ART. XV.—A GEOLOGICAL SKETCH OF THE MOST SOUTH-EASTERN PORTION OF LOWER CANADA.—BY LIEUT. F. H. BADDELEY, R. E., MEMBER OF THE GEOLOGICAL SOCIETY OF FRANCE, &c. &c.

The following Geological outline refers to the most south-eastern portion of Lower Canada, and to a country bounded on one side by the gulf of St. Lawrence, on another by the Bay of Chaleur, and on a third by the Metapediac river and lake, with the over-land route to Grand Metis, the whole forming a peninsula, whose greatest length, measured from Grand Metis to Cape Gaspé, is about one hundred and sixty miles, and greatest breadth, from the Magdalen river to Carleton, is about eighty.

Descending through the gulf of St. Lawrence from Metis to Cape Gaspé, the first feature in this country which attracts the attention is a range of mountains running nearly parallel with the shore, at a distance from it of perhaps from ten to twenty miles. The most elevated point of this range has been determined by Captain Bayfield to be three thousand seven hundred feet above the sea, a height which is nearly double that of any land in Canada, whose elevation has been ascertained.

Passing Cape Gaspé into the Bay of Chaleur, when off Percé, the end of another range from the south-westward is noticed, it is, however, considerably less elevated, never, I should think, exceeding one thousand five hundred feet.—Between these two ranges, far back in the interior, a table land exists, as there is reason to believe, destined, like other cultivable wildernesses, ultimately to receive settlers.

There is perceived a great contrast between the shores of this country on the side of the Gulf and those in the Bay of Chaleur, the rugged cliffs on the former pursue a nearly straight course to the north-eastward, (which ultimately becomes east) and suffer little or no other interruption in their continuosity, then what arises from the occasional occurrence of a small river or cove, offering little shelter to vessels seeking harbour.—The shores of the Bay of Chaleur on the contrary, though often rugged also, are deeply indented by bays affording frequently good roadsteads and sometimes harbours; indeed nearly the whole of this fine arm of the sea, which should be rather called a gulf than a bay, may be considered a good roadstead, while the basin of Gaspé, situated at its entrance, offers to mariners one of the finest, most secure and commodious harbours in the world, and it demands no prophetic foresight to see that one of these days this place must become the site of a great commercial port.

Referring my brother Members for further topographical details to my report on this country, in the hands of the Commissioners for exploring the unknown parts of Lower Canada, I will proceed to give a rapid digest of its geological features, the details of which will be also found in the same report.* Commencing at Grand Metis we

* In the instructions from the Commissioners, under whom I acted, when the materials for this communication were obtained, geological and mineralogical enquiries occupied only a secondary place, the capabilities of the country, in an agricultural point of view, being in them the paramount object.—Now it is well known, that although soils often depend upon the nature of the rocks they are associated with, they reciprocate little assistance towards the determination of the geological names, &c. of those masses themselves, which they often deeply cover up and conceal from the eye of the geologist, who, while pursuing his interesting speculations would, if he had the choice, greatly prefer to make the barren unproductive rock the subject of theme; it follows that the individual in the

find the well known transition clay slate, which so largely abounds in the vicinity of Quebec, and which, with its alternating calcareous and siliceous strata, exclusively possess the south shore from the Chaudiere to Cape Rozier, near which place, Captain Bayfield has detected the carboniferous limestone succeeding in *parallel* order to the clay slate. If there be no mistake either in naming this limestone the carboniferous or in describing it as conformable to the clay slate, which I have no reason to think there is, the fact is deserving of attention, in as much, as the position of this limestone contrasts with that which geologically is esteemed to be the same at Beauport, in this neighbourhood, where the strata are nearly horizontally disposed, and not dipping highly to the S. E. as at Quebec, Metis, Griffin's Cove and Cape Rozier. It is a fact, as Captain Bayfield justly observes, which seems to imply that

pursuit of good locations for settlers, is far from being in the best position to make geological observations on the country he traverses, which reflection, leads me to remark, how much that is interesting, both to science and to the public, might be elicited, if an individual qualified for the task, were yearly employed by the Home or Provincial Government, to collect geological and mineralogical information upon the Canadas, and, I know of no portion of the Lower Province which promises more favorable results than the district of Gaspé, without it be that important section southward of the St. Lawrence, and included between the St. Francis and Chaudiere rivers, wnerein His Excellency Lord Aylmer recently originated the discovery of some valuable water communications. Among the useful rocks and minerals which have been ascertained to occur in this latter section, may be enumerated mica, talcose and roofings, slates, steatite, serpentine, asbestus, *gold*, lead and bog ores.—The gold is a recent discovery, a lump of it weighing 2½ ozs., with a specific gravity of 15.7, having been found last autumn in a stream running into the Chaudiere; it is said, however, that a similar fragment was picked up many years ago near the same place,—This fact, whether solitary or not, derives importanee from the consideration, that much of the gold of the United States and of Russia is associated with rocks precisely analogous to those which are known to characterize the country in which this specimen was found.

