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THE

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Naturalist & Geologist,

AND PROCEEDINGS OF THE

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THE

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NATURALIST AND GEOLOGIST.

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ARTICLE XXXI.—*Observations on the Geology and Physical Characteristics of Newfoundland.* By MOSES H. PERLEY, Esq., President of the Natural History Society of New Brunswick, &c, &c.

This well-kno n Island lies on the north-east side of the entrance into the Gulf of St. Lawrence. It is separated from Canada by the Gulf; its South West point, Cape Ray, approaches Cape Breton; to the North and North East, are the shores of Labrador, from which it is divided by the Straits of Belleisle; and its eastern coast is washed by the North Atlantic.

Its form is somewhat triangular, but, without any approach to regularity, each of its sides being broken by numerous bays, harbours, creeks, and estuaries. In straight lines, as the sea-gull would wing its flight, its circuit is not much less than 1000 miles.

Its width at the widest part, between Cape Ray and Cape Bonavista, is about 300 miles. Its extreme length from Cape Race to Quirpen, at its north-east extremity, is about 419 miles, measured on a curve through the centre of the island. Its area is estimated at 36,000 square miles, equal to 23,040,000 acres.

Newfoundland is the nearest part of America to Europe, the distance from St. John's, the capital, to Valentia in Ireland, being only 1656 miles.

From the sea, Newfoundland has a wild and rugged appearance, which is anything but inviting. Of its interior, very little is known, as it has been but very partially explored. Such parts as have been visited by persons capable of giving a satisfactory description, were found much broken up with water; lakes, and marshes, rocks and scrubby trees, forming its chief features.

The prevailing character of Newfoundland is that of a rugged, and, for the most part, a barren country. Hills and valleys continually succeed each other; the former, but seldom rising into mountains, and the latter, rarely expanding into plains.

The hills, more or less lofty, are greatly varied in character. Sometimes they form long flat-topped ridges; occasionally, they become round and isolated, with sharp peaks and craggy precipices.

The valleys also vary greatly. Sometimes they present deep mountain gorges, and the wildest of ravines; while in others, they form depressions with gentle slopes toward the water, which is ever found flowing at their greatest depth.

The sea-cliffs of Newfoundland,—especially on the coast, between St. John's and Cape Race, thence westwardly, between Cape Race and Cape Ray, and thence northerly along the western coast and Bonne Bay,—are almost everywhere bold and lofty, with deep water close at their foot.

Loose rocks of all sizes, and with them huge boulders, are scattered all over the country. They increase the general roughness of its appearance, and give it a repulsive character.

This rough and rugged surface is covered by three different kinds of vegetation, which form three distinct districts.

The people of Newfoundland assign to these several districts, the names of, "Woods, Marshes, and Barrens."

The woods are in general found on the sides of hills, or the slopes of valleys, wherever there is natural drainage for the surplus water. For this reason, the forests, if they can be so called, occur most frequently, and the trees are of the greatest size, near the sea-coast, or near lakes and rivers, when the soil and other circumstances are favourable.

Newfoundland has been frequently described as a thickly wooded country, but such is not the case. The trees consist chiefly of spruce, (*Abies nigra*,)—white fir, (*Abies alba*,)—yellow birch (*Betula excelsa*,)—white birch, (*Betula populifolia*,)—and hackmatack or larch, (*Larix Americana*.) But what are considered large trees on Newfoundland, and were pointed out to the writer as timber trees, would be laughed at by a New Brunswick lumberman, and not deemed worthy of his axe.

On the eastern or Atlantic coast of Newfoundland, there is but little wood, of any value, except for fuel, and the building of fishing boats.

In the northern part of the island, on the limestone formation, it is said that formerly extensive forests existed, but that great fires destroyed the largest trees, and these have been succeeded by others of an inferior and much smaller species.

The greater part of the wood is of small and stunted growth, consisting chiefly of fir trees, about 20 or 30 feet high, and not more than 3 or 4 inches in diameter. In general, these insignificant trees grow so close together, that their twigs and branches interlace from top to bottom. The endless quantity of decayed trees, rotten stumps and branches, newly fallen trees, combined with the young shoots, and tangled brushwood, form very frequently a thicket that is almost impenetrable.

The trees are often covered with lichens, and tufts of white, dry moss, are entangled about the branches. Other green and softer mosses spread over the ground, concealing alike the gnarled and twisted roots of the standing trees, the pointed stumps of those that have fallen, the sharp edges and most slippery surfaces of the numerous rocks and boulders, and the holes and pit-falls between them.

Every step in the woods and wilds of Newfoundland is matter of toil and anxiety, requiring constant vigilance to avoid falling, and unremitting labour to find standing room. Climbing, creeping, and every other mode of progression, must be used to get onward. The course has constantly to be changed, and new directions are taken, in order to find those places through which to force a slow and tortuous way.

During the heat of summer, or what is called such in Newfoundland, the thickness of the low and stunted trees shuts out every breath of air, while they are not sufficiently thick at top to exclude the scalding rays of the sun. And this heated atmosphere is rendered more unpleasant by the strong smell of turpentine which emanates from every pore of the scrubby spruces and firs.

Such are the leading characteristics of what in Newfoundland are called "the woods." Embosomed in these woods, and covering the valleys and lower lands, are found large open tracts which are called "marshes."

Let it be understood that these marshes are not always low-lying lands, or even very level. They are frequently found at a considerable height above the sea, and often with an undulating surface.

Moss covers these marshes to the depth of several feet; it is green, soft, and spongy, and is bound together by straggling grass, and a variety of marsh plants. The surface is uneven, abounding in holes and hillocks, the tops of the hillocks being frequently covered with a short, dry, crisp moss.

The various colours of the mosses on these marshes, give them a peculiarly rich appearance, especially if seen from a distance, clothing the slopes of a hill with tufts or thin skirts of wood, scattered about. In such cases, a person not acquainted with the country would be led to believe it possessed great agricultural capabilities, and might be highly cultivated.

Except in long continued droughts or hard frosts, these marshes are always wet, and incapable of bearing the weight of a person walking across them. A march of three or four miles across a Newfoundland marsh, sinking into the moss at every step, always as far as the ancle, but sometimes knee-deep, is a most fatiguing operation, and most toilsome if a load has to be carried on the shoulders.

This thick coating of moss is precisely like a great sponge spread over the country. At the melting of the snow in spring, it becomes thoroughly saturated with water, which it long retains and which every rain-fall continually renews.

Numerous ponds of water are found everywhere in Newfoundland; and it is scarcely possible to walk a mile, in any direction, without encountering large pools, sometimes spreading out into very considerable lakes. In the lower parts small sluggish brooks or gullies are met with everywhere.

The extreme wetness of the marshes is due almost entirely to the spongy nature of the moss, as the slope of the ground is in almost every case quite sufficient for surface drainage.

Where the moss is stripped off these so-called marshes, either dry, rounded gravel, or bare rock, is generally found beneath.

Next we come to,—

The "barrens" of Newfoundland, which are extensive districts occupying the summits of the hills and ridges, and other elevated and exposed positions. They are covered partially with a thin, scrubby vegetation, consisting of berry-bearing plants and dwarf bushes.

Bare patches of gravel and boulders, and crumbling fragments of rock, are frequently met with in the barrens, and generally they are altogether destitute of vegetable soil.

It is only by means of these barrens, these stony sterile tracts, that any large portion of the interior of Newfoundland can be visited or explored. Though frequently broken, rugged, and precipitous, they are delightful to tread upon after traversing the heavy marshes or toiling through the tangled and annoying woods.

Sometimes, in the hollows of the barrens, and in other places, where the disintegration of the rocks has created a little soil, a bed of dwarf hackmatack or larch is met with. These stunted trees are called in Newfoundland "tucking bushes;" they grow about breast-high, with strong branches at right angles to the stem, all stiffly interlaced, the tops being as flat and level as if they had been hewn off. These "tucking bushes" are so stiff that in some places one can almost walk upon them; but as this is not quite possible, the labour of pushing and thrusting through them can scarcely be conceived by those who have not made the attempt.

These different tracts, "woods, marshes, and barrens," are none of them of any great extent at any particular place; but they are continually alternating with each other in the course of a day's journey.

The most remarkable feature of Newfoundland is the immense and scarcely to be credited abundance of lakes of all sizes, all of which are called indiscriminately "ponds."

These are found universally over the whole country, not only on the valleys but on the highest lands, even on the hollows of the summits of the ridges, and on the very tops of the highest hills.

These ponds vary in size from pools of 50 yards in diameter to lakes upwards of 30 miles long, and 4 or 5 miles in width. The number of ponds which exceed a couple of miles in extent, must on the whole amount to several hundreds; those of smaller size are absolutely countless.

It has been estimated, that in Newfoundland the quantity of ground covered by fresh water is fully one third of the island, and in this estimate I quite concur, believing it, if any thing, rather below the mark.

Taken in connection with this remarkable abundance of lakes and ponds, the scarcity of navigable rivers is almost anomalous. The broken and undulating character of the country with its craggy hills and deep ravines, is doubtless one cause of the absence of large rivers; while small rocky rattling streams are found in countless profusion.

Each lake, or small set of ponds, communicates with the sea by a valley of its own, of greater or less extent. Down this valley they send their superfluous waters, in what may be considered a mere brook. The general scantiness of these brooks, and the vast abundance of the ponds, are accounted for by the smallness of each system of drainage and the vast coating of moss found all over the country.

