot close this subject better perhaps than by comparing this Society in its present state to the first drop of water which fell on this semi-perforated stone. It fell unheeded and ineffectual, drop after drop splashed on—yeilding to that persevering touch, the stone has become a chalice incased with bright crystals!"

Note 7.—The appearance mentioned is, as nearly as can be described, as follows: rounded ridges in low relief, highly glazed and carbonized, crossed by similar smaller ones: the whole somewhat resembling trellis work—no traces of leaves.

The occurrence of any decided organic remains, either vegetable or animal, in the "Black Rock" of Quebec, has not come to our knowledge, although, considering the carbonaceous character of the rock, and that the organic remains of shells have been found in a position, to appearance at least, inferior to it, viz.: in the L. Stone conglomerate to the north of the town, their actual occurrence would not surprise. We say to appearance, because in all probability it is not in its original position

as it is not impossible that the Clay slate (with all its conformable strata in the district of Quebec,) has undergone a reversal, and has described an angle with the horizon of nearly 145° since it was deposited, by which revolution that has become undermost which originally was above.

If we suppose that the strata have moved only 35° (about their average inclination) out of their original horizontal position, then a L. Stone containing shells is found inferior to Clay slate and Grey Wacke, which, although we believe not unprecedented is of very unusual occurrence. Note 15.

Note 8.—Mica and Talc often resemble in colour, *external* lustre and flexibility, the precious metals. The former is distinguished from gold and silver, by its elasticity, specific gravity and want of the *true* metallic lustre. Talc is distinguished by the two last mentioned characters.

The following notice, extracted from one of the papers, of the occurrence of Gold in a part of the Territory of the United States, bordering on Canada, must prove interesting to our Canadian readers.

"*Vermont Gold.*—We some months since noticed the discovery in Vermont of several specimens of the precious metal, and now learn from the Boston Traveller that it has been analyzed by Gen. Field, who has forwarded a specimen for the cabinet of Harvard University. The Traveller states that "the gold was found in the highway, deposited with a quantity of clay, sand, and gravel; the soil was alluvial, and upon examination it appeared to have been brought down and deposited by a small rivulet, from a high hill. The specimen of gold, when found, weighed 8½ ounces; was of a conical form, and when found, there were firmly adhering to its base a number of small, transparent, rock crystals. The gold is soft, ductile, flexible, and malleable. Specific gravity 16, 5, and the lustre that of virgin gold. The soil of the region is argillaceous, affording beds of excellent potter's clay; and the rocks *in situ* are all of the primitive class."

Respecting the Gold Mines of North Carolina, the following extracts are given:

"*Gold Mines.*—A letter from an intelligent citizen of North Carolina to another in Baltimore under date of Salisbury, Oct. 6, says:—"The extent and value of the Gold Mines are becoming every day more apparent. Of course some Mines are larger than others. The one at Chisholm's has been found to be rich for a quarter of a mile up the branch, and on each side from 10 to 20 yards. There are many spots of 10, 20 to 100 acres on which gold can be found, averaging from half a grain to two grains of gold per bushel of earth. In most of these places it is not gold but water that is scarce. Gold has been found in the neighbourhood of Charlotte; those mines are rich, but their extent are not yet known. The gold found there is in very fine particles, imbedded in ferruginous clay, running in veins. This is taken out, made fine, then washed down, and the gold amalgamated. Chisholm's gold mine is situated two miles above the Narrows of the Yadkin river, on Beaver-dam Creek, almost one mile from its mouth. It is on this mine we are erecting our steam engines. If the machinery for working answers the purpose, we cannot fail to do a good business. The Gold is there—all that we want in order to obtain it, is

labor-saving machinery. I wish you could rise a company in Baltimore to work one of our best mines—I am confident you might realize great profits."—*N. York Com. Advertiser.*

"In the *United States*; in *North Carolina*, in Cabarras County, on Meadow Creek, &c. the Gold occurs in grains or small masses in alluvial earths, and chiefly in the gravelly beds of brooks in the dry season.—(GIBBS.) According to Mr. Ayres, one mass, weighing 28 pounds, has been discovered.—The Gold of Cabarras is alloyed with silver and a little copper. When purest, it is 23 carats fine, and is superior in quality to the Gold coins of England and the United States. In 1810, upwards of 1341 ounces of this Gold, equal in value to 24,689 dollars, had been received at the mint of the United States.—(Bruce's Min. Journ. vol. i.) It is said also to have been found on the upper branches of James' River; and on the Catabaw in *South Carolina*.

"It appears that most of the Gold of commerce is obtained from auriferous sands. When thus found, it is extracted by the simple process of washing the sand. When enveloped in other minerals, it is extracted by amalgamation with mercury."—*Cleaveland's Mineralogy, Vol.* II.

Note 9.—EXAMINATION OR DESCRIPTION OF A COMPOUND ROCK.

LOCALITY. A bowlder found buried in the sand on the shore of the River St. Charles.

GENERAL CHARACTERS. Aspect green and crystalline—hydrophanous,—opalescent, and exhibiting a play of colours—difficultly frangible.

PARTICULAR CHARACTERS. Upon the first inspection of a fragment of the rock, three minerals appear very distinct: one black, another green, and the third light blue. Upon a closer examination, the black mineral is divisable into two: 1st. That which is magnetic before the application of heat.—2d. That which is not.

I. The former appears distributed through the rock in aggregated masses, of a confusedly laminar structure, having generally an iron grey lustre: but sometimes exhibiting on the shining faces the black velvet lustre; these are two in number and opposite. It is crystallized under the form of a prism. It yields to the knife, but scratches glass; and when of most metallic aspect, is most brittle; the rock, though in the mass difficultly frangible, breaking sometimes with great facility where this mineral is most abundant. Before the blowpipe it presents to view small black globular points, fusing with slight intumescence.

II. This mineral differs from the other in the following particulars; it is distributed through the mass in a more regular manner, the structure is perfectly laminar, and the prismatic form of the laminæ more perfect and distinct. It has not the metallic aspect and is not magnetic before the application of heat, nor is it brittle. Before the blowpipe it fuses more readily and with greater intumescence into a dark globule, which is magnetic. The powder of both is green or greenish.

III. The green mineral is of a dark green, sometimes yellowish green-laminar structure. In the mass it is translucent on the edges; in thin plates or laminæ (not easily obtained) it is semi-transparent. It breaks into rhomboidal prisms with a threefold cleavage—cross fracture uneven, approaching conchoidal: before the blowpipe it forms a glassy enamel or semi-transparent glass; specific gravity 2, 5. When reduced to

thin laminæ, the lines of cleavage appear deeply shaded with green. This mineral is by far the most abundant, and may be considered the case in which the other minerals are enclosed.

IV. The bluish mineral is translucent and compact ; has a flat conchoidal vitreous fracture—greasy lustre, like fat quartz—scratches glass with facility—has a Sp. gr. of 2. 0; and appears yellowish with transmitted light.

V. When some of the powdered rock is heated in acid, scales of a golden colour, appear glittering in the bottom of the watch glass.

These characters appear to agree more nearly with the following minerals; but we are anxious to be corrected by some of our better informed readers.

No. 1. Perhaps black crystallized Hornblend, agglutenated and invested by oxidulous iron,
2. Black crystallized Hornblend.
3. Green Felspar—perhaps Amazon stone.
4. Opal.
5. Mica (black.)

We were induced to select this rock from its being of so striking a character, and from its containing so many minerals ; and also from a sort of friendship we bear these hoary monuments of a desolated world. They are worth all the skulls and cross bones in the universe, shewing the destructibility, not only of human life, but also of that universe itself. We never pass one of them but a fit of inquisitiveness seizes us. We delight to conjecture, how long it has been there ? how it came there ? how long it will remain there ? and where it came from ? With small chance of ascertaining the latter, it would be interesting, having made oneself acquainted with the characters of the most remarkable of those bowlder stones, to seek their native beds amid the hills in the neighbourhood of Quebec ; although without doubt, we should fail to find many there, the probably overwhelming cause which has scattered them over this country, as well as over other parts of the world, having been of far too general a nature to allow of their bearing any very striking local characters. However, some may be found, and the partial sweep of the mighty torrent thereby inferred, if they be in most cases, as is generally supposed, of diluvial origin. (Note 10.) De Luc, who has given the subject as much attention as any man, and has devoted a great deal of time to the almost exclusive investigation of these phenomena, by personally visiting their localities in Europe, appears completely puzzled, and is obliged to have recourse to a subterranean origin for many of them. There are two characters common to most of them ; their water-worn appearance, and the unequal pitch they exhibit on the summit ; that is, one face of the pitch is shorter and more abrupt than the other. Now the same thing may be observed in torrents, the blocks in which have precisely this appearance—the abrupt side facing the torrent : and it is natural that this should be the case. It has been supposed therefore, that by examining the general position of these masses, the direction taken by the propelling torrent may be ascertained. This, however, is far from being the fact as these faces will be found to point indiscriminately to all the points of the compass. Where this unequal

pitch is observed, it is owing probably to the mass having been at some remote period in the bed of some ancient torrent or river before the great and violent catastrophe took place to which it owes its present locality.

The largest masses we have seen in the neighbourhood, are situated on the very summit of the high ground at Beauport, forming a part of Government property. These masses, two in number, measure, the smaller from 20 to 25 feet in circumference, and 5 feet high; and the latter from 25 to 30 feet in circumference, and 8 feet high. In the latter case, taking the height as the diameter, the mass contains 268 cubic feet, and allowing 2. 6. as specific gravity, the weight will be found to be about 19 tun—no inconsiderable one to be found far removed from its native bed. However masses much larger are to be found in Europe, and one of the largest upon the summit of the Jura, with the great valley, in which is situated the lake of Geneva, between it and the parent rock in the Alps.

We cannot conclude without alluding to the opprobrium which attaches to the science of Geology, and which may be attributed to the indigested theories of the early writers on the subject. Facts in those days were made to suit preconceived systems, and, like portions of text in the hands of enthusiasts, were forced to inferences they were never calculated to bear. The subject is differently handled now. Men have started up—a Cuvier and a Buckland—individuals of distinguished talents, who remain satisfied to be guided only by facts, without the interference of any system; and who positively assert that those yet accumulated are totally inadequate to the formation of one. Few as they are, among them are some of a highly important nature; and he who desires any other proof, than the assertion of the Scriptures, of the occurrence of a general deluge about the time mentioned in holy writ, need only turn to the pages of Buckland's "Reliquiæ Diluvianæ," and if, after reading those, he be not convinced, let him never attempt to understand the clearest theorem in Euclid, nor how two and two can possibly make four.*—*Canadian Review, No.* 4.

Note 10.—It has been conjectured, that this mass might owe its position to the agency of causes now in operation, and of yearly occurrence, viz. to floating ice at the opening of the navigation of the St. Lawrence. That the numerous bowlders which crowd the shores and islands of this river owe their presence to the same cause, the operation of which has not escaped the observation of the inhabitants, who in many places owe the little L. stone they yet require to this agency, and who have noticed, that what they remove one year, is in this way supplied the next.

It has been observed, that although the bowlder in question may probably owe its position to the same cause, it could not have come by the route of the St. Lawrence at its present level, because it is well known that no ice rounds the promontory of Quebec, and therefore that none could deposit a bowlder on the right bank of the St. Charles, between high and low water mark, and near the wood yard, the place where it was found. It appears probable that it was deposited, at a period when

* In this article, as in some other published efforts of our own, we have taken the liberty of making alterations, or correcting the errors of the former press; as we believe ourselves possessed of the same right that a father exerts over an unruly son, of correcting his errors, even after he has commenced his career of manhood.—Ed.

the St. Charles, and also the St. Lawrence, were more elevated, perhaps, when they formed one water, and the present peninsula, from Cap Rouge to Quebec was an island.—But to indulge in these speculations is endless, and we feel already transgressing.

While justly ascribing many of the bowlders, we find distributed over these Provinces, to the agency of floating ice, particularly those found on or near the shores of rivers, we must not lose sight of the fact that the phenomenon of their occurrence is not confined to countries like Canada, but extends to others whose rivers are never frozen—travellers to the equatorial parts of Africa speak of them. It appears that no one cause will account for the position of these masses in all cases, and to fix upon a set of causes, which will do so, without involving any thing contradictory, is one among the questions the most difficult with which Geology has to perplex her followers.

Note 11.—"The Arabs, according to Shaw, use steatite in their baths, instead of soap, to soften the skin, and it is confidently asserted, that the inhabitants of New Caledonia, either eat it alone, or mingle it with their food.—Humboldt says, that the Ottomaque, a savage race inhabiting the banks of the Oronoko, are almost entirely supported during three months in the year, by eating a species of steatite, which they first slightly bake, and then moisten with water."—(*Phillips' Mineralogy*, p. 119)

Note 12.—The notoriety, which the bowlder lying near York, U. C. has obtained, on account of its containing a 4th Alkali, is well known, also that the peculiar mineral yielding it is considered to be the petalite. Of the presence of the former, little doubt can be entertained, repeated analysis having most probably proved the fact. That it is the Petalite, does not appear equally probable. The reasons for entertaining this opinion, are embraced in the following description, the faults of which, it is hoped, will be excused by those, who, however desirous to encourage precise information on similar subjects, will not always expect proficiency.

General Characters.

A Bowlder—Colour, externally, reddish or yellowish, with light green patches—internally, on a fresh fracture, sugar white, with the same green patches, but of a lighter colour—translucent on the edges—structure of three kinds, granular, fibrous and laminar—fracture uneven—hardness variable, but always yielding to the knife—tough in the mass (becoming indented under the hammer) brittle in small fragments—specific gravity *always above* 3. 0—its powder phosphoresces on charcoal heated to redness—effervesces in acid, but soon subsides, leaving considerable sediment—fusible before the blow pipe, with intumescence.

Particular Characters.

The white granular mineral, (the base through which the others are distributed,) may be divided into two—one which is soft and earthy, almost chalky, the other harder, translucent and crystalline; in fact the former appears only externally and may probably arise from the decomposition of the other minerals—the hardness in one case is above that of Granular L. stone and below it in the other—lustre dull or only glimmering. The grittiness of its powder to the taste, indicates the presence of a large portion of silex. It effervesces in acid, but immediately subsides,

even when in powder, leaving considerable sediment. It phosphoresces on charcoal as above stated. The effect of the blowpipe is to extricate bubbles and form a dull yellowish enamel.

The green mineral in patches, is light apple green—translucent, semi-transparent in fibres—structure promiscuously fibrous, fibres sometimes interlacing, at others radiating—fracture disclosing a tendency to break into long slender brittle prisms. It is scratched by the knife, but scratches glass—lustre shining and silky. The sp. gr. of a fragment tolerably free from admixture gave 3. 1.—3. 2. Effect in acid much the same as the last, but in a slighter degree—The same may be said of the effect of the blowpipe with the adition that the part furthest from the flame, loses its transparency and becomes white.

The laminar mineral is white, with a slight tinge of green or blue—translucent—the laminæ eleave in two directions, with polished surfaces parallel to each other. On the cross fracture this mineral has a compact aspect. It yields to the knife, though not easily, and scratches glass with facility—phosphoresces like the foregoing—sp. gr. always above 3. 0. but variable—effervesces in acid as above, but in a still slighter degree. When urged under the greatest heat of the blowpipe it fuses, with the extrication of bubbles, into a white glassy enamel.

The phosphorescence common to the mass is owing to the presence of carbonate of lime or magnesia, as appears probable from the circumstance, that after effervescence no such phenomenon is seen.

The green fibrous mineral most resembles those two varieties of Hornblend, Tremolite and Actynolite, one of which it probably is.

Now, according to Cleaveland and Phillips, the Petalite has a sp. gr. of only 2. 4-2. 6.; which no part of this bowlder, however carefully selected, can be made, even nearly, to agree with. Indeed the difference is so considerable as (together with other characters) to lead to the suspicion that the laminar mineral most resembling the Petalite is Spodumene, the sp. gr. of which, according to the same authorities, is 3. 1—3. 2, and which also contains the same alkali. Further, it appears probable, from its great specific gravity and intumescing fusibility, that the greater part of the white mineral may be Spodumene, under different forms. This conjecture, however, is left to the chymist and experienced mineralogist to verify or refute, our inquiry being limited to the more obvious physical characters, with the exception of the two chymical ones, of the effect of acids and the blowpipe.

One object of this paper is to court friendly criticism, whereby the crude notions and experiments of a novice, may be corrected through the matured studies of the proficient.—*Quebec Medical Journal.*

Note 13.—According to Macculloch, "Serpentine occurs almost exclusively among the primary rocks;" he also says, that "rocks composed of serpentine and carbonate of lime, are found of considerable extent, of which the verde antico is a striking variety."

Note 14.—It is a very curious circumstance that this mineral was bought as gypsum. The purchaser, as we are informed, 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 that the mineral in question is a very pure carbonate

of lime. Its association with granite and gneiss, places it among the primary marbles. That gypsum has even been found among primary rocks, is doubted by some geologists.