the carboniferous limestone of Beauport, (and probably the whole of that which is horizontal in the country) is of more modern origin then that at Cape Rozier, otherwise like it, the Beauport strata would have been lifted an edge, conformably to the clay slate, by the same cause to which the latter owes its elevation. With the clay slate at Metis is associated a siliceous limestone and a conglomerate of the two.

The route from Metis to Lake Metapediac being south-easterly, carries you over the bassatting edges of the rocks. In crossing this interval black basaltic looking masses were seen in addition to the recurrence of those which have been mentioned. The shore at the head of Lake Metapediac is covered with an angular shingle of clay slate, indicating the great proximity of the rock itself. This formation seems to extend quite to the Ristigouche, within a few miles of which, clay slate was again particularly observed forming rapids or slight falls in the river; our rapid progress down this stream prevented us from often closely examining the rocks we met with, but greenstone, quartz,* clay slate and perhaps transition limestone predominate. The rounded fragments of milk white quartz, in the bed of the river, strike the eye in passing them, by the dancing appearance they have, an appearance owing evidently to refraction, which one moment throws them, as it were, to the surface, and the next buries them in the water, according to the angle with the surface of the river at which they are viewed. The velocity of the waters in this river occassions almost all the alluviums which are forming in it to be composed of

* The quartz forms thick veins in the clay slate, and I think alternates with it also.

coarse materials, contrasting greatly with such as are forming in the sluggish waters of the Ristigouche, in which the alluvial deposits taking place, and they are many, are all composed of fine materials, covered usually, when above water, by a rich vegetation.—In some of the sandstones near the mouth of the Ristigouche, and which were there met with for the first time, a passage may be noticed between the most recent friable sandstone above, and the perfectly indurated rock beneath, affording in the estimation of some, a representation of a rock in the progress of formation, while others might explain this appearance by the action of weathering.

All the rocks we met with on the shore from hence to Cape Gaspé were secondary, the oldest of which occupying the lowest position, not only geologically but also geographically, as regards the Bay of Chaleur, is the carboniferous and fossiliferous* limestone of Cape Gaspé and Grande Grêve, associated in the neighbourhood of those places with sandstones, bituminous shales, coal, bituminous and sulphuretted springs. As we ascend the bay the new red sandstone formation succeeds, (un-conformably ?) accompanied, as in Europe, by its characteristic series of trap-rocks and coarse conglomerates. Individuals little experienced in geological phenomena might not readily see much analogy between these trap-rocks and modern lavas ; the case would be very different, however, were he to examine fragments of rock met with far back in the interior, particularly some from

* I have rarely noticed fossils in the decided transition rocks of Lower Canada, but in those which succeed to them, they abound. Among those recognized in the limestone of Gaspé are madrepores and orthoceratites, and some of the sandstones are crowded with tevebratulæ.

the bed and shores of the Caskapediac, about fifty miles upwards from its mouth, where they occur in great profusion. These fragments* he would find it difficult to distinguish, as hand specimens, from some recent lavas, and they are found in the vicinity of insulated dome shaped mountains, from whence they probably have originated.

Opposite to the mission or chief domicile of the Indians located in this bay, there is a remarkable dome shaped mountain, whose height was determined by trigonometrical