Upon every great accession of moisture, either from rain or melted snow, the chief portion is absorbed by this huge sponge; the residue fills the numerous ponds to the brink, and these discharge themselves gradually by the brooks.

Great periodical floods which would sweep out and deepen the channels of the rivers, are quite impossible, from the almost infinite number of small streams falling singly into the sea. These streams have not the power, at any time, of breaking down or overcoming the barriers which separate them, and so uniting their waters.

In dry weather, when the ponds begin to shrink, they are supplied by the slow and gradual drainage of the marshes, where the water has been kept as in a reservoir, to be given off when required. In this way, many ponds that have no great depth, and would otherwise be exhausted, are kept full of water in the driest seasons, and it is only in the greatest and most long continued droughts, when the marshes themselves begin to dry up, that the ponds are found to shrink much below their usual level.

CLIMATE.

As there are nearly five degrees of latitude between the southern and northern extremities of Newfoundland, there is of course a considerable difference in the severity and duration of winter. The climate of Conception Bay, which is in the south coast, and to the eastward of St. John's, the capital of the colony, is considered to afford what may be deemed the mean temperature of the island.

The weather there, although severe, is less fierce than in Lower Canada, and during winter, the extraordinary brilliancy of the Aurora Borealis, and the splendid lustre of the moon and stars, give a rare and peculiar beauty to the atmosphere.

The eastern coast of Newfoundland is much more humid than the western, owing to the heavy fogs which are driven in from the Grand Bank; and it is also more subject to violent gales and storms, owing to its exposed position. On the west coast, from Cape Ray to the north, and in the interior, the atmosphere is generally clear, and the climate is much the same as that of the district of Gaspé, in Lower Canada.

THE GEOLOGY OF NEWFOUNDLAND.

In the years 1839 and 1840, Mr. J. B. Jukes, a fellow of the Geological Society, who has since greatly distinguished himself in South Australia, was employed by the Government of Newfoundland to make a geological survey of the Island. The means placed at the disposal of Mr. Jukes by the Legislature, were exceedingly small, and it was only an ardent love of science, and a desire to do all that man could do, in an interesting but most difficult country, that induced Mr. Jukes to persevere as long as he did. Because Mr. Jukes, at the outset of his explorations, did not encounter anything of very great value, the Legislature declined to assist him in further researches, at the very point where those researches were beginning to be interesting, and becoming of practical value.

The only authentic account, therefore, of the Geology of Newfoundland, is that of Mr. Jukes, but to that has been added within a few years, the observations of other scientific men, who have been employed to explore certain sections of the island, with a view to discover its mineral wealth.

Mr. Jukes divides Newfoundland, geologically, into two sections, which are shown on the map by a line drawn from Cape Ray, the south-western angle of the island, to Quirpen, very nearly through the centre of the island.

To the south-westward of this line, the geological character of the country is such as to indicate a broken and sterile country, with but slight hope of mineral wealth; while to the Northward and eastward of the line, the country is composed of rocks of much more recent character, including an extensive coal formation, with various indications of other minerals.

The aqueous or stratified rocks of Newfoundland consist of the following formations:—

The upper, and the lower, or red portion of the coal formation.

Next in the descending order, magnesian limestone. Then, an upper slate formation, consisting of shale and gritstone, and variegated shales.

Below these, a lower slate formation—and then the gneiss, and mica slate.

The unstratified, or igneous rocks, consist of various kinds of trap. greenstone, serpentine, hypersthene, porphyry, syenite, and granite.

The upper part of the coal formation consists principally of dark shales, with brown or yellow sandstones, or gritstones, in thin beds.

The lower part of this formation is characterised by beds of red sandstone, red and green marls, and gypsum.

These two portions of the coal formation pass by insensible gradations into each other.

Yellow, brown, and whitish flags and sandstones, dark blue clay, with an occasional bed of black shale, occur throughout the whole of the coal formation. Some of the lighter colored sandstones contain carbonate of lime, red and green marl, and large masses of gypsum in thick beds.

The total thickness of the coast formation is considerable, and the portion examined by Mr. Jukes had a thickness of 1000 to 1500 feet.

The magnesian limestone which was seen, was generally of a yellow colour, about 50 feet thick, in beds of 2 or 3 feet each, frequently splitting into flags.

One bed of carbonate of lime was found of a grey colour, about 2 feet thick, with a band of brown chert.

The upper slate formation is supposed to be below the coal formation in the series.

The superior portion consists of dark micaceous shale splitting into thin laminæ, with interstratified beds of a very fine grained grey gritstone, which increase in number, thickness and coarseness of grain, with the increasing depth, until the shale disappears altogether. The thickness of the two portions seen is estimated at several hundred feet.

The lower slate series is deemed by Mr. Jukes to belong to an older formation and to be composed of two groups.

1st. A mass of grey and red sandstone, which at the entrance to the harbour of St. John's, has a thickness of 800 feet.

And 2nd. The St. John slates, in which beds of red, green, and grey stone alternate near the junction of the sandstone and the slate rocks, forming the transition beds between the two. The thickness of this formation is estimated at between 2000 and 3000 feet.

The cleavage of the slate is frequently parallel to the line of stratification, and in these cases produces excellent roofing slate.

Veins of white quartz and masses of porphyry are found associated with these slates.

Descending lower in the Geological scale, there is found the mica slate and gneiss and also the igneous rocks, which do not differ from those usually found in other parts of the globe; the mica and the gneiss however alternate with and pass into each other.

Except in some indistinct vegetable impressions in the coal formation, no organic remains have yet been found in Newfoundland;* but it must be remembered that its rocks have not yet been subjected to the careful examination of modern geologists, nor yet to the keen scrutiny of some of the younger members of this society, whose well directed exertions have enabled them to discover evidences that animal life had existed in formations which were supposed to be far below the existence of any living thing.

The strike throughout the island rarely varies from a true N. N. E., and S. S. W. course.

Hence, all the other prominent features of the country run in the same direction, not only as regards the ranges of hills, but also the principal lakes; all the deep bays and the numerous valleys lie in the same line of bearing.

The strike of the cleavage is not invariably parallel to the strike of the beds; but the cleavage is much more constant as regards the strike and dip in relation to the points of the compass

* Trilobites of the Genus *Paradoxides* have been found in the older slate formation of Mr. Jukes, and several lower silurian fossils have been obtained by Mr. Richardson, of the Geological Survey of Canada, in the limestone formation of the North of the Island, described in the concluding part of this paper.

than it is in relation to the strike and dip of the beds, or than those latter are to the horizon, and points of the compass.

As regards the relative age of the igneous rocks, Mr. Jukes supposes that the granites are generally newer than the mica slate and the gneiss, which repose upon them.

The coal formation seems to be contemporaneous with those of western Europe, Nova Scotia, Cape Breton, and New Brunswick, and with the most modern group of stratified rocks in Newfoundland.

On the west coast of Newfoundland, as might have been prophesied by the most casual geological observer of the formations of Cape Breton and the adjacent shores of the mainland, there exists the continuation of the coal formation of New Brunswick, Nova Scotia and Cape Breton, the great coal basin of the St. Lawrence, probably the largest in the world, extending from the Bay of Chaleur to the profound solitudes, vast morasses, tangled forests and innumerable lakes, ponds, and brooks, which cover and intersect so great a portion of Newfoundland.

The province of Avalon is nearly separated from the rest of Newfoundland by the Bays of Placentia and Trinity, a narrow isthmus only between 3 or 4 miles in width, existing between those two deep and spacious bays, and thus connecting Avalon with the main body of Newfoundland.

In Avalon there are two principal ranges of hills, which form regular watersheds.

The most easterly range is that which rises from the back of Reneuse to Holyrood in Conception Bay. Though not lofty, this range is very rugged, the faces of the hills being abrupt and precipitious. Along this range are some remarkable hummocky hills called the "butter-pots," of which the passing voyager between Cape Race and St. John's has a capital view in fine weather. Each of these "butter-pots" has about the same height above the sea, probably rather more than 1000 feet.

The southern coast of Newfoundland has very lofty cliffs, and the high lands contiguous to the sea exclude all view of the interior from that quarter. Mr. Jukes declares his belief that the country is composed chiefly, if not entirely, of granite.

Three varieties of granite were observed; one white, rather fine grained, with abundance of mica; another of a coarse grain, with less mica and of a reddish colour; and the third, by far the most abundant, a somewhat coarse red granite with large imbedded crystals of flesh-coloured feldspar.

The country, from the Dead Islands to Port aux Basques and Cape Ray, is composed entirely of mica slate and gneiss; and these rocks continue around Cape Ray for some distance to the little Cadroy river where they terminate.

A chain of hills, called the Long Range, composed almost entirely of this gneiss and mica slate, runs into the country from Cape Ray and is believed to intersect and divide the whole Island.

The south side of St. George's Bay, between this Long Range and the Gulf of St. Lawrence, is occupied by the coal formation.

The cliffs on the sea-shore and a band of country a few miles wide, lying parallel to it, exhibit the lower beds of the coal formation, namely the red sandstones and marls, with gypsum.

In the cliffs, near Cadroy Island, (where the writer first landed in Newfoundland) there is much red and green marl, with bands of white flag-stone.

The white flag-stone, and the greenish marl, contain many veins of white fibrous gypsum, and interstratified with these and the red marls are some thirty beds of white and grey gypsum, of a singular character.

The Micmac Indians of this coast report a bed of coal, of two feet in thickness, some distance up the Cadroy river; but Mr. Jukes was unable to procure a guide to it. The bed is said to be of very considerable extent.