The reports respecting this marble, as to its abundance and solidity, are favourable. Its translucency is remarkable, which, joined to its colour, a dazling white, sometimes slightly shaded with pink, renders it, to all external appearance, well calculated for economical purposes, particularly for the manufacture of vases, lamps, &c. The value of an article of this description, is increased, by the facts, that none of our quarries at home afford a white marble, and that those of Italy, have been said to be nearly exhausted. We believe that it has not yet experienced, under the chisel of the artist, that trial to which its appearance, in some respects entitles it; although far from being sanguine, that such a trial would prove successful; on the contrary, we suspect that its laminar structure, and the distribution of parts of unequal hardness throughout, would cause a failure in that respect. 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 from a letter addressed 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 with heat. The mineral in question burns to lime. By which characters, it is clearly proved to be a carbonate, and not a sulphate of lime.

The following extract from some notes taken in 1826, and first published in Neilson's Gazette, of the 11th December, will be found interesting; they are evidently from the pen of an individual acquainted with the subject.

"*Tadoussac, September 14th* 1826.—We walked this morning along the beach to *moulin à baude*, about four miles below this port, to see the bed of marble there. *Pointe rouge*, forming the south-east promontary of the harbour of Tadoussac, is chiefly 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 150 feet thick above the level of the river, and cut down nearly perpendicularly by the beating of the waves, for a distance of about 200 yards, which is the whole breadth of the bed. This clay is of the same character as that at *Pointe aux bouleaux*, and will prove as valuable when introduced in the arts.* The primitive rocks of the same description, which were found lying 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 Malbaie and the Saguenay. The shore is then indented, and a bed of gneiss stretching out into the Saint 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 wild oat grows so profusely, that it

* Can this be Kaolin or decomposed Felspar? the nature of the rock, a felspathic granite, renders it not unlikely.—Ed.

almost appears to have been sown by man. A larger bay a little further on, is, what is called, *moulin à baude* ; it is about 150 or 200 yards deep—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 150 feet high, ascending at an angle of about 70 deg. The direction of the bed is nearly north ; the breadth along its whole exposure varies from 6 to 8 or 9 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, which is dry at low water, affords a protected harbour, and admits at high water vessels drawing 6 or 10 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 48 hours sail from Quebec with a light fair wind. Large sound blocks of this marble of 15 or 20 feet in length by 4 or 5 feet square, might, I think, be obtained ; these would be fine ornaments, as columns, &c. to buildings—as the marble does not take a good polish, it would not be so much in request for chimney pieces, &c. It well deserves to be worked. It lies on the ground now leased by Mr. Mc Douall, as Crown Lands, and is attached to the Post of Tadoussac.

" The position of this bed, or more properly rent, and that of the clay at *Pointe aux vaches*, is not without interest to the Geologist.

" 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 late North West Company."

Mr. Chasseur has also seen this marble in situ, and his discription of it agrees with the foregoing. As the object of the Literary and Historical Society of Quebec, is to promote and forward every thing which has a tendency to explore and develope the natural resources of this country, we should be doing both ourselves and this individual an injustice, did we not mention a Museum of Natural History, almost entirely composed of Canadian subjects, which, with an industry, perseverance and intelligence truly laudable, he has collected together, for the instruction, as well as amusement of the public. No stranger should visit Quebec, without seeing this collection, and it is the duty of every Canadian and resident in the country, to encourage Mr. Chasseur in the prosecution of his labours, which, under such favourable auspices may terminate in a cabinet, at once the pride and ornament of the Capital of Canada.

Note 15.—On a former occasion we gave an erroneous report respecting this L. stone, which we take this opportunity of correcting. Its quality has not been exaggerated, but, owing to its regular stratification and *apparent* continuation, we have been too sanguine (a fault, all men fresh in the field are liable to commit) as to the quantity in which it is found. Upon opening a quarry, about the length of 60 feet, it was found at the further extremity, to be impure and to dip, considerably in the direction of its bearing, under the "Black Rock," and although found in small quantity in other parts of the field, it appears every where to be so mixed up with the latter rock, (or a species of shale much resembling it,) and a very impure L. stone of a somewhat oolitic structure, as to afford no hope of an abundant supply. The easternmost end runs into the neighbouring property, but probably not far. Its depth is unknown, but as it lies conformable to the "Black Rock," having the latter both above and below it, the pursuit of it in this direction would not pay. We are aware of the occurrence of large masses of L. stone in the conglomerate, forming the precipice to the north of the town of Quebec, but their appearance is far from having that promising aspect in regard to abundance, which the L. stone in question exhibited before it was explored; neither would their position allow of their being removed, if these masses were sufficiently large to render it desirable, on account of the danger of bringing down the superincumbent strata on the houses below. It is worthy of remark, that shells in a highly comminuted state, may be observed in the L. stone, at No. 4 Tower, a fragment of which, in our possession, bears the traces of a bivalve: a species of cockle has also been found, in the L. stone at the back of Mr. Cairnes' house in Mountain street.—Considering the whole formation to the north, and north-west of the town, to be a *local* conglomerate (which appears probable, from the angular untravelled appearance of the enclosed masses or pieces) a reversal of the strata in the District of Quebec, seems to be inferred from the occurrence of these organic remains, an inference we have attempted to explain in Note 7, though without flattering ourselves that we have done so successfully: the subject is a very difficult one, and it well becomes us to be diffident on a point where a Cuvier, a Buckland or a Macculloch, would probably hesitate.

Note 16.—Vegetable organic remains are also found: we have a specimen of the strata, on which is a plant or flower in blossom: the blossoms are round, and resemble, in miniature, the sun flower. The stem is slight, darkish green with a glimmering metallic lustre, which it owes to iron pyrites. The flower has the same colour and lustre, all but a slight halo round it, of a reddish colour, apparently the petals. On the same fragment, there are the impressions of long lanceolated leaves, to all appearance unconnected with the flower.

Note 17.—"A Kingston, ainsi que sur la plûpart des cotés du Lac Ontario, les cailloux sont des differentes especes des schistes durs, des chouches de quartz et de granite. On voit près du rivage de grosses pierres noires roulées, ressemblant à des basaltes, et beaucoup de pierres sablonneuses, contenant des impressions d'animaux de mer: en descendant le Fleuve St. Laurent, le pays est schisteux."—*Guillemard.*

Note 18.—Its natural state is uncalcined, and as a sulphate of lime it must always be "strongly impregnated with lime,"—perhaps, much mixed with carbonate of lime, is what is meant.

Note 19.—In this township, some years ago, an explosion took place in a vein of iron pyrites, of which the following is an account given to the Geological Society of London, by Dr. Bigsby.

"This explosion took place sixteen years ago (1809) in the township of Yonge, near the Lake of the 1000 islands, in the St. Lawrence. At the time a man was seeking his cow in the woods, within a short distance of the spot—on a sudden he was startled by a tremendous explosiou, attended by volumes of smoke and sulphureous odors. Three years since, on being informed of these particulars, Dr. Bigsby, visited the place. It is half a mile within the woods north of the road from Brockville to Kingston, near the easternmost of two creeks, and about ten miles from Brockville. He found, on the summit of a quartzose mound from 30 to 40 feet high, a round cavity 12 feet deep, 12 long, and 9 broad. Its sides consisted of very shattered quartz, spotted brown by oxide of iron, and covered profusely with acicular yellow and white crystals of sulphur. The lower parts of the cavity were studded with masses of iron pyrites of which there is a vein at the bottom of the cavity. It is a foot and a half thick, and disseminates itself into the surrounding quartz. This vein may be seen running east with a very high dip to the distance of a yard and a half.

"Similar phenomena have been noticed in a mountain in Vermont, (vide American Journal of Science for February, 1821) also in the country towards the head of the Missouri, (vide travels of Captains Lewis and Clarke,)" Geological Trans.

It is remarkable that pseudo volcanic substances, such as pseudo volcanic carbonate of iron, pseudo volcanic quartz, formerly having cubic pyrites disseminated throughout, the impressions of which still remain, are said to occur in the township of Yonge.

Note 20.—Although iron pyrites is not mentioned in the report of this township, it is with little doubt indicated in the following description. "The substance referred to has the appearance of gold, or rather like some pieces of coal of a glossy yellow, but much heavier. Some of it has undergone chemical process, but it evaporated with a sulphureous smell, from what, however, the writer of this article has learned the experiment was hardly satisfactory. It is also reported that several boat loads of it have been taken away by some Americans." As far as it extends, this description is perfectly satisfactory. If to these characters had been added its comparative hardness, no doubt would have remained as to the name of the mineral; for instance, when not too brittle to allow of the experiment, if it resist the impression of a sharp knife, or if too brittle, its fragments scratch glass with facility, it can be no other than iron pyrites, or sulphuret of iron. If, on the contrary, it yields to the knife, the mineral is most probably copper. Native Gold, which bears some resemblance to these two minerals, is always malleable, and *insoluble* in nitric acid. We have entered at length into this subject, because iron pyrites has often been, as it was in the present instance, mistaken for ores of the more valuable metals. Formerly ship loads, instead of

"boat loads" of this very dazling but almost worthless mineral, were sent home under the presumption that it was gold. It is a general rule that no ore which contains a profitable quantity of the more valuable metals will resist the knife. A few exceptions occur, but among the most rare of the metallic minerals, viz. the Argentiferous Arsenical Iron of the Harz, and the ores of Platina Irridium and Palladium.

Note 21.—If the townships and allotments of land in these Provinces have been laid down by compass, they cannot possibly be correct; for with all the care an experienced surveyor could bestow, he would not have been able to make the proper allowance for the degree of *local* magnetic attraction, the comparative intensity of which, at different places, is so various and uncertain.—We shall be told, that the surveyor, in laying down an allotment or township, first commenced his operations from some plain or bank of a river, far removed from hills or mountains (the more frequent depository of magnetic iron) and out of the reach of local magnetic influence; and that having there laid down a magnetic meridian, he no longer used the compass, but produced that line, by covering vertical pickets.

This method is perhaps the best that can be adopted in the absence of all instruments, except the compass, but after all it is very liable to error, for, (not to mention the impossibility of always finding a spot free from mountain or hill) if a plain so situated be found, who can be sure that local magnetic attraction does not extend to it—who can be sure that it is not itself the seat of that attraction. Where primary rocks occur, the presence of magnetic iron may be suspected; some of the secondary trap division are also magnetic (Note 3.) But sometimes its presence is so little indicated by the topographical outline of the ground as to deceive the most experienced. Mr. Watts, of Cape Diamond, and Mr. Saxe, of the Surveyor General's Department, agree in stating that the neighbourhood of L'Acadie is remarkable for the local magnetic attraction to be observed there. We believe no geologist would suspect its operation upon passing his eye over the country. As far as we are acquainted with it, the soil is alluvial, with a topping of vegetable earth, and no rocks or mountains within such a distance of the spot that they could effect the compass in so extraordinary a manner. The following quotation from Guillemard is descriptive of the soil in this portion of the Province :—"La rivière Sorel, après avoir quitté le bassin de Chambly, mouille le pied d'une large et haute montagne, appellée Belœil. Entre cette rivière et le Fleuve St. Laurent, est une plaine immense, sur cette plaine entièrement uni, il ne se trouve point de roc, et presqu'aucune pierre. En creusant, on trouve jusqu'à une profondeur considérable, des sols de différentes espèces; du sable, de l'argille, de la terre végétale, et dans beaucoup d'endroits, une autre matière végétale noir, ressemblant beaucoup à une espèce de tourbe appellée peat :" he adds. The summit of the Belœil mountain is a deep grey and large grained granite. It contains little mica, but a considerable quantity of black schorl; the sides of the summit are principally composed of a greyish black schistus very compact, some parts of which resemble basalt, in form and grain (texture ?) In descending the Sorel, rocks are no where seen. At Sorel the banks are of a fine clay, full of mica.

Is it possible that M. Guillemard may have mistaken that for granite, which is a trap rock of the same age and character as the Montreal mountain? Black crystallized hornblende, much resembles black schorl; *basaltic* hornblende, is associated with the former in the Montreal mountain.—We have hazarded this conjecture without having seen either specimen of the mountain of Belœil, or any other account of it than M. Guillemard's, because, if correct, it appears easy to explain the local magnetic attraction near L'Acadie, by supposing that the same trap formation comes to the surface in that place, part of which, in the case of the Montreal mountain, is known to be highly magnetic. (Note 3.)

In Gourlay's report of the Townships of U. C. Mr. Markland (by the bye a singularly applicable name as authority on such a subject) in a general report on Kingston, writes, "no mines have as yet been discovered but from the difficulties which surveyors have met with, in running parallel lines, owing to the variations of the needle, there can be no doubt of the existence of iron mines."

Lieut. Wulff, R. E. found also in the neighbourhood of Kingston, a variation of 10° in a distance of about 600 feet. We do not think it probable that mines of magnetic iron will be found in that immediate neighbourhood, because that part of the country appears to be decidedly secondary: the cause of magnetic influence is probably to be sought for in the granitic formation of the Milles Isles where beds of magnetic iron may occur. Trap rocks might account for it, but we are not aware of the occurrence of any near Kingston. To these authorities might be added others, as the fact is well established, and should be as well remembered by those who use the compass, either for surveying or for the more general purpose of security in the woods. It shews that too much confidence may be placed in this instrument, and that an implicit reliance upon it for security while traversing the forests might prove the destruction of the traveller. There is good reason to suppose that the granitic range to the North of Quebec is well supplied with magnetic iron, rounded masses of it brought down by the torrents have been sometimes met with in the neighbourhood of Quebec. The rocks forming the coast on the north shore, often contain so much as to affect, it is said, the Ship's compass in passing up and down the river.

Besides a natural local attraction, or a local attraction resulting from natural causes, instruments are sometimes subject to a similar influence, from artificial ones as appears from Mr. Amos Eaton's observations in Silliman's Journal for March 1827, p. 14: with the aid of a microscope he detected very minute steel scales attached to the limb of the instrument, left there in the manufacture of it.

The Theodolite is the only instrument which should be used by surveyors in this country, without any reference to its compass, but starting from a *true* meridian.

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*Note 22.—One of the Montreal papers lately communicated the intelligence that this ore was about to be worked by a Company. It is of the best description, and the circumstance of its having plumbago (carbu-

* The red oxide of zinc has been referred to this note improperly. The only remark we have to make on it, is under the form, of a quotation from the 2d No. of the Canadian Review, p. 380. "It is singular that only one new substance, the red oxide of zinc, has been found in the United States and the Canadas, while they are numerous in the southern division of America."

ret of iron) disseminated throughout, may improve the cast metal, and cause a saving in fuel. The following extract from the Canadian Review, No. 2, article "Geology," (believed to be from the pen of Dr. Bigsby), contrasts this ore with that from Marmora, of which an ample geological account is given, particularly interesting at the present moment, as the Marmora iron works, &c. are advertized for sale.

"The Iron works, for which Upper Canada is indebted to the enterprise of Mr. Hayes, are placed on the river Marmora, around a small cascade, rather more than a mile from Crow Lake.—This extensive establishment, has been erected, for the purpose of working some beds of magnetic iron ore.—The geological relations of the ore will include that of the district, so that both can be explained at the same time.—The cascade before referred to, flows over a pale and slightly porphyritic sienite, one of the youngest of the elder class of rocks, and here scarcely shewing any stratification.—On the one side of the river, this rock, coloured pale green by epidote, and much traversed by that mineral in veins, passes nnder the hill on the right, and on the other, floors the lower flat, and is lost in the adjacent shattered cliff, which it should be mentioned has a corresponding one on the the right bank of the river. In the lower parts of these cliffs, for a few feet, alternating layers of red, grey and green argillaceous sandstone rest horizontally on the sienite. It is of a very fine grain and smooth to the touch. It supports a very compact light brown limestone, of conchoidal fracture with a dim lustre, and often studded with small masses of hyaline calcspar like the limestone of the narrows of Lake Simcoe, which it greatly resembles.—The whole body of limestone may be 200 feet high; but it becomes in the upper parts of the hills, of coarser texture, darker in colour, and hid under soil and rolled fragments of rock.—It is without organic remains; as are the innumerable angular blocks scattered over the face of the country, and the naked terraces, about a mile from the works, on the road to the mouth of the river Trent; but a mile or so southwestward from the terraces, we again perceive in the bowlders of limestone, the usual orthoceratites, productæ, madrepores, and coralines.—The calcareous strata of the bed of the Trent abound in them and in the other shells characteristic of the older limestones.—A little above the cascade, on the left side of the River, sienite occasionally emerges from beneath the soil and herbage; and in one place meets with a large unstratified weather-worn fixed mass of white crystalline marble, which likewise attains no great height. In their irregular line of union, an oblong bed of this iron ore has been lodged, considerable in quantity, but now all removed except some insignificant strings and veins wandering in the sienite. Very few square feet of the marble is seen here, but it reappears as a rugged steep hill on the near side of Crow Lake; and again in Birch Island in that Lake, a mile and a half on the north west. This marble is of the purest white and possesses several varieties of texture, from the compact, to the fine grain of loaf sugar and the largely crystalized form frequently seen in the gravestones of Vermont.—It is unfortunate that these conditions are too minutely blended, and are not in large distinct masses; but as it is the marble will make very handsome chimney pieces, sideboards, tablets for halls, gravestones, &c.: perhaps on sinking deep into the rock it will improve. —The principal bed of ore is at the Upper end of Crow Lake, at the water's edge, and so conveniently placed that the ore boat goes there in

the morning, with two or three men and returns in the evening with 15 tons of it,—procured with a pickaxe, shovel and sledge hammer.—It is in the face of an acclivity about 50 feet high, and covered with bowlders fo quartz and greenstone, charged with iron ; the whole eminence probably a mass of ore, but at present, the exposed portions are only 20 yards broad and in places 10 feet high. It is traversed by confused fissures and is massive, and without shape, except that it juts out in very large angular wedges. No rock appears in connexion with it ; but the large unrolled masses of granular quartz, white and coloured by epidote abounding on the surface bespeak the close contiguity of that rock in situ.—The ore is the granular magnetic iron ore, one of the richest and best for general purposes. Its containing a good deal of sulphur however adds to the expense of working it ; a disadvantage from which the iron beds of Hull on the Ottawa are free.—These latter occur also in a district chiefly of marble white and crystalline, mixed with some pale sienite, containing disseminated much dark coccolite, and some plumbago.—There are several other beds at Marmora.—One called "Fosters" is in the woods 4½ miles directly east of the works, and a few hundred yards east of a branch of the Moira River, which enters Lake Ontario at Belleville. It is of the granular form of ore ; sometimes exhibiting large octohedral crystals, and is imbedded in sienite, dark and pale in spots according to the predominance of one or other of its component minerals, feldspar and hornblende. The manganesian garnet, a rare mineral, likewise present in the Franklin iron mines at Sparta in New Jersey, is found in the sienite of this ore bed, mingled with white rhomboidal calcspar.—The ore is so concealed by rubbish and earth that it is difficult to state its quantity.