* They are porphyries and vesicular or amigdaloidal wackes, but, whether transition or secondary, I have no data to determine. The paste of these porphyries and wackes is usually of a dark cinder grey or bluish grey colour, occasionally it is greenish. Their structure is partly porous, partly porphyritic, and partly amigdaloidal, the porphyritic structure, which is usually observed in fragments, distinct from those in which the other two varieties of structure occur, is occasioned by imbedded crystals of white lameller fel-spar, not easily seperated from their paste. The porous and amigdaloidal structures usually occur in the same fragment, and have a natural tendency to pass one into the other.—The latter is occassioned by ovular or rounder concretions, consisting of chlorite, stilbite and calc-spar, which, unlike the fel-spar. are easily detached. Two of these usually occur together, forming one concretion, the chlorite enveloping the stilbite or calc-spar in a greenish or brownish crust, shaped like a small pea or almond, having a fibrous structure and silky lustre, while the structure of the enclosed stilbite is lameller lustre, pearly and colour white,—the latter fuses with almost the facility of borax and in much the same manner, into a blebby, nearly opaque, white glass or enamel, but the mineral acids appear to produce no effect upon it.—The effect of the blowpipe on the paste itself is to convert it, with difficulty, into a dull black globule. The curvilinear concretionary forms, which are, in general, centrically hollow, appear originally to have filled all the cells of the porous wackes, as most of the latter shew some traces of the former, but that their presence has been the original cause of this structure, is an opinion which is opposed, it would seem, to the fusible character of some of these concretionary minerals, assuming, as almost all geologists do in the present day, that these rocks are of volcanic origin. We are not to forget, however, that they may have been, and probably were, formed under a great oceanic pressure, which would have had a tendency to raise the point of fusion of all minerals imbedded in them.—In general, however, the deposition of these minerals is attributed to a period subsequent to the formation of the rock they are disseminated in and in part to a condensation of gas while cooling.

calculation to be one thousand two hundred and thirty feet. This mountain has been considered to be of granite, it is, however, a trap,* with a structure obscurely porphyritic, and here I will observe, that the occurrence of granite *in situ*, throughout any portion of this peninsula, is conceived to be improbable. The obvious place to seek it would be in the range of mountains before described, as running parallel to the south shore of the gulf of St. Lawrence, but which range I should suppose was either trapose or of clay slate, and my chief reason for this opinion is, that while, with two unimportant exceptions, a specimen of granite or other pirmary rock, either rolled or fixed, was not met with in the whole of the country traversed, trap and clay slate fragments were found to abound.

Judging from the very limited *data* I have been able to collect, I should say, at a venture, that the line of division between the transition and secondary strata would be found roughly between Cape Rozier and the mouth of the Restigouche, which line has about the same bearing as the edges of the transition strata, that is, N. E., S. W.

Those members of the new red sandstone, with which most of the rocks in the bay agree, particularly those situated westward of Point Peter, are apparently the Exeter

* I cannot state the kind of trap, but instead of doing so, I offer to the accomplished geologist the following mineralogical description, from which, it is presumed, he will recognize it :—

Aspect nearly homogeneous-colour, reddish brown,—structure rather compact than lamellar,—lustre none, or only glimmering,—hardness moderate, yielding readily to the knife a whitish grey streak, but scratches window glass ;—fracture scaly uneven,—specific gravity 2 .6,—infusible before the blowpipe. The rock has externally a thin ferruginous coating, and its glimmering lustre, when it exists, appears to be owing to the reflection of light from minute crystals of glassy fel-spar. Its infusibility perplexes me—is it a porphyry, the base of which is siliceous ?

Red Conglomerate of Dela Beche, and its trapose associates, which form in Europe the lowest rocks of this formation, and they are here as there, characterized by their usual red colour and coarse conglomerated structure.

The foregoing geological description will naturally induce the enquiry from those conversant with the subject, whether any, and what indications of coal exist in this section of the Province, particularly if it be called to mind that it borders on the coal bearing basin of New Brunswick, a portion of the northern edge of which, it may indeed be esteemed to be. I may answer, generally, that several indications are met with on the shores of the bay and in the interior, they are not all, however, equally promising, the most so, I think, are those met with ascending the Gaspé River, up which the petroleum and sulphuretted springs, sandstones and bituminous shales before mentioned, are found, the sandstone sometimes interleaved by bituminous coal,—nor should I be in the least surprised if here, or in some other portion of the geological interval, between the carboniferous limestones and Exeter Red Conglomerates of the country, bituminous coal in some abundance should be discovered, as it already has been in small quantities, for it would there occupy a geological position, out of which, experience tells us, it rarely wanders; the coal also which has been noticed up the Mal Baie and Port Daniel rivers, although we possess no details respecting its occurrence in those places, are favoring symptoms, as are likewise the indications observable on the New Brunswick side of the bay, and which are still more pronounced.

Among the minerals met with in the Bay of Chaleur, besides coal and petroleum, may be reckoned galena* and

* Galena has been noticed at Grand Grève, Little Gaspé, and Indian Cove, on the other side of the bay.

blende,* forming small veins in the carboniferous limestone near the mouth of the bay, and also disseminated in the rock. Jaspers, carnelians, chalcedonies and agates, one passing into the other, and either forming veins† and concretions in the trap rocks, or strewing the shores as pebbles‡ under a rounded detached form. Lithomarge and basalt, the former in concretions, the latter in dykes, associated with seams of coal on the New Brunswick side of the bay, and it has been said gypsum, a mineral, however, which I did not see, although its occurrence is not doubted, as it is characterestic in Europe of the upper members of the new red sandstone formation, which formation I conceive to be the predominating one, on and in the neighbourhood of the shores of this bay.