Mr. Jukes, however, penetrated the coal formation from Crabb's River, which is about half way up the south side of St. George's Bay. He found that at least six miles of the country, formed of the lower beds of this formation, must be crossed directly from the coast, before arriving at the higher beds, in which the coal is situated.

Having passed over the lower beds, Mr. Jukes at length arrived at a bed of coal, three feet in thickness, resting on soft brown sandstone, with ferruginous stains. Whether this seam of coal was the whole, or only the lower portion of a bed, could not be determined; but the quality was found to be good, as it proved a bright, caking coal.

The distance from the sea shore, where this coal was found, is about 8 miles; but the nearest and only harbour is that of St. George's, distant about 20 miles. From the best observations Mr Jukes was able to make, he concluded that the tract in which coal might be found, would be an oval, some 20 or 30 miles long, by 10 miles in width, bounded by the sea coast on the north, and the range of primary hills on the south.

Mr. Jukes penetrated the interior more to the north east, by the Grand Pond, and near its eastern extremity, on the banks of a small brook, discovered a seam of coal, *part of it resembling cannel coal*—and in the bed of the brook itself, which is rapid and rocky, large pieces of coal were found, clearly showing that more beds existed higher up the stream.

There is here a large district, throughout the whole extent of which it is probable coal may be found.

The north side of St. George's Bay is occupied by magnesian limestone, lying above the shale of the coal measures, in which shale it is alleged coal has been found at Port-aux-Ports.

The country between Port-aux-Ports and Bay of Islands, and thence northerly to Bonne Bay, and Cow Head—is lofty and unbroken, (the writer now speaks from his own observations) and is occupied chiefly by igneous rocks.

Around Lark Harbour, the rocks are high, pointed and precipitous, consisting of igneous rocks of the most varied character, the scenery is wild, picturesque, and in the elevated portions, sterile to the last degree. Down the deep and narrow ravines, the winds rush with fearful violence, and the suddenness of the gusts are such as to render the operation of beating into Lark Harbour very exciting.

From the neighbourhood of Lark Harbour, nearly to the head of Humber Sound (a magnificent piece of water, by the way, interspersed with numerous islands, having broad and deep channels between them, forming altogether wonderfully striking scenery of unusual character) the rocks consist of dark brown and red schist or shale, grey gritstones, and black, grey, and red slate. Beyond this commences the great calcareous formation, which is supposed to form almost the entire north eastern extremity of Newfoundland.

At the north of the Humber, by far the largest river in Newfoundland, this formation consists of beds of limestone, containing veins and flakes of mica, so entangled with quartz rocks, and intimately associated with the gneiss and mica slate, as to leave no doubt of its being entitled to the denomination of a primary limestone.

The highest beds of this limestone are of a hard dark grey colour, with brown concretions, that on a surface which had for some time been exposed to the weather, stood out in bold relief.

Below these higher beds, are some thin beds of hard sub-crystalline limestone—some white, and some flesh coloured with white veins.

These thin beds have a thickness of about 100 feet, and from the thickness of the beds they are especially adapted for marble slabs, as they would take a good polish, and be highly ornamental.

Below this formation lies a few feet of thin-bedded black marble, of similar qualities.

Still farther dowr come large masses of grey compact limestone, having a thickness of 300 or 400 feet, passing into a perfectly white saccharine limestone, without any mark of stratification, and but few joints, or division lines of any kind.

About three miles up the Humber River, it forms lofty white precipices, of pure marble, crowned and surrounded by thick woods, which, closing in upon the rapids, produce most picturesque scenery.

Blocks of this magnificent marble, of any size required, might be procured here, and readily floated down the river into the sound, where vessels of any size may find safe and excellent anchorage.

From Cow Bay northward, along the west coast of Newfoundland, the coast is low, and altogether of primary limestone, which appears to form a belt of two or three leagues in width, bounded by a lofty ridge of mica slate, gneiss, and their associated rocks, forming apparently a continuation of the Long Range, and extending to Lake Quirpon, the extreme northern point of the island of Newfoundland.

This country has not yet been examined by any geologist, and the writer speaks of its general features from observations made while passing to and fro through the straits of Belleisle.

Having thus briefly and imperfectly pointed out the leading geological features of Newfoundland, it only remains to say that in addition to the gypsum which is found abundantly at Cadroy, and the splendid white marble of the Humber, ores of copper, in different varieties, have been found in several districts, and explorations are being carried on by various parties, whose discoveries have not yet been made public.

An extensive deposit of lead was found at La Manche in Placentia Bay, on the southern coast, which was worked for a short time by an American company, who carried away from it many hundred tons of valuable ore.

The people of Newfoundland are sanguine that gold will be found in their island, which is quite possible; the geological character of the island, in some of its characteristics, might warrant the belief, and induce some exertions to explore it more thoroughly.

Any notice of Newfoundland would be imperfect without an allusion to its fisheries, which furnish employment to its people, and provide its staple export. The Arctic current which passes swiftly and continuously along its eastern coast, rendering that side cold, damp, and cheerless—the dense fogs occasioned by this icy current meeting the lighter and warmer waters of the Gulf stream—the long, deep, and narrow arms of the sea, which penetrate far into the land, in every part of the island, and resemble very closely the "fiords" of Norway and Sweden, in all their principal features, affording the best and safest of harbours,—together with the fish and fishing of Newfoundland—will furnish ample materials for other papers hereafter.

[While the above paper was in the hands of the printer, intelligence reached us of the untimely decease of its able and accomplished author. Mr. Perley was a man eminent for his powers of observation, and possessed a vast store of information on the physical features and resources of the maritime provinces, which he was ever ready to render useful to his countrymen. He is well known in British America, and abroad, as the author of valuable reports on the fisheries, on timber trees, on emigration, and other subjects of public importance. The paper which we now publish was read before the Natural History Society of New Brunswick, not long before his departure on what was destined to be his last journey, and was kindly sent by the Council of the Society for publication in the Naturalist.—EDITORS.]

ARTICLE XXXII.—*Review of Hooker's Outlines of the Distribution of Arctic Plants.**

In this paper Dr. Hooker presents a most valuable summary of the Arctic Flora, entering in great detail into its wonderful geographical distribution, and very properly re-uniting in his lists many varietal forms that have been promoted too hastily to the

* Outlines of the Distribution of Arctic Plants. By J. D. HOOKER, M.D., F.R.S.—*Transactions of the Linnæan Society. London*, 1862.

rank of distinct species. Dr. Hooker also enters on the questions as to the antiquity and migrations of the species of this flora, and the variations which they may have undergone in the lapse of time. From many of his conclusions on these points, however, geologists who have investigated the post-pliocene deposits of Europe and America will find themselves obliged to dissent, as well as from the assumption, for it is nothing more, of the unlimited variation of species in a Darwinian sense, which pervades the paper, notwithstanding the positive geological testimony to the permanence of several of these throughout a great lapse of geological time. We take the following extracts and summaries from an able condensation of the paper by Prof. Gray, in the American Journal of Science:—

'The immediate subjects of the treatise are the Arctic plants, of every phænogamous species known to occur spontaneously anywhere within the Arctic circle; the geographical distribution of which, so far as known, is carefully indicated: 1. Within the Arctic region, under the several divisions—Europe, Asia, W. America (Behring's Straits to the Mackenzie River), E. America (Mackenzie River to Baffin's Bay), and Arctic Greenland. 2. Without this circle, and under the general divisions of N. and Central European and N. Asiatic Distribution, with three longitudinal subdivisions; American Distribution, with appropriate subdivisions; S. European and African Distribution; Central and S. Asiatic Distribution. The theory upon which the facts are collocated and discussed, and which they are thought strongly to confirm, is that of Edward Forbes, which was completed, if not indeed originated by Darwin:*—" first, that the existing Scandinavian flora is of great antiquity, and that previous to the glacial epoch it was more uniformly distributed over the Polar Zone than it is now; secondly, that during the advent of the glacial period this Scandinavian vegetation was driven southward in every longitude, and even across the tropics into the south temperate zone; and that, on the succeeding warmth of the present epoch, those species that survived both ascended the mountains of the warmer zones, and also returned northward, accompanied by aborigines of the countries they had invaded during their southern migration. Mr. Darwin shows how aptly such an explanation meets the difficulty of accounting for the restriction of so many American and

* This is scarcely correct. The theory of distribution originated by Forbes should be distinguished from the extension of it suggested by Darwin. EDS.

Asiatic arctic types to their own peculiar longitudinal zones, and for what is a far greater difficulty, the representation of the same arctic genera by closely allied species in different longitudes.* * * Mr. Darwin's hypothesis accounts for many varieties of one plant being found in various alpine and arctic regions of the globe, by the competition into which their common ancestor was brought with the aborigines of the countries it invaded. Different races survived the struggle for life in different longitudes; and these races again, afterwards converging on the zone from which their ancestor started, present there a plexus of closely allied but more or less distinct varieties, or even species, whose geographical limits overlap, and whose members, very probably, occasionally breed together." A further advantage claimed for this hypothesis is, that it explains a fact brought out by Dr. Hooker in a former publication, viz.: "that the Scandinavian flora is present in every latitude of the globe, and is the only one that is so.'