Another bed is situated about a mile beyond Foster's ;—a fourth, a quarter of a mile into woods, from the left side of the Crow Lake, a little above the head of the Marmora River. A fifth and large one is in the vicinity of Belmont Lake, about seven miles northerly from the establishment of Mr. Hayes. There are several varieties of ore which are not mentioned in this very cursory sketch, from not yet having received a due examination.—It was important to learn that these beds exhibit the same geological relations as the older and better known mines of the States of New-York, New Jersey, and Vermont. As has been before observed, the useful minerals exist in quantity only in certain situations,—a solitary deposit, or a few trifling ones, may be met with out of them, but never are so copious as to warrant the permanent investment of capital."

Note 23.—This is probably alluded to in the following extract from Charlevoix which we give more on account of the curious uncertainty which existed at the time respecting ores, than for any value it possesses.

" M. Talon avoit, sur tout, fort à cœur les mines de fer, qu'on assuroit être très-abondantes, et en revenant de France, il s'étoit fait débarquer à Gaspé, où il croyoit, sur le témoignage de quelques voyageurs, trouver *de l'argent*, mais il fut bientôt détrompé. Il fut plus heureux pour le fer. Il avoit envoyé le sieur de la Tesserie dans la Baie St. Paul, où ce mineur découvrit une mine qui lui parut très-abondante, il espera même d'y *trouver du cuivre et peut-être de l'argent*, il remarqua partout où il travailla que la terre étoit encore renversée par le Tremblement de Terre de 1663."

Note 24.—The following is an extract of a letter from Mr. Mason to Mr. Gourlay, on the subject of the iron works at Charlotteville:—

"In favor of iron works, is the high price of iron, and plenty of timber for coal. Every thing but these is against the first beginner. The bog ore is scattered over the whole country, but I do not know any one bed of ore that will exceed 120 tons. I spent three months in examining the country for ore, and I calculate that it will take all the ore I found within 20 miles of this place, to supply a small furnace for seven years, but I believe considerable quantities, within that space, are not yet found. No rock ore has yet been found in this part of the Province, and if there is any it must be at a considerable depth from the surface of the ground, and will be difficult to find, as the strata lie horizontal."

Note 25.—This mineral is turned up by the plough and is found in the water courses of a field, composed of a stiff clay near Dr. Mills', at Sillery, near Quebec.

It occurs under one of the the following forms: botryoidal, reniform or mamillated, and varies from the size of a nut to that of a large potatoe. These are encrusted on the outside by a yellowish white coating. Internally it is bluish black, though not uniformly so, exhibiting, when broken, red and yellow parts. Its structure is earthy, and it is extremely friable, very adhesive to the tongue, and gives out a strong argillaceous odor. Its Sp.-Gr. is low, but it absorbs water so rapidly and adundantly as to hiss, bubble and have its weight considerably increased after a short immersion; it does not, however fall to pieces in water. It yields to the nail and receives a polish from it. It is not magnetic until exposed to a red heat, with grease, and then only slightly. Before the blowpipe it becomes glazed, and rounded. With borax it forms a glass globule of the colour of amethyst, but the greater part remains suspended in the glass. If too much heat be applied, or if continued long, the colour of the globule is yellow; afterwards it becomes colourless.

The clay in which this mineral is found, was in some places coloured throughout of a light pink; in other places it is only superficial. The former forms, when washed and baked, an excellent chalk or pigment.

Note 26.—In Keating's "Narrative of an expedition to the source of the St. Peter's River," are the following observations on the native copper of Lake Superior:—

"The great interest which generally prevails on the subject of the "copper mines of Lake Superior, as they are called, will perhaps justify "us in offering, on this subject, a few observations, which we hazard "with some diffidence. We have seen native copper strewed in many "directions, over the great valley drained by the Mississippi and its tributaries, and we know from the reports of all travellers that it exists in "many places. It has also been found on several spots on Lake Superior, where it was long since looked to as an object of great promise. "The largest mass of it, that is known, exists on the Ontonagon River, "and for a correct account of the characters of this interesting block we "are indebted to Mr. Schoolcraft. Our journey having been conducted "on the north shore of the lake, we of course had no opportunity of seeing this interesting mass; but all that we know of the native copper of "that country leads us to the belief that it has not yet been found *in*

" *situ*, and that therefore these loose masses ought not to be looked to " as indicative of mines in their immediate vicinity. The great weight " and size of the mass on the Ontonagon might, it is true, induce us to " believe that it has not been transported from a great distance, if the " much greater size and weight of the boulders which are dispersed " along the vallies of the Mississippi did not attest, that, whatever may " have been the cause which produced these revolutions, the force with " which it operated must have been immense. It is not, therefore, to " these masses of native copper, but to the ores of this metal found in " rocks *in situ* that our attention ought principally to be directed with a " view to discover copper mines. We have ourselves seen a number of " localities of copper pyrites throughout the primitive rocks of the north " coast of Lake Superior, but these were always in small specks. A " more minute examination might probably lead to more successful re- " sults. We believe that there is a site of copper mines somewhere near " this lake, and we think it in no manner improbable that the masses " of native copper which occur, from the south shore of Lake Superior " down the valley of the Mississippi, have been scattered by the same " cause which dispersed the boulders of sienite rock. Whether the na- " tive copper found to the north-west on Copper Mine River comes from " the same place, is a subject upon which we have no data, and therefore " can form no opinion. Perhaps, as Mr. Schoolcraft suggests, the Por- " cupine Mountains, if well explored, would be found to contain copper " ores. We do not at present recollect any places where the pyrites or " any other ore of copper has been found in any quantity on Lake Supe- " rior. Mr. Schoolcraft, it is true, handed to one of our party some " fragments of ores of copper, brought to him in 1823 by an Indian, " who said he had found them on Keweena or Kewewenon point, on the " south shore of the lake. Upon the vague reports of an Indian we shall " build no theory ; the question which appears to us of far greater im- " portance is not where the copper lies, but what should we do with it " if it should be found. We are very doubtful whether any other ad- " vantage would result from it, at least for a century to come, than the " mere addition in books of science of a new locality of this metal. " It does not appear to us, that in the present state of that section of " our country, and with the unpromising prospects which it now offers, " these mines could be worked for at a great length of time. Copper, " we know, exists in many other parts of our extensive country, and " much nearer to the centres of civilization and population. Instead, " therefore, of wasting our endeavours and resources, in a futile attempt " to discover mines in so remote and dreary a country, let us apply " them to the investigation of those sections, where mines could, if " found, be turned to immediate advantage. Had the French, who first " overran our country, considered this point, and instead of wasting " their resources in idle searches, instead of fitting out an expedition to " ascend the Mississippi two thousand miles, for the sole purpose of col- " lecting green earth on the St. Peter, had they spent the same amount " in France, in working the mines that have since been opened there, " they would have rendered an essential service to their country and " benefitted their fortunes. Whereas, by the course which they were " led to pursue, they added but little to science, at the same time that " they ruined themselves.

" These observations are offered with the more hesitation, as they are " not founded on an extensive acquaintance with the localities of native " copper, &c. but rather upon a general, perhaps some may think a " hasty and superficial, inspection of the features and resources of that " section of the country, which many have considered as destined to " become the seat of future mining operations on a great scale."

Note 27.—"On an estate belonging to the Seminary of Quebec, in the Bay of St. Paul, a lead mine was discovered some years ago. The veins which have been traced are slight, but two Germans, who were brought over to the country on account of like discoveries in the upper country, examined this, and thought it worth the working," (Genl. Murray's Report, Smith's Canada, p. 59, Vol. 1.)

Note 28.—"There is a rich lead mine in the township of Potton, adjoining the boundary line between Canada and Vermont. In early times, the Indians are reported to have got loose masses of native lead, (sulphuret of lead?) It is situated at the base of a bald conical mountain plainly visible from Lake Memphremagog. On the top of the mountain, which is small but flat, there is a pond from fifteen to twenty rods in diameter. In the neighbourhood there is a hill with a precipitous descent, from the summit of which a column of dense smoke is frequently seen to issue, about a foot in diameter. One man got, a few years ago, between thirty and forty pounds of pure lead, (sulphuret of lead,) in one morning from the mine described." (Wilcox.)

Note 29.—"I have found a black and garnet coloured sand in great abundance on the shores of the Lakes Erie and Michigan. This is a sulphuret of mercury, and yields about 60 per cent. It is so easy to be obtained, and in so convenient a form for distillation, that it must become an important article of commerce." (Stickney, Silliman's Journal, Vol. 1.)

Note 30.—"I observed sulphur oozing abundantly from the cleft immediately adjacent to, and within the spray of the falls. I found gypsum incorporated with the limestone, in several parts of the cleft." (Hall.)

According to Lieutenant Portlock's R. E. Memoir before the geological Society, "the upper stratum at Niagara Falls is a firm compact Limestone, resting on strata of a very schistose nature. It is not by erosion of the surface that the Falls are made to recede; but the waters, after falling 150 feet, strike the bottom, and are partly converted into foam, in which state they are then driven up into the air, far above the rock whence they descended; the penetrating nature of this foam acts on the lower argillaceous strata until the overlying rock is undermined."

Note 31.—Mr. Justice Fletcher has tested this water, and states the result to be, that it contains no trace of metallic impregnation, nor sulphur under any other form than as sulphuretted hydrogen gas of a very evanescent character. (W. Green, Esq.)

Note 32.—"In the township of Scarborough, 15 miles east of York, there are too medicinal springs, four or five rods apart, the water bubbles out of the top, and runs over a concretion of the sediment, formed into the shape of a sugar loaf, of a grey or mixed colour. No considerable stream flows away. The water appears to be principally absorbed by the adjacent ground." (Gourlay.)

ADDITIONAL EXTRACTS ON THE GEOLOGY OF CANADA.

Geological Extracts from Keating's "Narrative of an Expedition to the source of the St. Peter's River."

"At twenty-eight miles below Fort Douglas, on the Red River, we saw limestone *in situ*; it is a horizontal secondary rock, such as probably lies under these prairies. It was the first rock which we saw in place after we had left the primitive islands in the valley of the St. Peter, unless, indeed, the rapids in Red River be occasioned by ledges of primitive rocks in place, which is not impossible, but which we could not ascertain at the time that we passed over them. We observed in the limestone no organic remains, although it probably contains some. This is the only place where limestone has been found, by the settlers, at the surface; it is therefore resorted to for the lime used in building at the fort, as well as for the tan-yard, and for the other wants of the colony, &c.

"After travelling eighteen miles on Lake Winnepeek, we landed on a fine pebbly beach, which we were told was encompassed in the rear by a deep swamp, called the "Grand Marais." This beach was covered with pebbles and boulders of sienitic and calcareous rocks, which, from their aspect, showed that we were near the junction of the primitive and secondary formations.

"On reaching the outlet of Winnepeek River, we observed a great change in the aspect of the water, which was clear and transparent; this was soon accounted for by meeting with sienitic rocks in place, and we were informed, by our guides, that similar rocks extend all the way up the river. About a mile beyond this we reached Fort Alexander. The junction of the primitive and secondary rocks is therefore* about 50 ° 45 of north latitude and about 96 ° 30 of west longitude. It appears probable, from all the information which we have collected, that the whole of the eastern shore of Lake Winnepeek, is occupied by a primitive formation, while the western is composed of secondary, and these probably limestone, rocks. This accounts for the fact that the prairies are limited to the east by that lake, while they extend as far north as the Saskatchawan, and to a considerable distance up that stream. It appears to us by no means improbable that the excavation of this lake was occasioned by the easier decomposition of the strata at the junction of the two formations. No where, perhaps, upon the surface of the earth, is a difference in the geological characters of the country attended by a more striking diversity in the superficial or topographical aspect. We observe here, that wherever the primitive rocks prevail, the country abounds in lakes, swamps, short streams filled with falls and rapids, as is the case with the whole country which extends from Lake Winnepeek to Lake Superior, and which reaches nearly to the Falls of St. Antony on the Mississippi, while the secondary formation is covered with fine high and dry prairies. The track which our party followed must have been very near to the eastern limit of the secondary or prairie country, as all the eastern

* The words (in this place) appear here wanting to render the sense complete.—Ed.

tributaries of Red River or the St. Peter, are represented as rising in those small lakes and lagoons. It would be curious to ascertain whether the small group of lakes called Devil Lake, &c. situated between the two Coteaux des Prairies, may not be occasioned by a re-appearance of primitive formations at that place.

"The rocks through which the Winnepeek River passes are decidedly primitive, but assume that chaotic appearance (if we may be permitted to apply the term), which we had already observed in the primitive rocks of the valley of the St. Peter. We can only account for the features which they present by supposing that they were formed under the influence of a very great crystallizing force, which was disturbed by some extraneous causes. Hence we observe within a small compass a number of different centres of crystallization at which different rocks were probably forming at the same time; within a few feet of each other there was a tendency to form gneiss, or sienite, granite, or mica-schist, &c.; the consequence of which is, that, at those centres, we observe distinct and well characterized rocks, while the intermediate space is filled by an irregular and rapid transition from the one into the other. We observed no distinct signs of stratification. At first we were inclined to refer this mode of formation, though on a much more gigantic scale, to that of the Schnecken-stein or topaz rock of Saxony. But we soon observed that the difference was immense, for while this exhibits an union of masses of homogeneous composition, differing only in position; the rocks of the Winnepeek do not present the "platten and grosmassigen absonderung" of the Wernerian school; they display no such homogeneous composition, and no division into masses; they, on the contrary, exhibit a connexion between all the parts, a fusion of the one into the other.

"At one spot (Portage de l'Islet), we observed a granite with an excess of felspar throughout the mass, which occasions in it a fine lamellar structure; this is however interrupted in numberless places by veins of coarse-grained granite. In some cases we see in these veins *apparently* fragments of other rocks imbedded in them. These fragments, however, are always composed of one or more of the four simple minerals which constitute the whole mass, viz. quartz, mica, felspar, and amphibole. Although they present the appearance of fragments, still we see no reason to doubt their being of contemporaneous origin; indeed, when examined with the microscope, we have frequently traced a gradual passage of the felspar of the vein into that of the imbedded fragment; it was not a mere impregnation of the rock by the felspar, as is often observable in the vicinity of metallic veins, where the rock has received a portion of the metal of the vein; but we could trace an uninterrupted union in the crystallization of the felspar of the vein with that of the imbedded mass. In some cases also, veins posterior in formation to the mass of the rock were distinctly observed. They were frequently seen intersecting older ones in a gneiss rock, and exhibiting very beautiful and diversified instances of a shift or slide of the older vein at its intersection by the more recent one.

"It is in the effect of the rocky bed of the Winnepeek, that its numerous falls surpass all others which we have seen; the cataract of Niagara, which far exceeds them in volume, is uniform and monotonous in

comparison; the horizontal ledges of secondary rocks of the latter are as far inferior in picturesque effect to the dark water-worn granite and sienite of the former, as the height of the bluffs at Niagara exceeds that of the rocky banks of the Winnepeek.