The best sections which present themselves in the bay for examining the conglomerates of this formation, are perhaps those to be met with in the neighbourhood of Percé. It has been said before that here terminates that mountainous chain from the westward, which characterises its northern shore. A high mountain, called the Table Roulante, probably the highest in the chain, and immediately at the back of Percé, represents this termination, an off-spur, from which cuts off all easy communication by land, between Percé and Mal Baie, the southern shore of which it forms.—In the prolongation of this spur of land to

* Blende, both yellow and black, is associated with the galena at Grand Greve.

† These veins are very conspicuous in the trap islet or peninsula opposite the settlement of Dalhousie, where is noticed chalcedony and agate lying sandwich fashion between two layers of jasper in a nearly vertical position, and bearing N. and S.

‡ These pebbles have long been noted for their beautiful oriental markings and shades.

the eastward is observed the perforated rocky islet, which gives the name of Percé to the locality, and the island of Bonaventure, both evidentiy outliers to the conglomerated masses, which form precepitous sections on the shores of the main land, with which they have a close geological agreement. I was prevented by rough weather from visiting the islet, but on the south shore of Mal Baie and Bonaventure island, I have the following observations to offer:—Both places are characterised by precipitous cliffs, whose strata, unconformable to the transition rocks we have described, and also, I think, to the carboniferous limestone of Cape Gaspé, in many places overhang, in their upper portions, the waters of the bay, and threaten distruction to the adventurous individual who breasts their sides. These conglomerates are composed of aluminous, siliceous and calcareous pebbles of a rounded form, varying in size and also in colour, the predominating shades of which are reds, purples and greens. Among them I recognized jasper, lithomarge, wacke (trap) and a sealing wax red zeolitic mineral, disseminated in grains through the mass of many of these conglomerates, the paste or cement of which appears to be in general calcareous. The associated limestones are either semi-crystaline, earthy or compact, the first mentioned have sometimes a zoned structure, like portions of the rock of Gibraltar. In the earthy and compact varieties I noticed bivalvular impressions, having a strong pearly nacre, but from want of practise in this department of the science, I am not able to determine their genus, they seem to abound (judging from specimens in our cabinet) in a yellowish or reddish compact limestone, which is met with in the perforated islet before mentioned. The arches or perforations in this rock have been formed evidently by the

same cause which has effected the disjunction of these outliers from one another and from the main land, and that cause is as obviously a watery erosion. Small nuclei of an anthracitic or blind coal were noticed in the overhanging cliffs in the south side of Mal Baie, and I was informed that the bituminous variety it also found, but this I did not see. The occurrence of bituminous coal on the New Brunswick side of the bay is also inferred from the reports of others, rather than my own observations, for the indications noticed by myself at Point Ainempk, on the Ristigouche, consisted in the presence of a bituminous shale, that burns with great difficulty, emitting little or no flame, aud leaves a large stony residuum. I am far from asserting, however, that the true bituminous coal has not been met with on this shore, on the contrary I feel assured that it has, and have little doubt that when sought for it will be found, almost as abundantly in the northern portion of New Brunswick as it has been in the southern.

Abstract of the Meteorological Journal kept on Lake Superior in 1824, *by the surveying party under the command of Lieut. (now Captain) Bayfield, R. N.*

	Temperature.							Winds.			Days on which Snow fell.	Days on which Rain fell.	Dry Days.	Thunder storms.
	Mean			Highest.		Lowest.		Westerly.	Easterly.	Various.				
	10 A.M. and 10 P.M.	At 7 A.M.	At 2 P.M.	At 7 AM.	At 2 PM.	At 7 PM.	At 2 PM.							
January	8°,20	5°,2	17°,6	32	41	–37	–20	14	4	13	6	,,	25	,,
February	0, 80	–7, 6	11, 5	20	28	–37	–22	16	6	7	5	,,	24	,,
March	19, 92	17, 5	29, 5	35	34	–12	2	11	16	4	8	3	20	,,
April	33, 38	30, 0	41, 0	36	51	12	32	6	18	6	4	2	24	,,
May	41, 45	38, 4	50, 9	60	72	24	31	9	14	8	1	6	24	,,
June	50, 00	46, 8	54, 8	60	68	36	40	15	8	7	,,	6	24	1
July	63, 55	59, 4	68, 8	64	82	50	56	18	8	5	,,	9	22	3
August	60, 90	57, 8	70, 1	68	80	45	58	16	10	5	,,	8	23	8
September	53, 30	52, 0	60, 9	67	77	38	50	14	11	5	,,	9	21	1
October	34, 15	29, 7	42, 2	48	60	18	27	16	9	6	4	5	22	,,
November	22, 82	18, 5	28, 4	38	41	–2	15	12	10	8	8	4	18	,,
December	13, 80	9, 6	22. 0	38	41	–24	0	19	5	7	6	1	24	,,
Annual	33°,46	29°,8	41°,48	68	82	–37	–22	166	119	81	42	53	271	13