'Moreover, Dr. Hooker, discovers in the flora of Greenland a state of things explicable upon this hypothesis, but hardly by any other, viz.: its almost complete identity with that of Lapland; its general paucity, as well as its poverty in peculiar species; the rarity of American species there; the fewness of temperate plants in temperate Greenland; and the presence of a few of the rarest Greenland and Scandinavian species in enormously remote alpine localities of West America and the United States. Our author reasons thus: "If it be granted that the polar area was once occupied by the Scandinavian flora, and that the cold of the glacial epoch did drive this vegetation southwards, it is evident that the Greenland individuals, from being confined to a peninsula, would have been exposed to very different conditions from those of the great continents. In Greenland many species would, as it were, be driven, into the sea, that is, exterminated; and the survivors would be confined to the southern portion of the peninsula, and, not being there brought into competition with other types, there could be no struggle for life amongst their progeny, and, consequently, no selection of better adapted varieties. On the return of heat survivors would simply travel northwards, unaccompanied by the plants of any other country.'

'The rustic denizens of Greenland, huddled upon the point of the peninsula during the long glacial cold, have never enjoyed the advantages of foreign travel; those of the adjacent continents on either side have 'seen the world,' and gained much improvement and diversity thereby. Considering the present frigid climate of Greenland, the isotherm of 32° just impinging upon its southern point, its moderate summer and low autumnal temperature, we should rather have supposed the complete extermination of the Greenland ante-glacial flora; and have referred the Scandinavian character of the existing flora (all but eleven of the 207 arctic species, and almost all those of temperate Greenland, being European plants,) directly to subsequent immigration from the eastern continent. Several geographical considerations, and the course of the currents, which Dr. Hooker brings to view on p. 270, would go far towards explaining why Greenland should have been re-peopled from the Old rather than from the New World. While the list (on p. 272, 273) of upwards of 230 Arctic European species which are all likewise American plants, but are remarkable for their absence from Greenland, would indicate no small difficulty in the westward migration, and render it most probable that the diffusion of species from the Old World to the New was eastward through Asia, for the *arctic* no less than (as has elsewhere been shown) for the *temperate* plants. Was it that Greenland and the adjacent part of the American continent remained glacial longer than the rest of the zone? And if our northern regions were thus colonized by an ancient Scandinavian flora, this seems to have been in return for a still earlier donation of American plants to Europe, to which a very few existing but numerous fossil remains bear testimony. Speculative inquiries of this sort are enticing, and the time is approaching in which they may be fruitful.'

'Indeed, the characteristic features and the immediate interest and importance of the present memoir, as of others of the same general scope and interest, are found in this: 1. That the actual geographical distribution of species is something to be accounted for; 2. That our existing species, or their originals, are far more ancient than was formerly thought, mainly if not wholly antedating the glacial period; and, 3. That they have therefore been subject to grave climatic vicissitudes and changes. There may be many naturalists who still hesitate to accept these propositions, as there as one or two who deny them; but these or similar conclusions have evidently been reached by those botanists, paleontologists, and geologists in general who have most turned their thoughts to such enquiries, and who march foremost in the advancing movement of these sciences. In this position, the author of the present memoir—prepossessed with Darwin's theory of the diversification of species through natural selection—having occasion to revise systematically the materials of the arctic flora, is naturally led to compare the new theory with the facts of the case in this regard; to see how far the vicissitudes to which it is all but demonstrated that the plants of the northern hemisphere have long been subjected, and the modifications and extinctions which he thinks must have ensued under such grave change and perils, during such lapse of time, may serve to explain the actual distribution of arctic species and the remarkable dispersion of many of them. That the enquiry is a legitimate and a hopeful one we must all agree, whether we favor Darwinian hypotheses or not. How well it works in the present trial we could not venture to pronounce without a far more critical examination than could now be undertaken. But there are good reasons for the opinion that this is just the ground upon which the elements of the new hypothesis figure to the best advantage.'

'The mass of facts, so patiently and skilfully collected and digested in this essay, have a high and positive value, irrespective of all theoretical views. We cannot undertake to offer an abstract, but may note here and there a point of interest. The flowering plants which have been collected within the arctic circle number 762, viz.: 214 Monocotyledons, and 548 Dicotyledons. They occupy a circumpolar belt of 10° to 14° of latitude. The only abrupt change in the vegetation anywhere along this belt is at Baffin's Bay, the opposite shores of which present, as has been already intimated, an almost purely European flora on the east coast, but a large admixture of purely American species on the west.'

"Regarded as a whole, the arctic flora is decidedly Scandinavian; for Arctic Scandinavia, or Lapland, though a very small tract of land, contains by far the richest arctic flora, amounting to three-fourths of the whole." This would not be very surprising, since this is much the least frigid portion of the zone, and has the highest summer temperature; but "upwards of three-fifths of the species, and almost all the genera of Arctic Asia and America are likewise Lapponian;" so that the Scandinavian character pervades the whole.'

'In the section on the local distribution of plants within the arctic circle, Dr. Hooker shows that there is no close relation discoverable between the isothermal lines (whether annual or monthly) and the amount of vegetation, beyond the general fact that the scantiness of the Siberian flora is associated with a great southern bend in Asia, and its richness in Lapland, with an equally great northern bend there, of the annual isotherm of 32°. Yet "the same isotherm bends northwards in passing from Eastern America to Greenland, the vegetation of which is the scantier of the two; and it passes to the northward of Iceland, which is much poorer in species than those parts of Lapland to the southward of which it passes." A glance at the supposed former state of things would suggest the explanation of all that is anomalous here.'

"The June isothermals, as indicating the most effective temperatures in the arctic regions (when all vegetation is torpid for nine months, and excessively stimulated during the three others) might have been expected to indicate better the positions of the most luxuriant vegetation. But neither is this the case; for the June isothermal of 41°, which lies within the arctic zone in Asia, where the vegetation is scanty in the extreme, descends to lat. 54° in the meridian of Behring's Straits, where the flora is comparatively luxuriant." The aridity of the former, and the humidity of the latter district here offers an obvious explanation; also the great severity of the winter in the former, and its mildness in the latter. And Great Britain, in which a far greater diversity of species are capable of surviving without protection than in the Eastern United States under the same annual isotherms, indicates the advantage of a mean over an extreme climate in this respect, if only there be a certain amount of summer heat. For lack of that, doubtless, very many of the introduced denizens of Britain would soon disappear, if deprived of human care.'

"The northern limit to which vegetation extends varies in every longitude; the extreme is still unknown; it may, indeed, reach to the pole itself. Phænogamic plants, however, are probably nowhere found far north of lat. 81°. Seventy flowering plants are found in Spitzbergen; and Sabine and Ross collected 9 on Walden Island, towards its northern extreme, but none on Ross's Islet, 15 miles further to the north."

"*Saxifraga oppositifolia* is probably the most ubiquitous, and may be considered the commonest and most arctic flowering plant." There are only eight or nine phænogamous species peculiar to the arctic zone, and only one peculiar genus, viz.: the grass, *Pleuro-*

*pogon.** Of the 762, found south of the circle, all but 150 have advanced beyond lat. 40° N., in some part of the world; about 50 of them are identified as natives of the mountainous regions of the tropics, and 105 as inhabiting the south temperate zone.'

"The proportion of species which have migrated southward in the Old and New World also bear a fair relation to the facilities for migration presented by the different continents." The tables given to illustrate this "present in a very striking point of view the fact of the Scandinavian flora being the most widely distributed over the world. The Mediterranean, South African, Malayan, Australian, and all the floras of the New World, have narrow ranges compared with the Scandinavian, and none of them form a prominent feature in any other continent than their own. But the Scandinavian not only girdles the globe in the arctic circle, and dominates over all others in the north temperate zone of the Old World, but intrudes conspicuously into every other temperate flora, whether in the northern or southern hemisphere, or on the Alps of tropical countries." * * * "In one respect this migration is most direct in the American meridian, where more arctic species reach the highest southern latitudes. This I have accounted for (Flora Antarctica, p. 230) by the continuous chain of the Andes having favored their southern dispersion."

'In presenting the actual number of arctic species, and in delineating their geographical ranges, the question, what are to be regarded as species, becomes all important. As to this, it does not so much matter what scale is adopted, as to know clearly what the adopted scale is. Here we are not left in doubt. Taking European botanists by number, we are confident that nine out of ten would have enlarged the list of 762 phænogamous arctic species to 800 or more, and would not have recognized a goodly number of the synonyms adduced, thereby considerably affecting the assigned ranges, especially into temperate and austral latitudes. In this regard we should side with Dr. Hooker on the whole, but with differences and with questionings—with halting steps follow-

* '*Douglasia* is mentioned in another place (p. 269) as an absolutely peculiar arctic or arctic alpine genus of E. America. But we have considered this genus as identical with *Gregoria*, of Duby. It would appear as if these two genera were established in the same year, since Lindley himself, in the Botanical Register, refers to Brande's Journal for January, 1828, for his original article. But this article will be found in the volume of that Journal for 1827; so that the name *Douglasia* is to be adopted, if the genus is sufficiently distinct from *Androsace*.'

ing his bold and free movement, but probably arriving at the same goal at length. Indeed, we freely receive the view which Dr. Hooker presents as appropriate to his particular purpose, and as the most useful expression of our knowledge of the relationships of the plants in question, when collocated in reference to the ideas upon which this memoir is based.'

Among the geological objections to the general conclusions views of Dr. Hooker, we may state the following:

1. The modern distribution of plants in the arctic regions is plainly related to the more or less equable temperature, greater moisture or dryness, and varying soil and geological structure, of portions of this area, in connection with the direction of ocean currents, of prevailing winds, and the migrations of animals. When we consider the distribution of arctic plants to the southward, and the peculiarities of their position in respect to meridians, we have farther to take into account the great post-pliocene subsidence and the distribution of coast lines and ocean currents at that period, as well as the cold climate, which is only one element, and a subordinate one, in the decision of the question.