"On the Winnepeek we have constantly in view changes in the rocks, which contribute to those of the surface; they present at times the schistose appearance of a gneiss and mica-slate, which disappears at the recurrence of the dark-coloured granite or reddish sienite; these being filled with veins of felspar, display, on a gigantic scale, the beautiful striped appearance, which has given to some of the marbles of Italy their well-deserved celebrity.

"We found near the lower falls of the Winnepeek River, a fragment of a mineral resembling the phonolite or klingstein shieffer. It contained small cubic crystals of iron pyrites. It was angular, and probably broken from a neighbouring rock, but we conld not discover it in its original site.

"At one of the portages of the Winnepeek River, we observed small black crystals, probably of tourmaline, shooting through the mass. A little beyond this, at the upper "Portage du Rocher du Bonnet," a fine white clay was seen, in which small fragments of lamellar felspar were observed. This was evidently a kaolin, or decomposed felspar; it appeared to be very abundant; at the surface where we saw it, it was much intermixed with the soil which appeared somewhat deeper and better than usual, but, we doubt not, that with a little exertion the clay might be obtained perfectly pure, and well suited to the manufacture of porcelain. A number of blocks of blue limestone, which we saw at some of these portages, led us to believe that we were then at no great distance from the secondary formations. Our evening encampment was, however, upon a very fine mass of granite, projecting into Bonnet Lake. The rock likewise appeared in insulated masses in the middle of the lake.

"On the 22d, we proceeded through the upper part of Bonnet Lake, and soon reached the rapids. The corroding effect of the stream upon the rock has produced many basins or coves in which the water forms eddies, and not unfrequently presents a smooth expanse, contrasting with the rough billows of the adjoining torrent. The red colour of the sienite is relieved by streaks of black mica, which intersect its surface, and give it the appearance of designs executed on a gigantic scale. In the course of this day we observed signs of an igneous action upon some of the rocks; we had already remarked the phenomenon on one or more occasion, but the characters were indistinct; whereas, at one of the portages passed on the 22d of August, the semi-vitrification at the surface of the fragment of a rock found there, appeared more distinct. The general character of the country was still, however, a gneiss and granite, which offered many instructive views of veins of the latter rock shooting through the gneiss; they were judged to be, for the most part, of contemporaneous formation.

"After passing Jack's falls, on the Winnepeek River, a great change in the appearance of the river was observed, and was distinctly traced to a difference in the nature of the rock. The granite and sienite were replaced by a slate, which appeared to vary from a mica to a clay-slate, presenting chiefly the characters of the latter. It is very distinctly stra-

tified. The strata are nearly verticle. Its junction with the granite was observed in many places ; the slate was superposed. The hills which we had observed above Bonnet Lake, did not continue after the slate had made its appearance. A corresponding change in the features of the stream is observed. The river expands considerably, being in some places several miles wide ; it includes a great number of islands, all of which have a solid, rocky foundation. The colour of the rock is of deep blue or black, imparting the same hue to the water. In some parts the rock appears covered with a ferruginous incrustation, produced probably by the decomposition of iron pyrites which abounds in it. The difference in the rocks did not continue long, for, after having travelled about fifteen miles on the 24th of August, the slate ceased and was replaced by granite, which soon passed into a decided sienite, producing a wilder and more uninhabitable country than any we had as yet seen ; the sienite rises, apparently in great confusion, in steep masses which are rounded at their summit ; they are covered with moss, and support but a very thin growth of scrubby pines on their surface. We have made no mention of the tributaries which Winnepeek River receives, because we consider them as the mere outlets of small lakes situated near our route ; from the information which we have received from those experienced in the character of this region, and which our own observation fully confirms, as far as we have had an opportunity of judging, the whole of the country may be considered as an immense lake, interspersed with innumerable barren and rocky islands, which were, probably, at some epocha of comparatively recent date, covered with water. This, which was kept up to a level far superior to that to which it now attains, by barriers which we shall not attempt to trace, has broken its bounds, and the country has been very extensively drained. Whether this operation is still continued can be but a matter of conjecture ; we see, however, nothing that makes it either impossible or even improbable. That at one time the Mississippi was one of the great outlets, appears to us equally probable ; and that the innumerable boulders which cover its valley, and which are analogous in character to the rocks which we have observed *in situ* on the Winnepeek and elsewhere, have been derived from the great convulsions to which we allude, appears to us equally apparent. We are not prepared to enter into any discussion as to the manner in which these boulders have been dispersed ; we profess ourselves as little satisfied as any geologists can be, with the various theories which have been suggested in Europe to account for the boulders of the Jura, or for those which cover the north of Germany, and which are probably analogous to the rocks observed, in place, in the Scandinavian peninsula. We are not prepared to admit that the boulders of the state of Ohio have been projected by a subterraneous explosion, or have been washed by the mere force of the stream, or floated down upon masses of ice, &c. &c. ; but we cannot resist the conclusion of our senses, that they have not always lain where we now find them, that they have been removed from their original site, that every thing makes it probable that they were formerly connected with the primitive formations of the St. Peter, the Winnepeek, the Lake of the Woods, &c. Thus far we think ourselves warranted to proceed from observations. The rest must be a matter of speculation, and we are not disposed to indulge in it. We shall therefore restrict ourselves to the following conclusions. 1. That the whole of the country between

Lake Superior and Lake Winnepeek was formerly covered with water to a much greater height than it is at present. 2. That this inland sea was bounded by barriers which were broken, at a time probably posterior to the deposition of the secondary limestone of Ohio; wherefore the fragments, which result from this great convulsion of nature, are found resting upon those secondary formations. 3. That this process of draining was carried on at first, partly at least, through the valley of the Mississippi. 4. That it is not improbable that this draining is still continued. 5. That if this be the case, it is partially through the valley of the Mississippi, but chiefly through Nelson's River.

"It appears that Rat portage is about nine or ten miles from the northernmost extremity of the Lake of the Woods. The Lake is elevated about ten or twelve feet above Winnepeek River, at the point where we left it. Its latitude, according to M'Kenzie, is 49 ° 37 and its longitude 94¼ ° west. Dr. Bigsby set it in latitude 49 ° 44 ° 22 ° probably from an observation of Mr. Thompson's. Previous to our arrival at Rat portage, we observed that the rocks had again changed to a slate, of which the stratification was very distinctly directed from east-north-east to west-south-west. The inclination was nearly a vertical one; the colour of slate is a dark green; it is very decidedly a micaceous slate, at least on Rat portage.

"Although most of the islands in the Lake of the Woods are formed of slate rock, yet some, as for instance, the Red-rock Island, on which observations were made on the 27th of August, are composed of granite; in this case the felspar is of a reddish appearance, and imparts to the granite the colour from which the name of the island was derived. We have frequently observd, in the islands which we visited, that the north-eastern extremity was bounded with boulders, the average diameter of which might be about two feet. Though these sometimes extend all round the island, still it is more usual to observe them only at the north-eastern point, seeming to indicate that they were carried down from that quarter. The direction of the strata of mica-slate appears to vary from north 60 ° to north 80 ° east. The angle with the horizon varies from 65 ° or 70 ° to the perpendicular. The rock is penetrated in some places with iron pyrites; veins of quartz also appear occasionally through the mass. We saw no limestone, but Dr. Bigsby informed us that he had observed some on the shore of the lake.

"At the mouth of the Rainy-Lake River, the banks are low and marshy; beyond this they rise somewhat, but present few hills; the river runs in many places over a pebbly bed. The country assumes a more smiling appearance, which led us to anticipate the meeting with limestone rocks; we saw none along the river, but some precipices, seen at a distance, were supposed from their horizontal stratification to be composed of limestone. On the river the rocks seldom appear in place; where we saw them they were principally mica-slate, sometimes, however, sienite. Dr. Bigsby found staurotide in the slate of this river.

"At Rainy-Lake Fort, there is a very fine water-fall, surpassed by two or three only of those on Winnepeek River. The rock is chiefly sienite, in which we thought we could distinguish a tendency to a stratification directed about north-east, and inclining about 65 degrees to the south-east. This, however, may have been a local feature.

"We proceeded through Rainy-Lake, for a distance of about fifty miles,

on a general easterly course. We found it to resemble in its characters the Lake of the Woods; it contains many islands, all resting upon a rock, which, for the most part, is a mica-slate, whose strata are directed north 70 degrees east, and nearly vertical; we have in a few places seen granite, sienite, &c. The islands betray a rapid and constant decomposition by the crumbling of the vertical strata, so that we doubt not that the physical characters of the Lake, as well as the size and form of the islands, must undergo very striking changes in the lapse of ages. From Rainy-Lake the voyagers pass into a number of small rivers or narrow channels, separated by portages. Among these rivers they distinguish that of the "New Portage," de la Croix, Maligne or Bad River, &c. Among the lakes are Vermilion, Namakan, or Sturgeon Lake, and de la Croix. We observed, as we advanced, that the country became more broken, the hills were higher, the islands rose to a greater height, and the region assumed characters indicating a dividing ridge.* A journey of a few days more bronght us to the "Portage de la Prairie," one end of which communicates with the waters of Lake Winnepeek, while the stream at the other end flows towards Lake Superior.

"From Lake de la Croix to the height of land the minerals presented but little diversity; in one place, the rock, which is a a mica-slate, contains many small nodules of quartz, and probably of garnet, which impart to it a rough appearance, and have caused it to be noted by the voyagers under the name of the "Rocher Grenuilleux." But the crystals of garnet were so small and ill-defined, that it was with difficulty they could be made out. The only good crystals which we saw were of tourmaline, in a granitic rock which forms the Island of the Straits, in Little Sturgeon Lake. These were beautiful, about an inch long, and terminated at both ends,† but they could not be detached except by blasting, which we had neither the time nor the means to execute. They were of an intense black, the more remarkable, as most of the rocks which we observed in the portages, as we advanced in our journey, were almost free from colouring matter. We frequently found granite, whose mica was of a silvery white, the quartz transparent and colourless, and the felspar resembling the adularia or moonstone. Near the dividing ridge many of the portages were extremely swampy.

"The highest water of the St. Lawrence, which we saw, was in a small pool called Cold Water Lake. This is a basin which is only one hundred and fifty yards long and about twenty wide. Its name is very appropriate, the temperature of its water being much lower than that of the surrounding lakes and streams. It is supplied by a spring issuing from the side of the hill, and which is not more than two hundred yards from the lake. This is one of the finest springs we have ever seen: its temperature, which was only 41° of Fahrenheit's thermometer, is lower than that of any spring which we have examined. The temperature of the lake is about 42°. That of the atmosphere at the time we made the observation was 63°. We saw no rocks in place about the spring, but entertain no doubt that the whole country is granitic.

"We reached Cold Water Lake on the morning of the 10th of Septem-

* Keating thinks however that this is not a dividing ridge in a strict sense. For his reasons see the work, vol. 2, p. 132.—Ed.

† By triedral summits?—Ed.

ber, and commenced our journey down the streams which fall into Lake Superior, near Fort William, which place we reached on the 13th. Our course from the height of land to Lake Superior was through Cold Water Muddy, and White-fish Lakes, Cats-tail River, Dog River and Lake, and the Kamanatekwoya River.

" Cats-tail River has a very circuitous course, through a valley about three miles wide, which is embanked by hills rising to at least one hundred and fifty feet. The valley partakes of an alluvial character, and consists principally of sand. The stream runs through it, being incased but a small depth below its level. The hills which bound the valley are chiefly granitic ; at one place where we passed near their base, we saw a beautiful pink granite, which extended for about half a mile. It was divided into large masses, showing no signs of stratification.

" On descending Dog portage, towards Lake Superior, we found mica-slate *in situ* on the east side of the hill, and this we observed still more distinctly at the next portage, where the sharp lamina of the slate, resembling the blades of cutting instruments, have caused it to receive the name of Knife or Devil portage. Although it was late when our party reached this place, yet we had occasion to observe a junction of the slaty and greenstone rocks. The greenstone is under the slate, whose strata are directed north fifty degrees west, and incline to the north-east about seventy degrees. There does not appear to be a passage from the one into the other ; but a tendency to the formation of both rocks probably existed at one time, whence the mica-slate was deposited immediately after the greenstone, no interval of time occurring between the formation of the two, as appears from the fact that we find patches of the latter enclosed in the inferior strata of the former, and also some portions of mica-slate in the superior part of the greenstone mass ; as the latter is not stratified, we could not determine whether the slate lay in parallel superposition, though we have reason to believe that it does. We observed that the masses of greenstone enclosed in the mica-slate lay in a direction parallel to the stratification.

" We observed, on the 12th, a very important change in the geological features of the country. In the morning, the rock was a very decided mica-slate, which gradually passed into a clay-slate, whose primitive characters were inferred from a vertical stratification observed in several places, and especially at a portage called the " Portage du Raccourci," or of the *short cut ;* in one place the rock abounds in iron pyrites. At the Mountain Portage, or that made at the Falls of Kakabikka, the rock was found to be in very distinct horizontal stratification. The connexion of this with the former rocks could not be observed, but we are induced to believe that there is a distinct passage of the one into the other. At the descent of this portage we could study the characters of the rock. We observed that the whole mountain is composed of an alternation of strata ; some are formed of a clay-slate, and others of a grauwacke or sandstone, formed by the union of grains of quartz and felspar united together by an argillo-calcareous cement. There are a number of small specks of calcareous spar. The rock contains nodules of silex of a colour which varies from an ash-gray to a light black ; it is pellucid. In some cases it assumes the characters of a Lydian stone. We observed throughout the mountain many points of iron pyrites ; in some cases also, a little copper pyrites was seen. The sandstone is formed of rounded

grains of felspar and quartz. We incline to the opinion that this is a transition rock, from the absence or great scarcity of organic remains; we sought in vain for them; it is probable that a more minute search would disclose some. We saw small nodules which, at first sight, were considered as probably of an organic nature, but upon closer investigation they did not justify this belief. The seams of the slate are lined with calcareous and ferruginous incrustations; the latter appear to be in great measure derived from the decomposition of the iron pyrites. While descending the river in our canoes, near *Bad* Portage, we observed the compass vary much; the north pole pointed to the south-east; this continued for a few moments, and induced us to believe that we were then near a bed of iron ore, which influenced our instruments.

"Proceeding down the river, about ten miles below the falls of Kakabikka, we encamped at a portage, occasioned by a considerable bed of flint or silex in every respect similar to that observed at the Mountain portage. It is probable that this flint was in like manner enclosed in the slaty rock, and that being of a more durable nature it has resisted decomposition, while all the surrounding slate was washed away.

"On the afternoon of the 15th of September, we took leave of Messrs. Mackenzie and Henry, and commenced our voyage along the north coast of Lake Superior. The weather was fair, the wind favourable and not too strong; we hoisted a sail, descended the river, entered the lake, and soon lost sight of the fort. The river discharges its waters into a bay which is seperated from the lake by a barrier of small islands, one of which has received the name of Paté, or pye, from its form. This is a high turretted rock, elevated several hundred feet. We passed at a distance from it, but it appeared to be formed of nearly vertical cliffs, and the upper part presented the appearance of a columnar division, while the lower seemed as though it were formed of the same horizontally stratified slate, which we had seen at the falls of Kakabikka. Having crossed the bay, which is about fifteen miles wide, we passed a promontory called Thunder Point, the elevation of which was estimated at eight hundred feet. This, as well as the rest of the shores, has a bold and fine outline. It is doubtless formed of the same rock as the islands; its dark red colour, deepened by the effects of the weather, is picturesquely relieved by an orange-coloured lichen which in many places conceals the rock. The next morning we observed that the place where we had landed* was covered with an immense number of small waterworn stones, which were found to consist of an amygdaloidal rock. There were a number of cavities and druses in these, which were lined with minerals of the zeolite family. These stones, which had been seen at the evening encampment near Thunder Point, had given the first intimation of our approach to a formation of a different nature from those which we had previously seen; subsequent observations fully confirmed the fact. The geologist met here† with a very interesting rock; it was the amydaloid in place. This appeared to be a reddish wacke filled with geodes of quartz, hyaline, agate, cornelian, jasper, onyx, &c. besides mesotype and stilbite. The latter mineral is found very generally disseminated; it lines small fissures or cracks in the rock which are generally not more than from one-sixteenth to one-twelfth of an inch in thickness. It is of

* An island in Lake Superior.