From the 25th of May to the 7th of September on various parts of Lake Superior, the remainder of the time at Fort William. Lat. 48° 23′ *N., Long.* 89° 23′ *W.*

Abstract of the Meteorological Register kept at Cape Diamond, Quebec, from January 1832 *to December* 1834.

1832.	Temperature.			Winds.			Days with snow.	Days with rain.	Dry days.	Thunder storms, &c.	Aurora Borealis.
	Mean at 9 A.M.	Highest.	Lowest.	Westerly.	Easterly.	Various.					
January	9°,92	39°	-17°	18	6	7	10	2	20	,,	2
February	7, 90	34	-25	19	7	3	13	,,	16	,,	2
March	19, 87	60	-11	20	8	3	8	4	19	,,	2
April	30, 13	52	3	15	13	2	9	4	19	,,	4
May	45, 39	74	28	7	23	1	2	11	18	,,	4
June	57, 50	82	41	15	13	2	,,	13	17	3	1
July	62, 06	85	44	14	17	,,	,,	20	11	5	1
August	65, 13	83	40	25	4	2	,,	10	21	7	2
September	53, 17	74	36	23	6	1	,,	14	16	2	2
October	42, 26	63	24	22	8	1	2	13	16	,,	2
November	26, 07	48	3	22	6	2	11	4	15	,,	1
December	11, 03	32	-12	20	10	1	8	1	22	,,	,,
Annual...	35°,87	85°	-25	220	121	25	63	96	210	17	23

1833.	Temperature.			Winds.			Days on which snow fell.	Days on which rain fell.	Dry days.	Thunder storms, &c.	Aurora Borealis.
	Mean at 9 A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.					
January	9°,00	36°	–30	21	8	2	11	2	18	,,	,,
February	5, 68	40	–16	17	6	5	9	1	18	,,	,,
March	17, 60	48	–20	18	9	4	6	1	24	,,	3
April	37, 70	80	9	11	14	5	5	8	17	,,	1
May	51, 22	75	26	11	17	3	,,	15	16	2	4
June	55, 47	84	30	15	7	8	1	13	16	2	2
July	62, 32	80	45	24	6	1	,,	17	14	6	3
August	59, 30	82	40	18	8	5	,,	17	14	2	5
September	50, 93	66	32	19	7	4	,,	11	19	1	5
October	38, 65	57	19	19	7	5	1	15	15	1	1
November	25, 10	48	0	20	7	3	8	2	20	,,	2
December	17, 20	36	–2	12	15	4	8	,,	23	,,	2
Annual...	35°,85	84°	–30	205	111	49	49	102	214	14	28

1834.	Temperature.			Winds.			Days on which snow fell.	Days on which rain fell.	Dry Days.	Thunder storms, &c.	Aurora Borealis.
	Mean at 9 A. M.	Highest.	Lowest.	Westerly.	Easterly.	Various.					
January	3°,00	29°	–23°	22	7	2	14	1	17	,,	4
February	17,28	41	–15	14	13	1	6	4	19	1	2
March	21, 00	43	–7	18	8	5	7	3	21	1	4
April	36, 56	69	11	15	10	5	2	8	20	,,	6
May	46, 38	69	24	12	13	6	1	14	17	,,	5
June	57, 46	77	41	15	13	2	,,	11	19	3	3
July	67, 06	93	50	20	7	4	,,	10	21	6	2
August	60, 06	82	45	17	13	1	,,	13	18	2	2
September	55, 06	78	29	23	6	1	1	9	20	3	3
October	37, 67	65	20	17	8	6	6	11	14	1	3
November	25, 13	40	2	22	8	,,	11	2	17	,,	5
December	5, 10	28	–24	16	14	1	17	,,	14	,,	2
Annual...	35°,98	93°	–24	211	120	34	65	86	217	17	41