2. The present flora of Scandinavia is related to its varied levels and soils, and to the moderation of its climate by the action of the gulf stream. In the glacial period its level was reduced by several hundreds of feet, and its climate was probably as cold as that of Greenland. Consequently, though the species inhabiting Scandinavia, or many of them, are no doubt ancient, their residence in Scandinavia may be modern, and there are no facts to show which of them resided there before the glacial period began.

3. The distribution of the sub-fossil shells of the post-pliocene, shows a shore connection between Scandinavia and Greenland, and at the same time a great depression of temperate Europe and America.* That is, there was much arctic land and little in the temperate zone. This geographical arrangement was no doubt, as Sir C. Lyell argues, the actual cause of the cold of the period. It was consequently impossible that plants could migrate southward except as seeds floated over the ocean, because they were cut off by wide seas from all southern land. Nor did they so need to migrate, for the cold of the glacial period did not necessarily imply extremes fatal to them, even in the arctic regions, though it produced conditions favourable to them in the islands that remained far to the southward.

* See Canadian Naturalist, vol. 5, p. 199.

4. In the post-pliocene period Greenland was either under water, or if land quite as suitable as now for arctic plants. Most probably it was in the latter case. Scandinavia had in that period a much less advantage, if any, over Greenland in point of climate than at present, and was probably connected with it by land or chains of islands, while there is no reason to suppose that Greenland was then connected with America. The flora of neither region could migrate to the south over the plains, because they were submerged, unless indeed covered with that general glacier which Agassiz at one time advocated, and Ramsay has recently proposed to revive. That these plants migrated by means of drift ice far to the south, there is good reason to believe;* but if they were extirpated from their arctic homes, they could not have returned in that way against the prevailing currents, nor could they have returned over the emerged plains, which would have been too warm and dry. They could have returned by only one agency, that of migratory birds, an agency which though not needed for this purpose, has probably done much to give Lapland its rich flora, as well as to scatter arctic plants to the south along certain meridians.

5. The law of distribution of arctic plants must always have been different in America and the eastern continent, owing to the north and south character of the coast lines and mountains in the former, and the opposite arrangement in the latter, with the varied effects of these different arrangements on climates and on geological subsidences and elevations. It could easily be shown that this fact accounts for many apparent anomalies.

6. It is farther to be observed that difference of geological formation, and difference of soil as depending on this, constitute great determining causes in the distribution of plants, as well as in their variations. Until the botanical geographer pursues his studies of distribution with a geological map in his hand, and a knowledge of the habitudes of plants in reference to soils, his labours will be to a great extent fruitless. A little more lime or a little less alkali in the soil renders vast regions uninhabitable by certain species of plants. For many of the plants of our Laurentide hills to extend themselves over the calcareous plains south of them, under any imaginable conditions of climate, is quite as far beyond the range of possibility as to extend across the wide ocean. A multitude of apparent anomalies belong to this cate-

* See Can. Nat., April, 1862.

gory, and it becomes specially important when we consider that so perfect are the arrangements for the migrations of plants, that they will discover and colonise every suitable spot, however small and however distant, and that the struggle for existence is really not between one plant and another, but between all plants and external conditions, of which soil is one of the most important.

Lastly, the actual geographical distribution of Arctic plants is very imperfectly known, except for a limited district in the west of Europe, and the evidence from fossil remains as to the distribution in the post-pliocene period is almost nothing. To this must be added the uncertainty that attends the determination of species in the case of plants so widely distributed. Though no one more competent than Dr. Hooker could undertake the task of comparison and generalistation, we venture to say that every one of his local lists will be open to serious objections and corrections of local botanists, where there are any, and where there are none the risk of error must be ten-fold greater. For example, in a list of a few Greenland species, said to occur only in one other locality beside, we find *Potentilla tridentata* and *Arenaria Greenlandica.* The former of these occurs not only in Greenland and Labrador, but in the White Mountains, on the coast of Maine, in Nova Scotia, and various places north of Canada, and it is one of the few species that are known to have inhabited Canada in the post-pliocene period. The latter is also found on the coast of Maine, and no doubt in many places between that and Greenland. Only a few months ago the discovery of *Calluna vulgaris*, the common heather of the old country, was reported in a locality in New England supposed to have been well explored; but this plant has been stated to occur in Newfoundland, and many years ago the writer was informed by local collectors that it occurs in Cape Breton. No doubt it may be found along the coast of north-eastern America everywhere where conditions are favourable, which can be however only in a few exceptional localities on the coast, and these somewhat out of the way of ordinary collectors.

In conclusion, Dr. Hooker deserves our thank for his able and original treatment of his subject; but the problem is very intricate, and we believe that he has not sufficiently weighed some of the elements for its solution, and has been disposed instead to lean on the hypothesis, which however specious and apparently useful in explaining difficulties, has not yet been proved by a single tangible fact, that under certain circumstances two real species may spring from one. We remarked the same defects some time ago in the author's introduction to his Australian flora. The time was when it was the failing of naturalists to separate varieties from each other as species, in order to avoid difficulties of distribution. Now the opposite tendency prevails, to account for the number of species by their supposed mutability and migrations. So science in its progress always sways between extremes, and the middle way of truth appears only after these oscillations have spent themselves. J. W. D.

ARTICLE XXXIII.—*On the Mammals and Birds of the District of Montreal.* By ARCHIBALD HALL, M.D., L.R.C.S.E.

(*Continued from page* 316.)

Picus pubescens. Downy Woodpecker.
P. (*Trichopicus*) *pubescens.* Baird!

V.S.P Bill black; legs and feet bluish; irides hazel; eggs 6, white.

Dorsal aspect. Frontlet brownish white; crown of head jet black, bordered laterally by a white streak commencing over the eye, and posteriorly by a crescent of crimson with which the white streaks are continuous; immediately behind the eye a broad black streak begins, and including the auriculars, terminates below the crimson crescent on the nape of the neck, meeting its fellow of the opposite side; sides of neck white, the white projecting backwards to the nape of the neck, where it is intersected by a narrow mesial line of black; interscapular region black, the centre feathers black; scapulars and rump black; small wing coverts black, the lowest row tipped with white; greater wing coverts black with a large white spot towards their tips; primaries and secondaries brownish black barred with white; the two lateral tail feathers, and a spot on the third white, with rudimentary black bars; all the other feathers black.

Ventral aspect. White, usually soiled on the chin and throat; the feathers as well as those of the interscapulary region very silky.

3rd primary longest; 4th next; 2nd next; 1st shorter than the 6th. Length 6½ inches; alar expanse 10 inches. In the female the occipital band is black.

P. pileatus. Cock of the woods.—Pileated Woodpecker.
Hylatomus pileatus. Baird!

V.S.P. Bill bluish black above, paler below; legs and feet bluish black; irides (golden?) hazel; eggs 6, white.

Dorsal aspect. Crown and crest crimson; line round the eye including the auriculars and meeting its fellow on the nape of the neck below the crest, brownish black, and separated on the side of the head from the crown by a narrow streak of white, which commences over the eye and terminates above the auriculars; moustaches crimson; a whitish line from the nostrils passes between the moustaches and eye and auriculars, expands on the side of the neck, and soon contracting descends to the shoulders and is lost under the wings; nape of neck, interscapulary region, rump, scapulars, wing and tail coverts brownish black—in the specimen before me, bronze; primaries and secondaries brownish black, with their basal halves cream white, and a tip of soiled brownish white on the 2nd, 3rd and 4th primaries; tail black; the white of the wings concealed by the great wing coverts.

Ventral aspect. Chin white; throat, breast, belly, vent, and tail coverts brownish black; the feathers on the belly tipped with white; wing coverts white; wings half cream white and half brownish black.

1st primary very short; 2nd and 7th subequal; 4th longest; 3rd and 5th subequal. Length from extremity of bill to extremity of tail $18\frac{1}{4}$ inches; alar expanse $27\frac{1}{2}$ inches. The moustaches of the female and young bird are dusky.

2nd Section.—Tridactylæ.

P. tridactylus. Northern Three-toed Woodpecker.
Picoides arcticus. Baird!

V.S.P. Bill, legs and feet bluish black; irides deep hazel; eggs 4 to 5, white.

Dorsal aspect. Crown of head rich golden yellow; occiput, nape of neck, interscapulary region, rump, wing and tail coverts glossy black with blue and purple reflections; primaries and secondaries black, the former and a few of the latter barred with white; the lateral tail feathers and the distal halves of the 2nd and 3rd white, usually much sullied; the centre feathers black.

Ventral aspect. A white line from the nostrils down the side of the neck, followed by a black one from the angle of the mouth, both lost upon the shoulders; chin, throat, middle of breast, belly, and vent white; sides of the breast and flanks white with black bars; shoulders black; central tail coverts white; the lateral ones white barred with black on their inner vanes.

1st primary rudimentary; 3rd to 4th subequal and longest. Length $9\frac{3}{4}$ inches; alar expanse $14\frac{1}{2}$ inches. The female has the head wholly black.

P. hirsutus. Northern Banded Woodpecker.
P. hirsutus. Viellot!
Picoides hirsutus. Baird!

D.C. Crown yellow, spotted with white; throat and beneath white, barred with black on the flanks; the four middle tail feathers black; outer feathers white.

Female smaller; head black with white spots.

Length 9 inches; alar breadth 15 inches.