† Another island in Lake Superior.

a fine red colour. In the geodes we observed all those varieties of quartz, which have given so much celebrity to the rocks of Oberstein on the Rhine. It is impossible on beholding this spot, on Lake Superior, not to admit it to be a secondary trap formation, similar to those of Germany, Scotland, &c. We find here also, probably, the original site from which have been derived all the specimens of jasper, cornelian, &c. previously mentioned as existing on the banks of the Mississippi, and for which Lake Pepin has long been celebrated. When we consider the easy decomposition of the wacke in which these geodes are imbedded, we cannot be surprised that the latter are always found loose and separated from the imbedding rock. The amygdaloid was not observed to be stratified, but in some places, it presented a columnar division. We are therefore induced to attribute the columnar appearance, which we thought we had seen in the Paté island, to the presence of trap rocks at its surface; it appears to us probable that all the islands which we saw are more or less covered with this interesting formation, which was probably deposited at a period subsequent to that at which the horizontal slate was formed. The examination of the geological structure of the north coast of Lake Superior will probably renew the discussion of the aqueous or igneous formation of the trap rocks. Upon this point we will not dwell, because we have no new facts to offer. Our visit to this coast was of too transient and hasty a nature to permit us to extend our observations. We, however, confess ourselves unable to discover in secondary trap rocks in general any signs of a Neptunian origin. If we were disposed to launch into theory, we might connect the existence of these trap rocks with the evident signs of the action of heat observed upon some of the rocks which we met in Winnepeek River. We might perhaps also attempt to refer to volcanic phenomena on a great scale, the changes to which we have already hinted as having taken place in that country. The rupture of the great barrier which confined the waters of the immense lake might be shown to have been probably produced by such causes. This opinion is not quite original, for Mackenzie has stated that he thought he could discover along the north coast of Lake Superior evidences of volcanic action.

"The physical revolutions, of which this part of our continent was the theatre, were too great to attempt to assign to them any but an immense cause. By those, who object to the igneous or volcanic theory of the formation of trap rocks, it will perhaps be argued, that the immense extent of country, on the shores of Lake Superior, which is covered with these rocks, opposes the hypothesis of their being the product of volcanoes; but the same has been said of the secondary trap formation of Bohemia, Auvergne, &c. While the igneous origin of these is supported by the respectable names of Desmarest, Humboldt, Von Buch, D'Aubuisson, &c. we may, arguing from the sound principle, that like effects may in both hemispheres be traced to similar causes, be permitted to consider the trap rocks, which we observed, as being probably of a volcanic origin.

"These amygdaloidal rocks, interspersed with other varieties of trap rocks, were frequently seen on the coast of the lake. We, however, often saw also sienite, but never had an opportunity of examining the junction of the two rocks. On the morning of the 17th, we observed a beautiful red porphyry, which on inspection we found to be formed by

fine crystals of felspar, united by a cement of the same mineral in the compact state; there was also some hyaline quartz throughout the mass, but whether in regular crystals or not we could not determine. This porphyry is not stratified; it very readily decomposes and crumbles into dust, forming a fine gravel of a brick-red colour, affording good beaches for the landing of boats. This rock evinces a disposition to break in vertical and probably columnar fragments, which are, however, soon destroyed by the easy decomposition of the mass. Beyond the place where we saw the porphyry, the amygdaloid recurred under the same appearance, except that its colour was of a bluish cast. It contains a considerable quantity of carbonate of lime, presenting a fine lamellar structure; the carbonate of lime lines fissures in which it has sometimes formed small but distinct crystals. At the evening encampment of the 17th, there were no rocks in place; the beach was strewed with numerous water-worn boulders, among which we observed many fragments of an impure green carbonate of copper, which could not have proceeded from a great distance, as its softness would have soon caused it to break.

"On the morning of the 22d we resumed our journey with a high south-easterly wind. We observed, as we advanced, that the country being all sienitic, presented a wilder and more barren appearance than where the trap rocks prevailed; it did not rise to such a height, the shores probably seldom exceeding two hundred feet; but good harbours became more scarce, owing, doubtless, to the greater resistance which the sienite offers than the trap rocks, to the destructive action of the waves. The rocks are likewise less ragged; they are steep and rounded at their surface. The divisions which they present are very irregular; we question much whether the rock be stratified, though in some places it assumes that appearance, especially when seen from a distance; for, on approaching, the divisions are found to be irregular, at least in all places where we had an opportunity of studying them closely. From a distance, we had been almost induced to consider the rock, at that place, as divided by vertical fissures, but on drawing closer, the features were found to be different. At a distance inland, the mountains appear higher, and it is by no means improbable, that they equal, if they do not exceed, in elevation, the height of the coast west of the Peak. The mass which constitutes these rocks, we have called a sienite, though it differs materially from the common sienite by the presence of quartz, which in some places forms at least one-third of the mass; perhaps the term of amphibolic granite would be more correct; we think a new name ought to be introduced into science, to designate a rock which constitutes such extensive formations. We have applied the term sienite instead of greenstone, which we believe Dr. Bigsby generally uses, because the proportion of felspar has appeared to us to predominate over that of amphibole. It bears to granite the same analogy that the *protogine* of Jurine does; for in it, the mica is replaced by amphibole, while in the protogine its place is supplied by talc. In some spots the protogine is also found, as well as a more compound rock, formed of quartz, felspar, amphibole, and talc; but these cannot be said to constitute important features; they are, at best, formations subordinate to the general sienitic mass. The colour of the rock is influenced by that of the felspar which is in great excess, and is of a flesh colour; the amphibole is green. The quartz sometimes penetrates the rock in the manner of veins, but this accident

is considered of contemporaneous origin with the formation of the mass itself, because, in detached fragments of the same, the quartz of the vein, and that in the body of the rock itself, were found to run one into the other.

" We had on the west coast of Michipicotton-bay observed a slaty rock, of a dark colour, sometimes almost black; it was well stratified; the direction of the strata was north 40° west, their inclination was vertical. It is found in some parts to contain much quartz and iron pyrites. This rock rises higher than the coast usually does; it forms a vertical cliff, which appears to be undergoing a very rapid destruction; but the fragments, instead of collecting at the base and forming an inclined plane, are washed away, so that the waters of the lake come up to this vertical bank, which rises like a wall, enclosing the lake. It is probable that, at the junction of this rock with the sienite, the river has forced its way into the lake, and that the wide bay of Michipicotton has been opened, for on the east side we again saw the sienitic rocks predominating. At the bay in which we stopped, five miles east of the trading house, we observed the sienite to be intermixed with other rocks, one of which contains a greater abundance of hornblende, and forms a real greenstone; another portion is mixed with talc, and a third portion contains hard nodules of quartz, which would at first convey the idea of a conglomerate, but which, being examined more closely, appear to present no characters but such as are entirely compatible with a primitive and highly crystalline formation; these nodules of quartz are connected by a talcose cement. All these varieties are found together, and belong to the same general mass, of which they form but local or partial features. They are all penetrated by iron pyrites, in great abundance, which in some points were evidently mixed with copper pyrites; all these were examined with care, in hopes of meeting with the native copper, and with other ores of the same metal besides the pyrites; our search was, however, unsuccessful."—For continuation see note 26.

Geological Extracts from the Canadian Review, No. IV.

" The northern shore of Lake Huron, with its nearest isles, consists principally of the older rocks; the secondary occupy the rest of the lake. The primitive rocks are part of a vast chain, of which the southern portion, extending probably uninterruptedly from the north and east of Lake Winnipeg*, passes thence along the northern shores of Lakes Superior, Huron and Simcoe, and after forming the granitic barrier of the Thousand Isles at the outlet of Lake Ontario, spreads itself largely throughout the State of New-York, and then joins with the Alleghanies and their southern continuations.

" The geology of that part of this primitive chain which borders on Lake Huron is but imperfectly known. I shall give such detached information concerning it as I am possessed of.

" The French River flows over a granular gneiss at its source and mouth; and over red and feldspathic gneiss about the falls of the Recollet. Its shivered and dislocated state, its mossy coating, and the astonishing quantity of native debris prevented my ascertaining the direction of the strata, although I landed more than once during my passage down the river.

* Vide *Geological Transactions*, vol. v. Part II. page 607.

"The low and sandy beaches of the south shore of Lake Nipissing are crowded with mounds of gneiss unmixed with any other rock. The direction, from its great irregularity, I was unable to determine.

"The rocks of the north coast, and its contiguous islands east from the French River, consist of gneiss, with occasional mixture of hornblende.*

"From the French River westward to the islands of La Cloche, about 50 miles distant, the lake near the shore is studded with innumerable islets. In the first 20 miles they commonly consist of gneiss, are barren, and surrounded by shoals, and are often, in fact, a heap of ruins. This is particularly the case very near the main; but further out in the lake they are loftier, and sometimes girded with a belt of flat ground, richly wooded. This belt was in many instances visibly supported on an horizontal dark slaty rock, which afterwards proved to be shell limestone. The primitive rocks of these Islands retained their wonted sterility. Both the Islands themselves, and most of the ridges of which they are composed, have a south-west direction; and individual masses of gneiss were observed to dip either vertically or more or less to the south-east;—a coincidence in position with the gneiss of the whole valley of the St. Lawrence, worthy of being remarked.

"The Isles of La Cloche form a charming contrast to the bleak hills of the main, in their forests and grassy vales, diversified, like an English park, by clumps of fine trees. Some of them are composed, as I am informed (for I did not see it,) of a dark rock, which when struck sounds like a bell.

"From La Cloche to the river Missassaga, a distance of 60 miles, is another assemblage of Isles; but principally, I believe, within 6 miles of the shore. In the first five leagues from La Cloche, they are woody, except those near the shore, which are barren, and composed of gneiss. Landing here on the main, I found issuing from a morass a round smooth mass (probably a vein), 50 yards broad, a crystalline quartz rock, running south-west, and containing nests of silvery mica and galena. The former in some parts combining with the rock, rendered it fibrous.

"Twenty miles from La Cloche, and four from the main, is a chain of five or more short islets, parallel to each other, and having their long diameter to the north. They are composed of genuine granite; and are bare, low and smooth.

"Further to the west, soon after this, a multitude of small sterile islets, loaded with debris, occurs for 20 miles along the shore, composed chiefly of hornblende rock. They are of a deep black colour, and in one instance had the glazed lustre occasional in this mineral. The rock varies in its constituents. On the east it is moderately pure, but seldom very crystaline. Further west, it takes a green tinge, and in certain spots feldspar or quartz is visible in grains. It is often traversed by beautiful and strong veins of quartz, clouded green and red. The compact black species contains much olivine, and some elongated crystals of hornblende.

"From hence to the river Missassaga, another appearance is noticed. The islets of granite return, intermingling with the trap, both rocks being in the form of low oblong smooth mounds; the granite taking a northerly direction, and the trap running south-west. Some of the islets possessed the calcareous girdle before mentioned.

"Being delayed at a point 10 or 12 miles west of the Missassaga, for thirty-six hours, I examined the beach of the mainland for one or two miles.

* Communicated to me by Lieut. Grant.

"I here met, protruding from the woods into the lake, a rock, which is an intermixture, on a large scale, of a light-coloured greenstone, and a compound of white quartz and red feldspar minutely blended, but the latter predominating. These two aggregates mutually penetrate and traverse each other in the most capricious forms (as in marbled paper.) They are in equal quantities; each being indicated by strongly contrasting configuration, knotty, straight, waved, or stellular. Ramond compares the contortions and confused appearances of certain rocks in the Pyrenees, to the effect produced by a mixture of differently coloured glutinous liquors, issuing from separate vessels at the same time, or to convolutions of smoke. These comparisons apply well to the masses under consideration*.

"These mounds exhibit no tendency to stratification; but their long diameter appeared to be always directed to the north-west. They are found westward for some miles near the shore, accompanied by a few granitic mounds, holding a northern course.

"The limits of this rock are not known. It is succeeded on the west by the morasses about Thessalon river. It has given the name of Le Serpent to that part of the north shore in which it occurs. Greenstone slate†, lying beneath a granular quartz to be noticed hereafter, is found in one of the islands forming the insular groups north of False Detour. The granular quartz of Green Island is succeeded on the west, after a small interval of marsh, by various greenstones, extending along the north side of the channel and narrows of Pelleteau.

"At the lower end of the broad promontory constituting the east side of Portlock Harbour, and in the small isles on its east, the greenstone is dark and compact, but here and there rendered slaty by weathering. It contains, in patches, numerous masses of the red ingredient of the rock of Le Serpent, from one to eighteen inches in diameter; all bearing positive marks of attrition to a moderate degree, and sometimes becoming so plentiful as to make the rock a decided conglomerate. Proceeding still westwards, by degrees the red ingredient disappears altogether, and the greenstone resembles a splintery slate, commonly of a dark leaden hue, which runs however either rapidly or gradually into cream-colour, red, blue, or light green. Its course is distinctly north-west, and it dips at a high angle to the north-east, when not absolutely vertical.

"The greenstone of the large island close to Portlock Harbour varies much. In one part is nearly pure hornblende, splitting into cubic blocks; in another it gradually resumes its conglomerated state, the nodules being small and rare. At the south-west end it is very slaty for a square mile.

"At the place where the hornblende abounds, thin waving veins of ligniform asbetus are common. The centre only of the vein is pure, the sides passing into greenstone. Vertical seams of quartz, with drusy cavities of quartz crystals, are often met with; and thready veins of galena also. I found a mass of this ore loose, on the opposite side of this channel, weighing one pound and a half.

"The precipices and steeps of the main in the Narrows of Pelletau are also greenstone; but, as usual, of different aspects. The bluff at the

* A somewhat similar rock appears to have been found by Dr. MacCulloch in the Isle of Arran, not far from Glenelg. Vide *Western Isles of Scotland*, vol. ii, p. 399.

† The greenstone slate of the northern shore breaks, often, with a very sharp edge and conchoidal fracture.

lower end is only slightly slaty. It contains a confused mass of quartz veins, with a small quantity of copper pyrites, and the carbonate of that metal. The middle portion of these cliffs is extremely splintery, and appears to be ferruginous. At the head of the Narrows the greenstone is much less disintegrated, and dips into the clear and deep waters in compact black walls. I have passed a league into the interior from the Narrows and Channel of Pelletau, without finding any remarkable difference in geological structure between the interior and the shores. The contiguous islets are of a similar formation, and are composed of aggregated ridges rising to a great height.

"These greenstones dip from the secondary strata on the south, in the same manner as at Malbay, 90 miles below Quebec, gneiss and mica-slate dip from, and abut against, a horizontal calcareous conglomerate full of organic remains, and, among others, of three species of orthoceratite."

"The connexion of the secondary with primary rocks of Lake Huron has been very imperfectly examined; and, in fact, is almost wholly concealed by the thick vegetation of those islets where the contact of the two formations does occur; or, in other cases, by the wide intervening tracts of water.

"I shall first notice those rocks, which, though not primary, possess less decidedly a secondary character.

"About the river Thessalon, on the large island opposite to, but seven miles distant from its mouth, and in the insular groups of the lake, north of False Detour, my friend Major Delafield (American Agent under the 6th and 7th articles of the treaty of Ghent) observed a granular quartz, forming the north points of the islands, and dipping north, at an angle of 45 degrees. On one isle it was remarked to run imperceptibly into the greenstone slate that lay beneath it. In High-cliff Island the granular quartz forms a precipice 100 feet high. On this island limestone containing orthoceratites is met with, which appeared to Major Delafield to alternate with the quartz. This quartz rock is frequently seamed with white quartz, of which blocks, containing much chlorite earth, lie loose on the shores. It is always hard, minutely granular, and now and then very crystalline. It contains no petrifactions.

"This rock extends westward as far as Green Island, and is then succeeded by the greenstones on the north of the Channel of Pelletau.

"Immediately on passing into the Lower Basin discharging into the Narrows of Pelletau, a quartz rock shows itself obscurely among the marshes about St. Joseph; but from the insular barrier to Lake George, it is abundant, and has a north-west course, and a dip which is either vertical or not discernibly otherwise. At the barrier it consists of minute grains of vitreous quartz, cemented by the same substance, rather powdery, opaque, and white. It is somewhat easily frangible. Its fissures are sometimes lined with brilliant red quartz crystals.

"The islands on the north of the Upper Basin, about the Narrows of Pelletau are of the same rock, with the same direction, but possessing more compactness. At the foot of Lake George it is often crystalline, dense, slightly translucent at the edges, conchoidal in fracture, but frequently also foliated; the fragments then becoming schistose, with a shining lustre. It is here very commonly a conglomerate rock, of great beauty, studded with nodules of red and brown jasper, averaging an inch in diameter, and usually arranging themselves in the form of belts or

stripes, from one to five feet in breadth. Black and brown hæmatite occur sparingly at this place.

"Two broad strata of greenstone occur in this rock, three miles apart; the lowest five miles from the Narrows, whose rock it resembles, though it is more syentic.

"The character of the sandstone, which I am now about to describe, appears both in the position of the strata and in the texture of the rock itself, to be decidedly different from the preceding.

"The greater part of Lake George, as well as of the Straits of St. Mary, rests (I believe) on a horizontal red sandstone. I have observed in various parts of this lake, large slabs of this rock, with sharp fresh edges most of it soft, and of dull lustre, but frequently quite crystalline, and remarkably hard and white with large ferruginous red spots."

"The shores and bed of Lake Huron appear to have been subjected to the violent action of a flood of waters and floating substances rushing from the north. That such a flood did happen is proved, not only by the abraded state of the surface of the northern mainland and scattered isles of the Manitouline range, but by the immense deposits of sand and rolled masses of rocks which are found in heaps at every level, both upon the continent and islands: and since these fragments are almost exclusively primitive, and can in some instances be identified with the primitive rocks *in situ* upon the northern shore; and since, moreover, the country to the south and west is secondary to a great distance, the direction of this flood from the north seems to be well established.