The above description is taken from Audubon's work. The following is a description of a young male now before me:

V.S.P. Dorsal aspect. Prevailing tint black; crown of head spotted with white; from behind the eye reaches a streak of white meeting a circle of white at commencement of the dorsal region; back barred with white; tail coverts black; the three outer tail feathers with their outer vanes white or soiled white; the outermost feather wholly white with the exception of three or four black bars on the inner vanes; central feathers black with an occasional whitish spot; the primaries and secondaries with white spots, the former on both vanes; the latter on the inner only.

Ventral aspect. Throat and breast white; flanks and ventral portion white barred with black; hinder tail coverts white.

This bird has only three toes, and has the bill straight, somewhat flattened, with the upper bill acutely ridged; the nuchal bristles stand forwards, closely appressed and bristly.

Length $7\frac{1}{2}$ inches; alar expanse 13 inches.

The bird before me was shot last autumn (1861) on St. Helen's Island, opposite this city, and presented to Mr. Hunter of the Natural History Society. Its sex was verified by Mr. Hunter, and it therefore in almost every respect resembles the adult female. It must have been a bird hatched last summer. I cannot but regard this species as extremely rare visitants.

Genus Cuculus.

Gen. char. Bill as long as the head, compressed and curved, and carinate above and below; nostrils basal, lateral, oval, and surrounded by a naked and prominent membrane; tarsi feathered below the knee; feet slender; outer toe versatile; interior and middle connected at base; tail cuneiform; 3rd primary longest.

C. Dominicus. St. Domingo Cuckoo.
Coccygus Dominicus of Nuttall!
Cuculus erythropthalmus of Wilson!
Coccygus erythropthalmus. Baird!

V.S.P. Bill, feet and legs bluish black; irides light hazel; eggs 3 to 5, bluish green.

Dorsal aspect. Over the whole surface light bronze colour, exceedingly glossy; tail cuneiform, of the dorsal tint, tipped with white.

Ventral aspect. White, tinged with bronze on the chin and throat; wing and tail coverts yellowish white.

A naked space round the eyes of a vermillion colour; 3rd primary longest; 4th next; 2nd shorter than the 6th; 1st equal to the secondaries. Length 11½ inches; alar expanse 14½ inches. This bird does not appear to possess the characteristic of other cuckoos; viz., in laying her eggs in the nests of other species, but on the contrary, prepares her own nest, hatches her own eggs, and tends her young ones with the most maternal anxiety. It is addicted however to the practice of sucking the eggs of other birds.

Coccygus Americanus. Yellow-billed Cuckoo.
Cuculus Carolinensis. Wilson.

V.S.P. ET M. Upper part of upper mandible, and tip of lower black; lower part of upper, and all the lower except the tip yellow; irides hazel; eggs 2 to 4, bluish-green.

Dorsal aspect. Whole dorsal aspect greyish-brown, with greyish-bronzy reflections, which are almost absent on the tail coverts. Two middle tail feathers of the dorsal tint, all the others blackish. The 3 exterior feathers largely, 4th minutely, tipped with white; the outer tail feathers half the length of the middle ones; the greater portion of the vanes of the primary, and nearly all the secondaries, bright rufous colour.

Ventral aspect. White. The two central tail feathers whitish, tipped with black. The rufous part of the rings is scattered below; inner wing coverts white, tinted with nankeen. Feathers of leg long dusky white.

Length 12 inches: alar expanse about 16 inches. This description is taken from a female. The male has all the dorsal feathers, except the two centre ones, broadly tipped with white By no means a common bird in this vicinity.

Ord. IV. Gallinaceæ.

Genus Tetrao.

Gen. char. Bill short, thick, arched above, entire, and naked at base; nostrils basal, semiclosed by a membrane, and partly concealed by the small projecting frontlet feathers; eyebrows naked, studded with scarlet papillæ; tarsi feathered and destitute of spurs; 3 toes before and one behind; front toes connected at the base, all of them pectinated on both inferior margins; 3rd and 4th primaries longest; tail consisting of 15 to 18 feathers.

Sub genus Tetrao.

Sub gen. char. With the lower portion of the tarsus and the toes naked.

T. umbellus. Ruffed Grouse.
Bonaza umbellus. Baird!

v.s.p. Bill horn colour; legs and feet livid; irides hazel; eggs 10 to 15, dull yellow.

Dorsal aspect. Crown of head crested, waved with black, grey and brown, the first colour predominating; on the nape and sides of the neck, there is a similar intermixture of colours, but a predominance of white tinged with brown; interscapulary region and rump brown, with very minute wavy black lines, with a triangular spot of whitish in the centre of each feather towards the tip; inner vanes of the scapulars black towards the ends, waved black and brown internally; outer vanes with a streak of cream white near the shafts bordered by black, and finally edged with brown sprinkled with black; great and small wing coverts brown, streaked and sprinkled with black on the inner vanes, brown sprinkled with black on the outer vanes, with a central streak of white; tail round, grey, banded narrowly with black, and sprinkled with black in the interstices of the bars, with a broad terminal band of black feathers being lastly broadly tipped with grey sprinkled with black; primaries and secondaries dusky brown; the six first primaries spotted with cream white on their outer vanes; the outer vanes of the secondaries edged with brown sprinkled with black; on the few last secondaries the tips of the inner vanes are similar to the outer vanes, and on the outer vanes a large spot of black.

Ventral aspect. A streak from the nostrils to the eye, and from the eye above the auriculars cream white; cheeks and auriculars black mixed with brown; chin, upper part of throat, and sides of throat rufous; on each side of the lower part of the neck a ruff of black feathers with purple reflections; lower part of throat anteriorly, rufous edged with black; breast brownish white barred near the end with rufous, and lastly tipped with pure white; sides of the breast under the wings, rufous with a streak of white along the shafts, and minutely sprinkled with black at the tips and along the edges; belly and flanks white with a brownish band of rufous and tipped with white; vent rufous white; tail coverts rufous tipped with white, the white running up the shafts for some distance.

3rd and 4th primaries subequal and longest; 2nd and 6th equal; 1st and 7th equal; the shafts of the wing feathers incurved; wing itself much rounded. Length 17¾ inches; alar expanse 23 inches. The female bears a great resemblance to the male. The ruff, however, is smaller and browner. The general hue of the bird varies considerably. In the specimen before me a rufous tint prevails. The most usual predominant tint is a chesnut brown. In those specimens where the plumage is tinged with chesnut, the tail partakes of a light brown hue. In this species the eyelids are not naked.

T. Canadensis. Spruce Partridge.—Spotted Grouse.
T. Canadensis. Baird!

V.S.P. Bill horn colour, dark; feet and legs livid brown; irides hazel; eggs 5, varied with white, yellow and black.

Dorsal aspect. Crown of head, nape of neck, interscapulary region and rump, black waved with grey, darkest on the head and back, and lightest on the neck and rump; the feathers of the rump are black barred semicircularly, and tipped with grey; scapulars, and greater and smaller wing coverts black waved with chesnut; tail coverts black, barred with grey; tail round, black, with a broad terminal tip of bright chesnut; a spot above each nostril, a streak below the eye, and another above the auriculars, white; a naked spot above the eye bright vermillion; cheeks and chin black.

Ventral aspect. A semicircle of white meets on the throat, commencing at the auriculars; feathers of throat black tipped with white: those of the upper and lower parts of the breast black; sides of breast black, broadly tipped with white, meeting on the centre of the breast causing a banded appearance; feathers of body and vent black tipped with white; flank feathers black waved with chesnut, and a streak of white down the shafts; tail coverts black broadly tipped with white.

3rd and 4th primaries longest; 1st and 8th equal; 2nd and 6th equal; quills incurved, dusky brown, the six first primaries edged with white on the outer vanes. Length 14 inches; alar expanse 20½ inches. The female is 13 inches long, and is much lighter coloured. In her the black breast and throat are wanting, and generally the black of the dorsal aspect is supplanted by a chesnut or bright ferruginous; the secondaries and scapulars have streaks of cream white on their inner vanes; the rump is waved with grey; the two central tail feathers barred with chesnut, which is imperfectly continued to the outer vanes of the other tail feathers; the feathers of the belly and breast barred black and white, and tipped broadly with white.

Sub genus Lagopus.

Sub gen. char. With the tail round or square, and toes feathered similar to the tarsi.

T. lagopus. White Grouse or Ptarmigan.
Lagopus albus. Baird!

D.C. "Bill weak, compressed towards the point; nails subulate, black and curved; the male constantly with a black band through the eyes; female without the dark ocular band, cicatrice over the eye smaller. Summer plumage.—Above greyish rufous, marked with numerous zigzag lines; on the breast and flanks a great number of black feathers waved with pale rufous; wings, all below the breast, and feet, pure white; the female and young less white; cicatrice over the eye scarlet; weight 24 ounces. Length 14½ inches; alar extent 23 inches."—(Nuttall, page 674).

Genus Columba.

Gen. char. Bill moderate, straight, compressed, rather gibbous towards the tip which is also curved; base of nostrils covered with a soft skin, with an inflated appearance, in which the nostrils are situated, which are medial and longitudinal; feet short, robust, usually red; tarsi reticulated; toes free, 3 before and 1 behind; tail of 12 to 14 feathers; 2nd primary usually longest.

Sub genus Columba.

Sub gen. char. Legs and feet short and robust; tail square or cuneiform; wings long and acute.

Subdivision II, with the tail long and cuneiform.

C. migratoria. Passenger Pigeon.
Ectopistes migratoria. Baird!

V.S.P. Bill black; nasal protuberance whitish; irides red; legs and feet red; eggs white, two in number, one of them, according to Wilson, usually abortive.

Dorsal aspect. Head, neck, interscapular region, rump, scapulars, great and small wing coverts slate blue; the bluish tint prevailing on the head and rump; on the neck with golden green and purplish reflections; scapulars and great wing coverts with a few long black streaks on the inner vanes of the inner row of scapulars, and on the outer vanes of the outer row of scapulars and the coverts; primaries and secondaries dusky brown, the 2nd, 3rd, 4th, 5th, 6th, 7th and 8th primaries margined with white on their outer vanes; tail coverts bluish slate colour; tail cuneiform, of 12 feathers; the two central feathers brownish black; the two lateral feathers nearly white, the others mostly pale slate colour, with a predominance of white on their inner vanes; near the insertions of all, except the central feathers, on the inner vanes, an oval black spot succeeded by rufous more internally.

Ventral aspect. Cheeks and sides of neck slate blue; chin pale; throat and breast rufous, ("vinaceous"—Nuttall,) with a golden green iridescence; belly and vent paler rufous; wing coverts and flanks white tinged with slate blue; tail coverts white; inner surface of wings slate blue.

2nd primary longest; 1st next; the others graduated. Length including the tail 16½ inches; alar expanse about 22 inches; length of the tail 7½ inches. The female wants the rufous breast, or at most has but a tinge of it in that situation. The young bird, when it arrives in this district, or is bred here, has a deep slate coloured dorsal and ventral aspect, interspersed with soiled white spots. The down, of a dirty yellow colour, may also often be seen above the plumage.

C. Carolinensis. Turtle-dove or Carolina Pigeon.
Zenaidura Carolinensis. Baird!

D.C. Forehead and breast vinaceous; a black spot of it under each ear; tail of 14 feathers, with 4 of the lateral ones black near the extremity and white at the tips; crown and upper part of neck greenish blue; general dorsal colour pale yellowish brown; some of the inner wing coverts spotted with black; below brownish yellow. Length 12 inches; alar extent 17 inches. I saw a specimen of this bird in 1831 which had been shot by some Canadians in the woods on Isle Jesus. It is extremely rare.

ORD. V. GRALLATORIÆ.

Fam. II. Pressirostres.

Legs long; without a thumb, or the thumb too short to reach the ground; bill moderate.

Genus Charadrius.

Gen. char. Bill shorter than the head, compressed, slender, straight, and rather gibbous towards the tip; nostrils basal, placed horizontally in the membrane which covers the nasal fossa; legs slender, of moderate length, of the three toes projecting forward the exterior is connected to the middle one by a short membrane; the inner toe free; thumb obsolete; tail rounded or square; 1st primary shorter than 2nd which is the longest.

C. pluvialis. Golden Plover.
C. apricarius of Gmelin and Wilson! Adult bird in summer plumage.
C. Virginicus. Baird!

V.S.P. Bill, legs and feet black; irides hazel; eggs 4 to 5 pale olive spotted with black.

Dorsal aspect. Frontlet and space round the eyes greyish white; crown of head, interscapulary region, rump, scapulars, and greater and smaller wing coverts greenish black, the feathers tipped with brown, yellow, yellowish white, or in some instances white; nape of neck grey streaked with dusky; tail coverts white tipped with pale lemon yellow; tail white barred with greenish black; on the two centre feathers the bars assume a serrated appearance, the feathers also tipped with lemon yellow; primaries black, their inner vanes white except towards the tips.

Ventral aspect. Chin, belly, vent, tail and wing coverts white; cheeks, sides of throat, throat, breast, white streaked with dusky.

1st primary longest, the others graduated. Length $10\frac{1}{4}$ inches; alar expanse 20 inches. In the summer plumage the ventral aspect is black.

C. vociferus. Kildeer Plover.
Aegialitis (Oxyechus) vociferus. Baird!

V.S.P. Bill black; legs and feet yellowish; irides dark hazel; eyelids scarlet; eggs 4, yellowish cream colour, spotted with black.

Dorsal aspect. Frontlet, round the eye, and spot above the auriculars white; front of crown black; remainder of crown, auriculars and dorsal region, including the wing coverts, olive grey; nape of neck forming a part of the collar, white; rump and tail coverts tawny; primaries blackish brown, white on most of of the inner vanes, with a streak of the same colour close to the shafts, on the outer vanes about $\frac{1}{3}$ their length; lower row of the greater wing coverts tipped with white; the lateral feathers wholly white, with 5 rudimentary blackish brown bars which are imperfectly carried on to the vanes of the second feather.

Ventral aspect. Streak from the angle of the mouth to the auriculars blackish brown; collar including the chin white; belt on the breast black, intersected by a narrow white streak; all the other parts white including the wing and tail coverts; tail subrotund, the feathers accuminate.

1st primary longest, the others graduated; one of the axillary feathers as long as the 3rd primary. Length 10 inches; alar expanse $19\frac{1}{2}$ inches. A very elegant bird.

C. semipalmatus. Semipalmated Ring Plover.
Tringa hiaticula of Wilson.
Aegialitis semipalmatus. Baird!

V.S.P. Bill orange at base, black towards the tips; legs and feet yellow; irides dark hazel; eggs 4, dark coloured, spotted with black.

Dorsal aspect, Fore part of the crown black, with a crescent of white immediately over the frontlet feathers; a spot below the eye white; streak from nostrils below the eye to the auriculars black; back part of the crown, and the whole dorsal region, including the wing coverts, dark olive grey; rump and tail coverts paler; the lower row of the great wing coverts tipped with white; primaries brownish black. broadly edged with white on the inner vanes, and extending itself into a streak along the shafts on the outer vanes of the three or four last; tail olive grey, deepening into brownish black tipped with white; the lateral tail feathers wholly white, and the white tips of the two adjoining very deep.

Ventral aspect. Collar, including the chin, white, but across the breast black; all the other parts white.

1st primary longest, the others graduated; the longest axillary feathers scarcely longer than the 4th primary; feet semipalmated —whence its name. Length $7\frac{1}{4}$ inches; alar expanse $13\frac{1}{2}$ inches. Tail subsquare.

Genus Vanellus.

Gen. char. Feet 4-toed; thumb short with a nail and reticulated feet.

V. helveticus. Black-bellied or Swiss Plover.
C. apricarius of Wilson!
Charadius helveticus of Brisson!
Vanellus melagonaster of Becstein and Temminck!
Tringa helvetica of Linnæus!
Squatarola helvetica. Baird!

V.S.P. Bill, legs and feet black; irides deep hazel; eggs 4, cream colour, spotted and blotched with light brown and purplish brown.

Dorsal aspect, Frontlet and sides of the crown white; crown and nape of the neck black with brownish white tips to the feathers, giving these parts the latter colour; dorsal region blackish brown broadly tipped with yellowish white; smaller wing coverts olive brown tipped with brownish white; greater wing coverts olive brown tipped with white; rump feathers white barred with brown; primaries blackish brown, a broad streak of white covering one-half of the inner vanes; the middle portion of the shafts white, the white sometimes continued in a streak to the outer vane; axillary feathers brownish black, edged and tipped with soiled white in a serrated manner on the margins; the outer vanes themselves having a worn serrated appearance; tail subsquare; the lateral feathers wholly white; all the others white with 8 or 9 bars of brown.

Ventral aspect. The white border over the auriculars continued down the sides of the neck, terminating broadly under the wings; cheeks, auriculars, chin, throat, breast and belly, and its sides black; vent, flanks, and tail coverts white; femorals also white; 1st primary longest.

1st primary longest; long axillary feathers shorter than the 4th primary, but longer than the 5th. Length $11\frac{1}{2}$ inches; alar expanse $22\frac{1}{2}$ inches.

In its winter plumage this bird has its ventral aspect wholly white; the dorsal aspect blackish brown, varied with greenish yellow fringed with crimson, The young birds have a good deal of white mixèd with the black on the ventral aspect.

Fam. II. Cultirostres.

Genus Ardea.

Gen. char. Bill subequal in length to the head, long, compressed and acuminate; upper mandible furrowed slightly; ridge rounded; nostrils lateral, basal, semiclosed by a membrane, and placed in a groove; lores and orbits naked; legs long and slender, a naked space upon the knee; middle and outer toes connected at the base; inner one free; hind toe long; tail of 10 to 12 feathers; 2nd and 3rd primaries longest.

Sub genus Ardea.

Sub gen. char. Bill straight, longer than the head; neck long and slender, and with long pendant feathers from its lower surface; legs long.

A. herodias. Great Heron.
A. herodias. Baird!

D.C. "Bill yellow and black; legs brownish black tinged with yellow, netted with seams of whitish; naked space above the legs brownish yellow; irides orange; eggs 4, greenish blue.

"Dorsal aspect. Space round the eye from the nostril light purplish blue; forehead and middle of the crown white passing over the eye; sides of crown and occiput bluish black, and crested, with two long tapering black feathers 6 inches long; whole upper part of wings, tail and body light ash, the latter ornamented with a profusion of long narrow white feathers, originating on the shoulders and falling gracefully over the wings; primaries dark slate.

"Ventral aspect. Chin, cheeks, sides of head, white; throat white streaked with double rows of black; the rest of the neck brownish, but from the lower part of which proceed narrow pointed white feathers, which spread over the breast nearly to the thighs; under these plumes, the breast, and middle of the belly, are deep blackish slate, the latter streaked with white; flanks bluish ash; vent white; thighs, and ridges of the wings dark purplish rust colour.