"The boulders of granite, gneiss, mica-slate (rare,) greenstone porphyry, syenite, and various amygdaloids, are principally of such varieties of these rocks as I have not met with *in situ*, either in the neighbourhood of Lake Huron, or in a journey of 600 miles which I made to the east and north-east of the lake, through the forests of the river Ottawa.

"Of mica slate I met with only two fragments, of a brown colour, among the trap isles. A fragment of serpentine was found in Drummond Island, on Blockhouse Hill.

"The greenstone porphyries have a light-coloured base, and contain crystals of red or white felspar—seldom of both in the same block. I have seen boulders of the porphyry with red felspar, on the Ottawa, 500 miles to the east of Lake Huron. The syenites are the same as those of Europe.

"The amygdaloids are often coloured brown by iron, and then contain almond-shaped masses of epidote only. The green varieties contain nodules of agate* and red jasper, white amethyst, epidote radiating upon layers of quartz and small garnets.

"It can scarcely be doubted that these rocks will be found *in situ* somewhere on the northern shore of Lake Huron, between the Missassaga and Pelletau's Channel. It is there and on the Isle of St. Joseph that these boulders most abound. Together with the fragments of the above-mentioned rocks, are found others of trap, green-stone slate, greenstone-conglomerate, jasper-conglomerate, and quartz rock. These occur in every part of the lake, but most abundantly near their parent rocks. The conglomerates closely resemble those which have been found on the northern shore *in situ*. The base of the conglomerates is either quartz

* Agates, jaspers, &c. are found abundantly as pebbles, on Lake Superior and about the Mississippi.

or greenstone. Of the quartzose conglomerate the nodules consist rarely of white translucent quartz, sometimes of greenstone; and more commonly of red, green, brown, black, or parti-coloured jasper. In some instances pieces of quartz—rarely of green-stone—are mixed with those of jasper. The greenstone conglomerates contain nodules, either of quartz, of greenstone, or of the red ingredient found in the rock of Le Serpent. This latter conglomerate has been noticed as occurring *in situ* in the channel of Pelletau.

"It is only about the Narrows of Pelletau that the rock of Le Serpent has been seen in a rolled state. Breccias similar to the conglomerates are not uncommon; but I have never found them *in situ*.

"Pebbles of red sandstone, and quartzose or slaty limestone, have a very limited range; they only now and then wander as far as the Manitoulines, the southern shore, or Michilimackinac.

"I have already noticed the quantity of primitive boulders found on the Isle of St. Joseph. The beach of the rivers Thessalon and Missassaga is covered by boulders of black trap, granite, gneiss, and jasper-conglomerate.

"The Georgian or Penetanguishine arm of the lake is loaded to excess with sand and rolled pebbles. Penetanguishine, and much of the south-east coast of this arm of the lake, is a collection of sand-hills, enveloping quartzose, granitic and amphibolic blocks of all sizes, and in vast quantity.

"Passing into the southern division of the lake, 64 miles south of Cabot's Head, the limestone cliffs of the Manitouline range are succeeded by cliffs of clay. From this point beds of clay, covered towards the upper part of the river St. Clair by thick beds of sand, extend for 150 miles to Lake Erie, and thence along the northern shore, which presents a series of clay cliffs and sand-hills, to the north-eastern extremity of the lake. The whole of the intervening shores and woods are strown with rolled blocks of gneiss, porphry, conglomerate, and greenstone, such as prevail on the northern shore of Lake Huron. In a south-westerly direction, the clay-beds prevail over the Michigan territory, and the states of Indiana and Illinois, to an unknown distance. In the two last-mentioned states (which I have not visited) rolled blocks abound.

"The argillaceous and sandy banks of the southern shore of Lake Huron are conspicuous near Point aux Barques, in the Gulf of Saguina, and about Presqu'isle. The debris of the rocks of the northern shore are here rare, and much rolled. Staurotide was picked up on the southern shore by Mr. Schoolcraft.

"Besides the sand and boulders before spoken of, which are ancient, and have travelled from a distance, there are fragments of another character, which may be called *native*, reposing on the parent rock, or not far removed from it. This debris is comparatively recent, having been detached by various natural causes, such as torrents, change of temperature, &c. The latter agent operates either by the expansion and contraction of the rock itself, or of the water contained within its fissures. In the spring the nocturnal frosts and diurnal thaws are very violent. In the winter the thermometer is frequently 50 degrees below the freezing point, and in summer it ranges from 60 degrees to 90 degrees of Fahrenheit. I once saw it at noon, on the 20th of June, 1820, at 101½ degrees in the shade.

"These recent fragments, whether of the older or newer rocks, are angular and mostly small, and cover their parent rocks, as well in the high as in the low grounds, often to the deph of several feet. Examples of this are seen in the slaty greenstone of the Narrows, in the quartzose limestone of Drummond, and in the quartz rock at the foot of Lake George.—All the countries to the north of Lake Huron are loaded with similar debris. The French river in one wild spot, the scene of an Indian massacre, is almost choked with it. In Lake Nipissing, near its southern shore, there is a large heap of square clean masses of gneiss piled together promiscuously.

"An instructive fact is presented by many parts of Lake Huron, and very strikingly in the channels of Pelleteau. It shows that the recent debris is nearly stationary. The opposite shores of this channel consist of different rocks, the one being limestone, the other greenstone. Each shore is lined with its own debris, without any admixture, except that of rolled pebbles of granite, pudding-stone, or greenstone, left by the debacle on the calcareous beach.

"In the spring the ice occasionally removes fragments of great size: the inhabitants of Quebec annually see them transported in this manner down the St. Lawrence. During the winter the ice surrounds the blocks that are upon the shallows; and on being broken up in May, it carries them by a rise of water to some other shore. Remarkable instances of this are found on the islets near the south end of St. Joseph; where, a few yards from the water, and above its level, rolled stones, many feet in diameter, are found deposited, with a furrow extending from the water to their present place of rest.

"That changes in the level of Lake Huron have occurred, and that its surface once stood much higher than at present, is proved by the traces of ancient beaches and zones of rolled stones and sand that are found in the neighbourhood of the lake. Such an occurrence has been noticed in Collier's harbour, at Blockhouse Hill, which has the appearance of a beach, and of having formed the west end of the Isle of Drummond, when the lake stood higher than at present. Similar alluvial ridges are found surrounding the other lakes and rivers in Canada. These may be accounted for partially by the effects of the wind; which, blowing strongly from certain quarters for a few days, accumulates the water on the leeward coast, the waves there washing up the shingle in scalar ridges to the height of 6, 8, or 10 feet."—Notes on the Geography and Geology of Lake Huron, by Dr. Bigsby.

Geological Extracts from the Canadian Review, No. II.

* *On the utility and design of the Science of* Geology, *and the best method of acquiring a knowledge of it; with Geological Sketches of Canada.*

"The study of Geology has of late years attracted the enthusiastic services of the first intellects of the age, by its novelty and usefulness; and by the grand and curious mechanism of the structure it attempts to explain. We know the Canadas to abound in valuable mineral products; and also in geological phenomena as interesting and instructive as they are neglected: we are, therefore, induced to entreat the attention of our readers to the results of such researches in extending national resources; and in advancing abstract science,—objects, in our estimation, equally honorable.

"With this view, we shall briefly point out the importance and design of this branch of Natural History, and the best method of acquiring some knowledge of it;—concluding with a few sketches of remarkable localities in the Canadas.

"It is only in appearance that Geology has been slow in engaging notice; for the philosophers of antiquity by no means withheld its fair proportion of their usual scholastic dreamings. It was natural, however, that its progress in modern times should be more tardy than that of Chemistry, Mechanics, or Pneumatics, &c. for they are based on the discoveries of the closet or the city, while the materials of the science now under consideration are gathered by the enterprising only, in distant and widely separated countries.

"So great is the gratification of successful enquiry, that each department of nature will ever have its train of investigators; but geology, is not merely a recreation for the inquisitive; it exercises a prodigious and immediate influence on the civilization and prosperity of a people. It is gradually conferring on the operations of mining, (the true source of manufacturing greatness,) the same enlightened rules that chemistry has furnished to the economical Arts. It is banishing blind empiricism. Every day the ancient denomination of "Gentlemen Adventurers," assumed by the proprietors of Cornish mines, is becoming less applicable. It has collected, arranged, and examined, a great assemblage of facts, or rather of laws, and successfully applied them to the purposes of life. Certain invaluable substances, as magnetic iron ore, anthracite, coal, salt and gypsum, &c. have been shewn by it to exist in quantity, only in particular depositories—so that it is a vain waste of time and means to seek them elsewhere. The coal field of the north of England, has even been measured; and with the triumphant conclusion, that it will only be exhausted in 1500 years, at the present enormous rate of consumption. A few years ago, the miners of Derbyshire, in England, threw all their white lead ore on the public roads, in ignorance of its nature. Very lately the Americans, in building at Saguina, in Lake Huron, were accustomed to fetch their limestone from Detroit, 130 miles distant, when it was plentiful in the bay adjacent. The officers of the Hudson's Bay Company, stationed at Fort William in Lake Superior, also have brought their limestone from lake Huron, although it was to be procured 17 miles off, at

* An anonymous article, but we cannot be mistaken in attributing it to Dr. Bigsby.

the water's edge, near the base of Thunder Mountain. The early decay of the granite, of which Waterloo Bridge at London is built, is to be expected from the fact, which we have learnt from high authority, that the large crystals of feldspar, constituting so great a portion of the rock, is of the kind containing soda and therefore easily acted on by the weather. In an undertaking of so much moment, it is a matter of regret that the materials were not submitted to the judgment of a skilful geologist previous to their being used.

"Satisfied of the extreme utility of this science, many countries have established schools and colleges for the instruction of the persons intended to conduct the working of their mines, in mechanics, chemistry, metallurgy, practical mining and geology. The most celebrated of these, at present, are the *Ecole des Mines* of France, and the mineralogical College of Freyberg in Saxony: but Mexico, Hungary and Idria also possess them; all sufficiently endowed with funds for the salaries of eminent teachers, the expences incurred in essays and chemical experiments; and for the support and increase of their cabinets of minerals.—The English government is fully justified in leaving the direction of the industry of the nation to its capital and men of science. It has found it necessary to appoint a geologist to accompany the Engineers employed on the great Trigonometrical survey of Britain, as the contiguity of certain rocks has been observed to affect both the pendulum and the magnetic needle. Dr. Macculluch, the distinguishsd author of the "Description of the western Islands of Scotlands" has been selected. It is hoped that some general laws will be discovered for the correction of these aberrations.

"Geology is the foundation of Physical Geography. On the nature of the rocks of any region depend its great features of mountains, vallies and plains, whose courses, dimensions and shape are derived from the position of the strata, and the peculiar outline, which each mineral mass, speaking generally, appropriates to itself. The same may be added of rivers, which are affected, also by the power of absorption possessed by their beds. Limestone being frequently cavernous, sometimes engulphs, partially or wholly, the streams flowing over it. Thus, part of the water of the Ottawa, immediately after making the descent of the very picturesque Falls of the Chaudière, enters a concealed chasm, and reappears in two places, the one in the middle of the river three-fourths of a mile below, and the other, as we are informed, about a couple of miles further down. Canada furnishes many examples of the characteristic features above alluded to. The shapeless, rounded massiveness of a granitic mountain is finely expressed by Cape Tourment, thirty miles below Quebec, which passes into the interior in huge flanks, now and then intersected by deep ravines of singular ruggedness and grandeur. Thunder mountain, in Lake Superior, presents a basaltic precipice 1400 feet high, of uncommon magnificence, faced by the usual rude colonades. To these constantly recurring laws, often in beautiful groupings, we are indebted for the mouldering and fretted cliffs of sandstone on the St. Lawrence, a few miles above Brockville, and for those of limestones, at the Falls of Niagara, broken into stair-like ledges, overhung with large pointed tables of rock, and having their bases strewn with gigantic ruins. The pretty village of the "The Forty," in Grimsby, on Lake Ontario, is close to a

fine cliff of this kind. The Manitouline Islands of Lake Huron are full of them.

"The botany of a district, as is well known to the student, and the agriculturist is influenced essentially by its geology. Besides the operation of the latter on climate, the soil yielded by the disintegration of of certain rocks is favorable to the growth of a particular order of plants, indifferent to another, and is often almost incapable of sustaining any kind of vegetation. It is thus that the Bagshot-sand has created large tracts of unimproved and unimproveable wastes, which are allowed to remain even in the immediate neighbourhood of London.—Sherwood Forest in the midland counties of England, from the nature of its beds of sandstone will never produce any thing further than a lean hungry grass, except by the sides of rivers or where artificial means have been employed in its improvement. The extreme sterility of the countries immediately north of Lake Huron and Superior is owing to their granitic and other siliceous rocks; but much of the south shore of the latter Lake is held in irremediable barrenness by the vast quantities of sand and bowlders deposited there by the same great flood which poured abundance on the north coasts of Lakes Erie and Ontario, in the fine calcareous clays which there prevail. We need scarcely add that the infinitely varied forms of animal life, their presence or absence in certain seas or countries, their number and perfection, are mainly produced by vegetation. Under these considerations, an acquaintance with the principles of geology appears to be indispensible to the general welfare. How extensive is the sphere of its controul!

"It is the business of the practical geologist to ascertain the nature, disposition and contents of the matters fixed or loose, which constitute the crust of the earth. He ought to be the annalist of nature only.—A scrupulous and unwearied collector of facts.—Her commentator is the speculative geologist who classes, and reasons on the phenomena noted "in the solitude of the pine forest, and silent shore." The description of the rock masses involves much detail on their chemical composition, external mineral characters, as colour, transparency, hardness, natural divisions by the laws of crystallization, &c.; their appearances on weathering, and at the point of contact of two dissimilar rocks. The rocks originally defined by Werner, with the addition of a few discovered by Macculloch* and Brongniart, occur in every part of the earth, as far as has yet been examined; but not with perfect identity, for those of every large district have some distinguishing mark, although often trivial. But still, some varieties of the porphyries of Lake Superior resemble very closely that of Arran in Scotland. The granite of le Serpent, in Lake Huron, is the same as that of some parts of the Alps. The gneiss, sienite and basalt-like greenstone of the above Lake are quite like those of Sweden and Norway. The sienite of Kingston is that of Markfield Knoll in England. The limestone of Lake Erie full of various madrepores, is scarcely to be discerned from that of the shores of the Red Sea, and not to multiply instances further, the black augitic trap of Montreal Hill occurs also in the Sabine country near Rome.

"Amid the seeming confusion which strikes the hasty observer, an admirable order is found to exist in the disposition of rocks. This part of

* Author of a very valuable "Classification of Rocks," 1 vol. oct. 450 p. London, 1821.

the subject is peculiarly intricate, but includes a great number of very interesting facts. These intricacies arise principally from the very small portion of strata exposed, and from the displacements, contortions, and abrasions, caused by repeated catastrophes, originating in the interior of the earth, and by the present continued action of running water. These multiplied effects create false estimates of the situation, dimensions and direction of strata, as has been excellently exemplified in a set of models made of slips of wood, differently coloured, after an idea of Professor Farey. The geological associations of these rocks are nearly the same throughout the world. They are usually found in the same groupes, and are characterised by the same contents. The porphyry of both Lake Superior and England is in contact with, and passes into, red sand-stone and amygdaloid, the last filled with carnelian, zeolite, amethyst, &c. The mountain limestone of Canada and England is in contiguity with the same older rocks ; but that of the former country differs in being placed in horizontal strata, and in containing many additional and very beautiful organic remains, now of great price in Europe. The same parallelism may be continued through the other rocks of the two continents.

" The contents of the various denominations of rocks are every where much the same. This fact often throws light on the nature of the containing rock, when it happens to be obscure. The older limestones are the principal seat of the elegant mineral called Tremolite, mica slate that of cyanite. In Siberia, Connecticut and the Lake of the Woods, (north of Lake Superior) Beryl occurs in Granite, and Staurotide in the mica slate of the two last places. Diamonds have only been found in a quartzose conglomerate, in Brazil and the East Indies.—It is singular that only one new substance, the red ozide of zinc, has been found in the United States and the Canadas, while they are numerous in the southern division of America.

" It may be well to recapitulate here that the geological outlines of north and south America have been traced by Richardson (land expedition to the arctic circle) Maclure, Humboldt, and others. Those of Europe, and especially of England, have been detailed with greater minuteness, by a multitude of learned men, among whom, Saussure, De *Luc*, Von Buch, Cuvier, Buckland and Macculloch, are the most conspicuous for the magnitude and importance of their labors. The immense region in Europe and Asia under Russian Jurisdiction has been described by Patrin, Pallas and Strangeways, (lately attached to the British Embassy at St. Petersburgh.) Heyne, Fraser and Leschenault have given some excellent memoirs on the structure of India, the Malay Archipelago, and the countries bordering on the Red Sea. The Coral Islands of Australasia and the south seas have been examined by Otto, Kotzebue, Hall, Foster and the ill-requited Flinders.—Excepting some sketches of Egypt and the Cape of Good Hope, Africa is as yet unexplored. We have seen some specimens of granite and iron ore from Sierra Leone. The volcanic islands of Mauritius, Bourbon and the Canaries have been ably investigated by Bory St. Vincent.

" There are two views in which the prosecution of this science may be regarded ; according as the student takes it up as an occasional amusement, or as the serious occupation of his life ; designing, for instance, to illustrate the geology of his own country. Little labour will suffice to accomplish the first object : and truly fortunate is he who can occa-

sionally escape from the collisions of commerce, or the strife of the passions, into the romantic scenery that surrounds our Canadian Cities;—to trace at every turn of the forest, in the curiously associated strata, their brilliant spars, and organic relics, the goodness and wisdom of the great Architect;—and his power in the convulsions and consequent devastation which the elements have at intervals caused. It is necessary that the student should be acquainted with about an hundred rock masses and minerals, as granite, mica-slate, basalt, quartz, serpentine, calcspar, &c. These he can never know from Books. Treatises on mineralogy are only useful to the advanced scholar;—to refresh his memory generally,—or to assist in the examination of unknown substances by their specific gravity, appearances under the blow-pipe, hardness, and cleavage, &c. &c. It seems almost impossible for the mind to embody and realise to itself a number of abstract qualities exhibited singly in books, and unaided, (as is the case,) by the approximation of the most important. A mineral held in the hand, presents to the senses a numerous group of leading characters. It is probable that a sufficiently comprehensive cabinet exists in most of the principal towns of Upper and Lower Canada; to which, we feel assured, free access would be granted with particular pleasure. In case no such cabinet exists, from the fluctuation of society, common in colonies, Mr. Bakewell* of London, (the author of many excellent works connected with these subjects,) is accustomed to furnish small ones at the moderate charge of £3 3s. Mr. Mawe, in the Strand, next door to Somerset house, sells collections, strictly mineralogical, (while those of Mr. Bakewell are geological,) for from 5 to 50 guineas. Both these gentlemen are in the habit of exporting to all parts of the world; so that a person resident in Canada, or in the East Indies, has only to send an order by letter, referring the party to an agent in town for payment, and he will find the package at his door in a few months. The specimens are numbered and are accompanied by an explanatory book of reference.—In mineralogy, the best book for those who confine themselves to one, is professor Cleaveland's "Elements of Mineralogy," (2 vols. Boston, 1822.) Its preliminary chapters on the terms and principles of the science are of moderate length, accurate, plain, and satisfactory. His arrangement allows of easy reference. The descriptions of the minerals are well marked, but are free of the puzzling and cumbrous prolixity of the German School. The concluding papers on the outlines of Geology, are remarkable for the great quantity of important information they contain, compressed into so small a space.

"In geology we would recommend Bakewell's "Introduction," in one volume. In fact, there is no other respectable work in the English language, excepting the small Compendium of Geology, by Phillips, a name of the highest rank in this and Chemical science. We recommend Mr. B's work, for its very sufficient and agreeable manner and matter, the clearness of the discriptions and the felicitous illustrations. It has become, in England, quite a drawing room companion. To these treaties may be added, Playfairs' eloquent "Illustrations of the Huttonian Theory; more especially for its able discussions on the nature and origin of alluvia; and Parkinson's "Introduction to the study

* We find that Mr. B. has changed his abode since we had the pleasure of studying under him.—He has lately published an instructive and entertaining account of the Tarentaise, &c.—The Directory will furnish his address.

of organic remains," (1 volume 8vo. London 1822,) for a very concise and pleasing sketch of this important department—a department particularly interesting to the Canadian from the great number of new and singular species of fossilized animals, lately discovered in his country. It is a study important from the variety, magnitude and complex forms of its subjects, and from the extraordinary fact, among others, which it discloses—that organic life has existed on the surface of this globe in groupes, each occupying an aera of tranquility, and endowed, not with dimensions and powers incompatible with mutual safety, but with habits and faculties so harmonised as to ensure a certain permanence of all classes. It may be considered as proved, that a succession of these societies has taken place; and that each has been destroyed by a great catastrophe. It is observed that the race immediately following one of these periods of devastation has a few individuals of the preceding epoch mingled among them. Cuvier, in his "Theory of the Earth," has given a most masterly relation of these events; but, within the last few years, much has been added by Brongniart, Brocchi, Delabeche, Webster and others. Their labors however are as yet buried in insulated memoirs in the transactions of the learned societies of Europe. The "Reliquiæ Antideluvianæ," of Professor Buckland, (1 vol. large octavo, 3rd English Edition in 2 years,) presents a very entertaining, and at the same time elaborate, narrative of the effects of the last deluge. It is absolutely crowded with facts of an enchaining interest; but the most novel, although not the most curious,) are in the accounts of the numerous bones of wild animals, as bears, wolves, lions, jackals, &c. &c. lately discovered in the caves of several parts of England and Germany. That of Galyenreuth, in the latter country, has been long known.—His work is a detailed History of what he terms diluvian and alluvion:—the great accumulation of debris which sometimes invests the highest hills, but more frequently occupies the valleys, and which as clay, lime and sand we call soil. Hutton, Saussure, Playfair, and lastly Hayden, have employed themselves on this part of the science previously to Buckland; but the latter, besides being by far the most experienced practical Geologist, has been more deeply impressed with the importance of the investigation. New personal researches, and a very extended course of reading, were occasioned by this more comprehensive view of the subject. Guided thus by an ingenious, learned and patient spirit, he has arrived at many conclusions in advance of his predecessors, and has confirmed others, which had been but unsupported surmises.

"A correct and minute description of the geology of an extensive and complicated region is a task of no ordinary character; and, especially on this side of the Atlantic. There are to be surmounted here, the difficulties incident to a new country, the greater portion of which is an unknown and unnamed wilderness, rendered impenetrable by displaced rocks, underwood and morasses, and, therefore, only to be examined in ravines and watercourses; in place of the cultivated hills and plains of Europe, illustrated by accurate maps, full of artificial sections by canals, mines, roads, wells, and quarries,—abounding in accommodations for the traveller, and what is still more essential, in fellow labourers, creating at every step, new light and new facilties. What a pleasing homage did science receive in the person of De Luc, who, during his geological travels through England, Flanders and Germany, on his arrival at any

town or village was immediately claimed as the guest of the resident Prince or Nobleman,and was furnished likewise with the best local information, carriages, workmen, and intelligent guides.

" In Canada, these researches, on a large scale, become very expensive in hiring conveyances, by water and land, to remote places; and the more distant these are from a dense population, the worse are the services and the more inordinate the demand. A government, or an associate body only, can afford to maintain a geologist in a distant and savage district like our upper Lakes from the great cost of the outfit. The necessary habits of extreme personal exertion from day dawn to dusk, contentment with coarse and often scanty fare, and the frequent exposure to cold and rains requires a powerful constitution; and the best is apt to fail under a continuation of these fatigues and privations.

" To prepare the student for these labors an intimate acquaintance with the greater number of minerals contained in the rocks, or composing them, is absolutely requisite; with the whole in fact, if possible, and they amount to seventeen hundred. He will make discoveries in the field in proportion to his familiarity with these substances in all their disguises; minerals do not occur in the woods, unsoiled, fresh and bright like flowers, but disintegrated by the weather, covered with earth and moss, rolled and frequently in a stony mass, a small fragment only being visible. For a thorough knowledge of mineralogy the learner must repair to Europe, or to one of the cities of the United States, as New-Haven, Boston, New-York, or Philadelphia; where he will have liberal access to excellently arranged and very complete cabinets—more nseful to him than any in the first mentioned quarter of the globe, for the latter contain few specimens of American minerals; and it is with them that he should principally interest himself. The chief part of the most splendid collection in the United States, that of Col. Gibbs, and now placed for public use in Yale College, was purchased at Paris during the tumults of the French Revolution. The British Museum, at London, is utterly useless. A few gems, ores and brilliant spars only are exhibited and without any designations. But an admirable method of instruction is afforded by the private lessons, of the very highly respectable and learned Mrs. Lowry of Great Tichfield street, London. These, which need not be described, and an occasional visit to other cabinets, as those of the geological society, Messrs, Heuland, Bakewell and Mawe, will be all that is necessary. Mrs. Lowry's cabinet also includes a fine suite of rock specimens in the greater variety of their forms, from granite to the alternating fresh water and marine depositions above chalk. We were astonished at the superb collection of geological specimens amounting to 60,000, in the possession of Mr. Greenhough, and arranged after a new and useful method.

" The United States are very deficient in opportunities of studying organic remains. There are now however some tolerable collections in New-York. Peale's Museum at Philadelphia, possesses some fine specimens accurately labelled, and what is much valued in Europe, a pretty complete set of the fresh water shells of North America. Mr. De Luc at Geneva gives lessons on fossil remains aided by a good cabinet. Mr. G. B. Sowerby of King Street, Covent Garden, London, does the same, and disposes of well arranged collections. He is perhaps the most scientific conchologist in Britain.

" Persevering application to books is now to be continued for two or three years; and after this period also, the progress of the science must be kept pace with. Excursions should be made:—if with a teacher, the advancement is very rapid. A few walks in each of the great geological subdivisions will accustom the student to careful observation. They will shew him the deceptions arising from the laws of perspective, in estimating the direction of mountain chains, or the courses of rivers,—teach him to name no rock until he has at least struck it with the hammer—to be satisfied with no supposed line of stratification until he has examined a considerable extent of country—and, what is very difficult, to distinguish the fissures denoting stratification from those which are accidental or secondary—above all, he will soon be taught that a line written on the spot is worth a volume of after recollections. The Canadian has the advantage of exploring unbroken ground, where he can cross no man's path—a virgin territory as large as Europe. The geology of distant and rarely visited places, it is to be remembered although noted very imperfectly, but truly, is very acceptable information. It is in the description of a near and well known district that we peremptorily demand detail and precision. The only implements required in the field are, a hammer about $2\frac{1}{2}$ pounds weight, and having a handle 14 inches long, if the rocks be granitic; but only $1\frac{1}{2}$ pound in weight, if the region be calcareous or arenaceous; a compass with a moveable dial-card, (allowing always for the local variation,) and a small bottle of well diluted sulphuric acid, to test the presence of lime. The blow-pipe, weighing scales, goniometer, &c. are to be employed at home.

" With respect to books on Mineralogy; to Cleaveland's Elements, we have only to add Philips' Introduction, very recently published, and particularly valuable, on the crystalline form of minerals, a character of great moment. The mineralogical traveller should always have in his pocket Aikin's small volume on minerals.

" In Geology, the first books to be perused are Bakewell and Phillips, already noticed. To those should succeed the systems or lectures of D'Aubisson des Voisins, Delametherie, Faujas St. Fond, and the Abbe Breislac. De Luc has published " Elements of Geology," but the usefulness of the work is almost altogether destroyed by its frequent obscurities in language, for which it is perhaps indebted to the translator, and by an ample indulgence in visionary discussion. D'Aubuisson, a celebrated French Engineer, is the author of an elegant essay, in which he attempts to prove the aqueous origin of the Basalts of Saxony. His arguments there appear conclusive, but since the date of its publication, his sentiments have altogether changed; and without being supported in the able manner of his first treatise; although some late evidence seems to prove them correct.—His "Systeme," in two closely printed octavo volumes, is by far the most methodical, practical and accurate work in any language. It was published in 1821, and therefore contains most of the recent discoveries. It is simple and concise in its language and arrangement, and like Dr. Thompson's system of Chemistry is valued for the number of its well authenticated facts. He dwells but briefly upon the purely speculative part of the subject—a part better left alone in the present day, and proceeds at once to the relation of existing appearances. Delametherie, (*Leçons sur la Géologie, Tom* 3,) on the contrary detains his reader with much astronomical learning, applying it

very imperfectly and obscurely, in our opinion, to the explanation of certain catastrophes, the formation of the atmosphere, changes of climate, &c. The remainder of the work, will well repay a perusal. The amiable and enthusiastic Faujas St. Fond, wrote his elements of geology by command of the Emperor Napoleon, greatly against his inclination.—He was, in consequence, dissatisfied with his performance, and only struck off fifty copies. Much of it is slovenly and crude, but his disquisitions on the animal remains found in the younger series of rocks, (Mæstricht, Paris, &c.) and in clay and gravel are very valuable. The chapters on granite and volcanic productions are written with considerable care. The Roman or Neapolitan Abbe Breislac has produced a work of sterling merit, translated into French, and comprised in three volumes. As might have been expected from an Italian, he has devoted a great part of his attention to the examination of volcanoes, their minerals, and their connexion with basaltic and trachitic rocks. His plates are excellent.

"These are the principal "systems" to be studied. The essays in particular departments, as conglomerates, coal formation, basalt, alluvia, &c. of Kidd, Kirwan and Greenhough may be consulted with great advantage, in addition to the works named in a previous page. The transactions of the *Ecole des Mines*, and the *Annales des Musée* of Paris, of the Geological Society of London, Wernerian Society of Edinburgh, are to be frequently examined, together with the scientific Journals of Silliman, Brewster and Jamieson : they are treasuries of geological knowledge. The travels of Saussure (Alps,) Spallanzani (Sicily and Lipari,) Von Buch (Norway and Teneriffe,) Ramond and Charpentier, (Pyrenees,) Beudant, (Hungary.) De Luc, (England, &c.) Macculloch and Faujas St. Fond, (Scotland,) are models of description and reasoning. The work entitled "Geological outlines of England," lately published by Coneybeare and Phillips, is conspicuous for its clear, though minute, details, and its enlightened views. The labors of Humboldt have been concentrated in his recent digest of universal geology—a performance full of original matter, and acute observations which ought to be in the hands of every student. Brongniart, a Parisian Professor, puts forth every few months very valuable, and sometimes voluminous, tracts on various classes of rocks, as ophiolites, on the trachitic rocks, nearly allied to the productions of volcanoes—on salt and fresh water formations, describing at the same time their numerous organic contents.

"For an intimate acquaintance with organic remains, reading is less required than a personal familiarity with the things themselves, but it presupposes a knowledge of conchology, and botany.—The three most necessary books are Parkinson's Treatise on organic remains," in three quarto volumes, and amply illustrated by engravings (it is in the Montreal Library.) Sowerby's Mineral Conchology, in several octavo volumes; and Lamoureux "Sur les Polypes Flexibles" &c. in one quarto volume. The first of these works contains all that was known at the time, (1804—8), and is written by a man enthusiastically attached to the science, and of sound learning. Sowerby embraces nearly the whole subject as known in the present day, in a series of plates accompanied by short descriptions. Lamoureux, (Paris) is an elegant recast of Ellis and Solander on Corals, with the additional information obtained within the last 60 years. Lamoureux is one of the most distinguished naturalists of

France. Mr. Mantell, of Lewes, (England) has lately published a full and accurate account of the Fossils of the South Downs, accompanied by very numerous plates, of new shells and crustacea, designed and engraved by his wife. The only general work on Trilobites and the Crustacea is the excellent one produced by the united labours of Brongniart and Desmarest. This department should engage much of the attention of the Canadian geologist, as his country abounds in new and splendid forms of this singular fossil animal; and such as these authors never saw.—The figures* of Knorr, Luidius, Plott, Martyn and Lister, and those of the Baron Schlottheim are copious and valuable sources of reference. A very scientific work on organic remains in general may be daily expected from Mr. Miller of Bristol, the able illustrator of the Encrinital Family.

"The mineralogy of the Canadas has hitherto been almost altogether neglected: but the imperfect researches which have been made, prove it to be rich in the scarcer kinds of minerals and not deficient in those applicable to economical purposes.†

"The Canadas possess peculiar interest as including the great chain of fresh water seas of the Saint Lawrence,—monuments of the last deluge among a thousand others, illustrative of the history of countries whose more early civilization has destroyed these remarkable vestiges. Lake Superior itself, as well as all the other lower Lakes, has been vastly larger than at present, as is indicated by ancient beaches rising above each other on successive high plateaux, which nearer or more distant surround that body of water. They are formed of sand, clay and rolled materials, and in Lake Huron contain layers of the fresh water shells which now inhabit its rushy shallow bays. The valley of St. Etienne, six miles long, at Malbay, affords, on a small scale, an excellent example of these appearences. It has been the bed of a narrow lake, with a depth at first of 400 or 500 feet, but which has thrice suddenly lowered in level on the destruction of its barrier being as often repeated. These events, and their magnitude, are marked by three embankments, which, together with the middle of the valley, rough with the oblong mounds deposited by conflicting currents, now constitute the farms of a contented peasantry.

"It becomes desirable to investigate the geology of Canada from its including the vast spur or offset (for want of a better term) from the primitive mountains of Labrador and Hudson's Bay, which, extending to the head of the Mississippi, divides the waters flowing into the Hudson's Bay, from those of the St. Lawrence, and penetrates from east to west for nearly 2,000 miles into the greatest secondary basin in the world. This basin consists of alternating beds of sand-stones and lime-stones, placed horizontally. Its boundary skirting the west side of the Alleghanies, passes from the Canadas to the gulf of Mexico, then directs its course westward to the rocky mountains and northwards along their base at least as high as the Peace river or the Slave Lake; properly named "The Lake of Outcasts." From thence it extends irregularly eastward, and occupies all or most of the Lakes on the route to Hudson's Bay, great part of whose shores are composed of calcareous rocks.

"To convey an intelligible account of the geology of so vast a region as Canada requires volumes. We shall proceed to sketch a few of its more instructive localities: commencing with one in our own immediate neigh-

* The works?—Ed.

† Here follows a list of Canadian Minerals, which, having been already introduced into the catalogue at the beginning of this work, is now left out.—Ed.

bourhood. We shall not stop to describe scenery with which we are all familiar; but at once observe that the beautiful groupe of rounded woody eminences in the rear of Montreal with rough sloping sides, and here and there an interrupted cliff, partly in ruins, consists chiefly of crystalline hornblende, massive, shapeless and without a trace of stratification, except the feeble intimations afforded by a few perpendicular fissures. This rock is one of the Trap family, which we believe is correctly supposed to be a lava of a very distant date, an idea much strengthened by appearances now to be described. It underlays the greater portion, if not the whole of the triangular space, included by Montreal, St. Johns and Chambly, covered now and then by a conglomerate, and one of the elder limestones. It appears above the soil in the Common of Laprairie, at Longueil, and in many places along the River Richelieu. Its fragments are frequent throughout the above district, and extend twenty miles above the foot of Lake Champlain, to the Genesee Country, in a south-west direction and nearly to Prescott on the St. Lawrence, in Upper Canada.—The lime-stone of the plain invests the Trap Rock of Montreal Hill, to within a variable distance from the summit of one or two hundred feet. It is in horizontal layers, and usually quite undisturbed, as if it had remained in tranquility from the hour of its deposition. But it is a most singular circumstauce that from the Hill, as from a centre, there strike into the limestone in all directions, and with tolerably straight courses, a great number of perpendicular walls, dykes or veins of the Trap, which have been traced for a $1\frac{1}{2}$ mile easterly, and to Lachine a distance of five or six miles. They frequently divide and again unite inclosing masses of the limestone. Sometimes they seem to meet with obstacles in their progress, when they collect into a large knot, and again project a number of tortuous ramifications. They are from one to three feet in breadth, and do not taper rapidly; still however now and then enlarging and contracting in size for short spaces. Fourteen have been counted in the race-course only.—Sometimes the fluid mass, escaping from the perpendicular dykes, has insinuated itself in thin sheets between the layers of limestone, which it is to be particularly remarked, preserves a nearly perfect horizontality—a fact only to be explained, (and not in a very satisfactory manner,) by the supposition that at the time of the eruption, the limestone had not yet consolidated, and of course had not then received the lamellar structure: It is generally allowed that all strata have remained some time in this condition; to which indeed are ascribed the fantastic contortions observed in gneiss and mica slate, and of which the north shores of Lake Huron furnish extreme cases, while the limestone of the River Jacques Cartier, contemporary with that of Montreal, and the grey wacke of La Rivière St. Anne la Grande, afford excellent examples of strata disposed in regular arches. These appearances are still rare, and are regarded with curiosity in Europe.

To return to the Dykes, they are of compact or fine granular trap, of a dull brown or black colour, and contain more or fewer crystals of hornblende and augite;—both well defined. The limestone adheres firmly to them; and near the line of junction, imparts to them some of its calcareous matter. It is full of shells, when in close contact with the dyke:—and in one case a cluster of terebratulæ is imbedded in the dyke itself. The occurrence of shells in trap scarcely meets with credit even at the present day.

"The rock of the hill varies in its mineralogical characters. It is usually highly crystalline, and is almost altogether hornblende: but augite is also often present in great quantity, and is distinguished by the dihedral terminations of its crystals. In some places it becomes slaty, and then is largely intermixed with white granular quartz. Much of it resembles the dykes of the plain. The minerals characteristic of a trappose or volcanic origin are imbedded plentifully. They are olivine, augite, zeolite, chabasite, basaltic hornblende, rhombic tables of feldspar. The limestone of the hill is bluish black, of dull lustre, compact, and of a conchoidal fracture. That of the race-course is similar; but in the quarries adjacent, it is rendered crystalline and hair brown by vast quantities of organic remains. It is there covered by four or five feet of calcareous shale. All these limestones, and those also about Lachine are of the same age, from being in juxta position, and containing the same fossil and mineral substances. The fossils are highly interesting. One superb specimen of the encrinis moniliformis has been found in the quarry nearest the race-course.—It is of the same size as that represented for its beauty in the frontispiece to Parkinson's large work.—Two other species occur there, the pear and staghorn. The remarkable many chambered shell, named orthocera, is frequent there as large as the celebrated ones of Lake Huron. There are also numerous and rare forms of the trilobite, named by Linnæus "Entomolithus paradoxicus"—the very scarce conulariæ quadrisulcatæ. Trochi, encrinital columns, turbos, turbinoliæ, corallines, terebratulæ, productæ, madrepores, retepores, &c. are innumerable. The principal mineral substances are blende, an ore of antimony, iron and copper pyrites, purple flour spar, and some exquisite crystals of the carbonate of lime. Even in so slight a sketch as the present it must not be omitted, that the Montreal hill, at some remote period has been an island in a vast collection of fresh water, whose limits we cannot now describe. This is indicated by the great embankment surrounding its base, but in much the best preservation on its southern and western sides. It is composed of fine clay, flinty and calcareous sand, primitive bowlders and rounded masses of the black limestone of the district, which it is worthy of remark, scale off in concentric layers, like the coats of an onion; no such natural divisions being apparent in the sound rock. Among these materials of a deserted beach, fresh water shells belonging to the genus saxicava have been found. The canal, also, in the flat below (often covered to a great depth by rolled stones,) has penetrated a white flaky marl, which is full of fresh water shells identical with those of the Canadian lakes of the present date. They are anadonta, uniones, Physæ heterastrophæ, Planorbes, Helices, Cyclades, Malaniæ, Virginica, &c. &c. The horns and bones of wild animals have been found there.—Similar deposites occur on the north side of the hill.

"The streams which enter the St. Lawrence, on its north shore, near Quebec, are highly instructive; and afford a rich harvest to the collector of organic remains. We refer to the rivers Montmorenci, Beauport, St. Charles and Jacques Cartier. Their geological History may be understood from a slight sketch of the first named river. The Montmorenci falls into the St. Lawrence over a bed of sandy red gneiss, (a slaty kind of granite abounding about Quebec,) whose strata run south-west and

dip at a high but varying angle to the south-east. On this rock, where forming the river banks, with numerous fragments of its own substance interposed, rests a conglomerate of very small white grains of quartz, cemented by a calcareous matter, powdery, and white, red, and green in parts. It is from one to four feet thick, and about 350 yards above the bridge disappears by a thin edge, resting upon the gneiss :—a fact only to be witnessed at seasons of drought, but it is of use, by shewing the existence of partial formations, in fields or districts. It is stratified horizontally. This proves it to have been deposited at a time of tranquility, to be of a posterior date to the rock on which it reposes, and to have remained at rest. In its turn, the fine grained conglomerate, (so nearly resembling grey wacke, as to require a chemical test in its distinction,) supports a brown, often crystalline fetid limestone, crowded with organic remains, principally corallines, retepores and encrinites :—and above this, for thirty or forty feet rises a dull compact, black limestone in horizontal strata from six to eighteen inches thick, parts of each being occasionally brown and crystalline. The most remarkable organic remains are very fine casts of conulariæ, the best in Canada. None have yet been found in the United States, but several at Montreal, the Bay of Quinte, and in lake Simcoe. A particular kind of trilobite may next be mentioned, of which Brongniart has only seen two fragments from Llandilo in Wales. These also are finest at Montmorenci, but occur at Lorette, Beauport, Montreal, Lake Champlain, and the Bay of Quinte. All the shells found at Montreal, with the addition of ammonites and scaphites, are plentiful here. The accidental mineral substances are the same :—petroleum is occasionally met with occupying small cavities lined with calcspar.

"It will be remarked with surprise, that on the sides of the semi-oval chasm in front of the fall of Montmorenci, the limestone gradually declines from the horizontal position, and finally dips into the earth at an high angle. This is best seen on the right side. Much of it must be considered as displacement from natural causes, which are of great power in Canada ;—but not the whole ;—for the inclination continues below the bed of the St. Lawrence and affects very extensive districts in the south east. The chemical composition of the rock undergoes a slow change by the admission of clay and quartz, and by the disappearance of the organic remains. Here and there however we find a solitary trilobite.

"The opposite Island of Orleans is partly based on the new rock, which often becomes a brown, green, or red, clayslate ; and overspreads the south shore of the St. Lawrence, frequently alternating with conformable, (a geological term expressive of parallelism,) strata of quartz rock, grey wacke, brown crystalline limestone, and a pale calcareous conglomerate wholly composed of re-cemented fragments of limestone, both rounded and angular :—and some containing the organic remains which as far as we are aware belong exclusively to Beauport, and the Falls of the St. Charles and Indian Lorette. It is necessary to remark that each of their numerous alternations have been effected successively in some extended period of quiescence, but at intervals sufficient to allow of the hardening of the last layer.—The conglomerate with shells assists in proving the whole to be of more recent formation than the conchiferous limestone of Montmorenci, &c.*—*Canadian Review, No. 2.*

* In this article we have taken the liberty of making a few alterations, but only we believe, with one or two slight exceptions, where an error in the former press rendered it necessary.—Ed.

" Le District de Gaspé abonde en pierre à chaux, surtout la Baie de Gaspé, dont le rivage nord depuis son entrée y compris le Cap Gaspé en montant, est une suite de caps et de précipices de la meilleure pierre à chaux. Dans la Baie des Chaleurs elle n'est pas aussi abondante; la Côte dans cette partie du District n'est qu'une chaîne de caps bas de pierre rouge et sablonneuse, semblable à l'espèce appelée poudingue, qui, par l'action de la mer et de l'air, tombe en gravier fin et en sable. A Percé et aux environs, dans certains endroits les caps paroissent être en partie de marbre veiné composé de pétrifications marines. Dans New-Carlisle, à la distance de trois ou quatre miles de la mer, à un petit lac, il y a un lit de marne calcaire, que l'on dit être d'une espèce supérieure, et dont j'ai vu des échantillons. Il n'y a point de doute qu'il n'y ait des mines de charbon dans différentes parties de ce District; à Douglass-Town, dans la Baie de Gaspé sur la rive sud de la rivière Saint Jean, j'ai recueilli une petite quantité de matière goudronneuse et inflammable qui sort de la terre en grande quantité vers la haute marque de l'eau, et qui ressemble en couleur et en odeur au goudron fait de charbon de terre et que je crois être de l'asphalte ou d'autre espèce de bitume. Je l'ai déposé au Musée du Séminaire de Québec. En creusant un peu la terre j'ai trouvé une terre couleur de charbon et j'ai été informé par quelques-uns des habitans que l'on avoit fréquemment trouvé des morceaux de charbon vers cet endroit-là. Dans la Baie de Gaspé et dans la Baie des Chaleurs à Paspébiac, j'ai trouvé plusieurs beaux petits cailloux que j'ai fait travailler depuis par un Lapidaire à Québec qui m'a dit que c'étoient des plus belles cornalines, agates et jaspes, supérieures à aucune pierre de ces espèces que l'on trouve en Europe et semblables à celles des Indes.—*R. Christie, Esq.*

While this work was at press we received a specimen of granite from Mr. Chasseur coupled with the request to afford him information as to the name and peculiarities of a particular mineral it contained. The following is the result of our examination, which agrees precisely with the character of the " lepidolite," a mineral not hitherto mentioned, as far as we are acquainted, by mineralogists as having been found on this continent.

The specimen is part of a bowlder found at St. Augustin near Quebec.

Descriptive Characters.

Colour reddish or yellowish white—transparent in thin laminæ—structure distinctly laminar, separating with great facility into plates or scales which strongly resemble mica or talc in form, lustre and flexibility.—It is *not* elastic—somewhat unctuous to the touch—lustre pearly and silvery—yields to the knife with ease. Before the blow pipe it *fuses readily* into a white shining globule of enamel.

It is sufficiently distinguished from mica by not being in the least elastic; from talc by being fusible.

" According to Gmelin, the lepidolite from Sweden and Moravia contains lithia." (*Cleaveland's mineralogy.*)

Additional Remarks and Corrections.

THE shale described at pages 3, 17, 20 and 23, differs from the rest of the "Black Rock" of Cape Diamond in its chemical as well as physical characters. Before the blow-pipe it is infusible (or at most receives a slight black glazing,) while the part furthest from the blue flame turns to a bright red. In acid it refuses to effervesce. A character frequent in this shale, that has been omitted, is its beautifully irised appearance in some places, which is probably the effect of a struggle for predominancy between the iron and carbon it contains.

There appears to be little disposition to effervesce, also in those thin strata which display a tendency to break into cubical or prismatic fragments. These likewise redden under the blowpipe and with a sort of spitting intumescence, form a black scoria.

This character of reddening with the heat seems to form one distinction between the alternating shales in this formation and the clay slate or other more calcareous strata. A character the former owe to the presence of iron, which is sometimes sufficient to move the magnetic needle, after exposure to heat on charcoal or with grease.

As the non-effervescing quality of the shale of Cape Diamond, appears to contradict what has been said page 16, that this description of rock about Quebec effervesces violently for a short time, it is necessary to explain that the writer had in view the series of conchiferous shale, which is found alternating with fetid lime stone at Beauport.

At Notes 7 and 15 we have indulged ourselves in what may be deemed wild conjecture. In touching upon these subjects it is difficult to refrain always from doing so : where there are few data there is always an ample field for surmise, and generally a propensity to indulge it; particularly when the former are of a nature to be understood only by the most experienced. The bending or waving of the strata, however, will account for the fact we have noticed in a more simple way as well as for the varieties of dip in different places. In supposing that the Clay slate &c. in the district of Quebec had undergone a reversal, the fact was lost sight of that the dip of the strata is not always to the S. E. but frequently to the N. W. in that district. Allowing therefore that such a reversal had occurred at Quebec, it would not follow that it had taken place elsewhere. The waving of the strata in some situations amounts to contortion. It is easy to conceive therefore that the upper surface of such strata may sometimes have the appearance of being the lower. Phillips has well explained this by a diagram in his Geology of England and Wales. It is not meant that the waving or bending of the strata will account for their removal from the horizontal, or nearly horizontal, position, in which they were originally deposited. On the contrary the former is probably the consequence of the latter, which whether it be attributed to the subsidence of strata, or to any other effort of nature—whether the phenomenon was sudden or progressive, it was not likely to have happened without causing undulations in the strata.

Note 21. We have said that where primary rocks occur the presence of magnetic iron may be suspected—this is too general. The sentence should stand thus, where primary rocks occur, *in this country*, the presence of magnetic iron may be suspected.

The Talc alluded to at page 4 contains no potash but magnesia. It is

the scaly talc or nacrite, whose constituents are silex, alumine and potash.

Green Earth, page 4, would be better under the head which follows as it is always found to contain a little magnesia. Alumine and lime are not constant ingredients in this mineral.

Steatite (same page) contains no potash; in which it principally differs from soap-stone, a mineral it so much resembles. Whether it contains alumine or not appears to be a disputed point.

Potash is not always present in chlorite.

Tourmaline, a variety of schorl, contains magnesia and not lime.

At Page 9, Pearl spar is out of its place.—It does not contain phosphoric acid—Its constituents are lime, magnesia and carbonic acid.

The mineral described, note 20, may be pyritic coal—iron pyrites alone yields a sulphureous odor when exposed to the blowpipe (which we presume is the "chemical process" alluded to) but it does not *evaporate*.

There is great probability that coal mines exist in the neighbourhood of the springs of petroleum on the Thames River U. C.

It is equally probable that rock salt abounds in the Upper Province, associated as usual with gypsum, although at too great a depth to allow of its being obtained in a solid state for at least a century to come.

FINIS

ERRATA.

Page 1 For varities read *varieties.*
2 For Feurnginous read *Ferruginous.*
Do. For mica-state read *mica-slate.*
3 For terrebratulæ read *terebratulæ.*
5 For varities read *varieties.*
Do. For lilac read *lilach.*
Do. For lamina read *laminar.*
6 For conchieferous read *conchiferous.*
Do. For terrebratulæ read *terebratulæ.*
8 For they probably form part read *the latter probably form part.*
9 Pearl spar is out of its place, see corrections at the end of the Book.
13 For Townsbip *read Township.*
16 For calcaines read *calcaires.*
Do. For its consequent bearing read *their* consequent bearing.
Do. For its upper edge read *their* upper edges.
17 For N. W. read W.
18 For earthly minerals read *earthy* minerals.
25 For three-fold eleavage read three-fold *cleavage.*
29 For hornblend read *hornblende.*