"Bill 8 inches long; $1\frac{1}{4}$ inch wide. Length 4 feet 4 inches; alar extent 6 feet."—(Taken from Nuttall's Ornithology).

Sub genus Botaurus.

Sub gen. char. Bill subequal to head, compressed, deeper than broad; upper mandible sensibly curved; legs and neck comparatively short; naked space above the tibia short; feathers of neck voluntarily erectile.

Section I, with occipital feathers.

A. discors. Night Heron.
A. nycticorax of Wilson!
Nyctiardea gardeni. Baird!

v.s.p. Bill black, tip pale horn colour; legs bluish green; irides red; eggs 4, greenish blue; eyelids purplish blue; lore pale greenish yellow, (bluish white,—Wilson).

Dorsal aspect. Frontlet, and line continued from it over the eye white; crown of head, back, and scapulars jet black with a pea green iridescence; nuchal region ashy white; rump cinereous; tail, secondaries and primaries dark ashy, the latter tinged with bluish slate; the first primary white on the outer vane, the others having a worn appearance; great and small coverts ashy brown; occipital feathers 2 to 3 or 4, long, narrow, white.

Ventral aspect. White, purest on the chin and throat, tinged with ashy on the flanks, and with cream colour on the belly and vent; femorals white.

3rd primary longest; 2nd and 4th subequal; 1st longer than the 4th. Length $24\frac{3}{4}$ inches; alar expanse $34\frac{1}{2}$ inches. Length of the occipital feathers 6 to 8 inches; length of bill from the angle of the mouth to the tip $3\frac{1}{2}$ inches; breadth across the angle of the mouth 1 inch 1 line.

The young bird has a deep brown dorsal aspect, streaked with rufous white, and triangular spots of white on the back and wings; quills ashy, with a terminal spot of white. Ventral aspect. Cinereous streaked with white; irides orange. They want the occipital feathers.

Section II, without the occipital feathers.

A. lentiginosa. American Bittern.
A. minor of Wilson and Buonaparte!
Botaurus lentiginosus. Baird!

v.s.p. Bill yellow at the sides and beneath, blackish brown above; lores, eyelids, and legs pale greenish yellow; irides orange; eggs 4, cinereous green.

Dorsal aspect. Line over the eye yellowish white; crown *ferruginous brown; feathers of nape and sides of neck, large, long,* with straggling vanes, ferruginous yellow streaked with brown; below the auriculars a streak of black descends 3 or 4 inches down the neck; dorsal feathers umber brown mottled with black, with cream coloured margins; greater and smaller wing coverts, scapulars, secondaries, rump, and tail brown, sprinkled with brownish yellow and black; the brownish yellow predominating on the great wing coverts; primaries clove brown with pale outer margins.

Ventral aspect. Chin white, with a narrow line of brownish yellow in the medial line; throat cream colour, the feathers with broad central brownish yellow streaks; on the belly and vent the streaks are narrower; flanks brownish yellow, sprinkled with brownish black; tail coverts cream colour; wing coverts cream colour sprinkled with brownish black.

2nd and 3rd primaries subequal in length and longest; 1st about a line shorter. Length 21 inches; alar expanse 31½ inches. The female resembles the male, and the young bird is also similar but has the tints less decided. The legs of the American bittern are long; length of the tarsus 3 inches 2 lines; length of middle toe from the ankle joint to extremity of the nail 3 inches 8 lines; length of bill from the angle of the mouth to the tip 3½ inches.

A. exilis. Little Bittern.
Ardetta exilis. Baird!

V.S.P. Bill yellow with a black ridge; legs and feet yellow tinged with green anteriorly; irides orange yellow; eggs unknown, but if resembling the European analogous species, white.

Dorsal aspect. Frontlet, chesnut deepening into black on the crown of head, which has a deep sea green reflection; sides of head, nape of neck, chesnut; feathers of back and scapulars dark chesnut tipped with rusty yellow; small wing coverts brownish yellow, with a central broad spot of brownish black; upper row of great wing coverts, with the lower row of the smaller ones, rusty yellow; lower row of great wing coverts bright chesnut; rump cinereous, the feathers tipped with whitish; primaries and tail dusky, the former tipped with chesnut.

Ventral aspect. A streak on either side the throat white; chin, remainder of the neck to the breast rusty yellow, with a fine central streak of black in the centre of each feather, internally the neck feathers are white, the rusty yellow confined to the distal halves; on each side of the breast the inner feathers are blackish brown tipped with chesnut; belly and vent white; thighs feathered to the knees.

2nd primary longest; 1st and 3rd subequal, the rest graduated. Length 11½ inches; alar expanse 14½ inches; length of the bill from the angle of the mouth 2 inches 2 lines; length of middle toe 1 inch 6 lines. A very rare bird in this district, only met within the extensive swamps on the southern shore of the St. Lawrence so far as I am aware.

Fam. II. Longirostres.

Genus Scolopax.

Gen. char. Bill longer than the head, more or less curved; thumb too short to assist in walking; 1st and 2nd primaries usually longest with the axillary feathers usually elongated.

Sub genus Calidris.

Sub gen. char. Bill moderately long, slender, straight, soft, flexible, compressed at the base, depressed at the tip, flattened and obtuse; nostrils lateral, and longitudinally cleft; legs slender; toes divided; 1st primary longest.

C. arenaria. Sanderling Plover.
C. rubidus of Wilson!
Charadrius calidris of Gmelin and Brisson!
Tringa arenaria of Linnæus!
Type of genus Arenaria of Bechstein!
Type of genus Calidris of Vigors!
Calidris arenaria. Baird!

V.S.P. Bill, legs and feet black; irides dark hazel; eggs 4, dusky spotted with black.

Dorsal aspect. Frontlet and side of the head white; crown black the feathers tipped with brownish white; nuchal region cinereous with linear darker streaks; dorsal region, scapulars and small wing coverts black, with four whitish spots on each feather; on the back the white spots have a yellow tinge; rump feathers brown faintly tipped with blackish brown; lateral tail coverts white; centre ones brownish tipped with rufous; upper row of greater wing coverts like the rump; lower row broadly tipped with white; tail subrotund; the two centre feathers blackish brown tipped with yellowish white; the lateral ones more or less tinged with cinereous; primaries black with white shafts.

Ventral aspect. A line from the nostrils to the eye blackish brown; cheeks white, faintly marked with cinereous; chin, sides of throat, and throat, breast, belly, vent, tail and wing coverts, and flanks white; sides of breast faintly tinted with rufous and tipped with cinereous.

1st primary longest, the others graduated; the long scapulary feathers subequal to the 5th primary. Length $8\frac{1}{2}$ inches; alar expanse 14 inches. The winter plumage is the only state in which we meet with this bird in the district. The dorsal aspect, when moulting, is considerably varied with grey.

Sub genus Strepsilas.

Sub gen. char. Bill moderate, hard at the point, strong, straight, slightly elevated at the tip, with a flattened ridge and truncated tip; nostrils basal, lateral, semiclosed by a membrane; feet 4-toed; the thumb barely reaching the ground; the anterior toes connected at the base; 1st primary longest.

S. interpres. The Turnstone.
S. collaris of Temminck!
Tringa interpres of Wilson!
Tringa monnilla of Linnæus! young of 1st year.
Strepsilas interpres. Baird!

V.S.P. Bill black; legs orange yellow; irides hazel; eggs 4, olive green spotted with brown.

Dorsal aspect. A line from the ridge of the bill to above the eyes including the frontlet, a line from the angle of the mouth to the collar, the auriculars all black; an orbicular spot in front of the eye, another below the auriculars, and a third below the collar, white; crown and nape of neck streaked with black bordered on the sides with white; feathers of the back, scapulars, and coverts varied with chesnut, black, with occasional white tips to the feathers; rump white; upper row of tail coverts black; lower row white; lateral tail feathers white, with a spot of blackish brown on the inner vanes; bases of all the others white, changing to blackish brown and tipped with white; primaries blackish brown, white on the inner vanes near their insertions; shafts white.

Ventral aspect. Chin and throat white; breast, sides of the breast, with the collar black; all the rest white.

1st primary longest, the rest graduated; long scapulary feather subequal to the 3rd primary; tail square. Length $9\frac{1}{2}$ inches; alar expanse 17 inches. The young of the 1st year have no traces either of black or chesnut, but a cinereous brown assumes its place; the feathers of the back have yellowish tips; the feet are yellowish red.

Sub genus Numenius.

Sub gen. char. Bill long, slender, compressed at base, depressed at the tip, furrowed for half the length and curved; nostrils in the furrow of the upper mandible, basal, and lateral; legs long, moderately stout; toes short compared to the leg; thumb barely reaching the ground; front toes connected at the base; 1st primary longest.

N. longirostris. Long-billed Curlew.
N. (Numenius) longirostris. Baird!

D. C. Bill 7 inches long, brownish black, purplish flesh colour below towards the base; legs and feet greyish blue or lead colour; irides dark hazel; eggs 4, cream coloured spotted brown?

Dorsal aspect. Blackish brown, spotted and interruptedly barred with different shades of rufous; line round the eye brownish white; primaries brownish black on the outer edges, pale rufous on the inner and barred with black; shafts of the 1st primary white; the rest of the wing pale reddish brown, with waving linear bars of dusky; axillaries plain with a few remote dusky *marginal streaks*; *tail rounded*, pale rufous, with about 10 dusky brown bars; crown blackish with whitish streaks and no medial line.

Ventral aspect. Chin, brownish white; neck pale, whitish buff, streaked with black; belly, thighs, and vent pale rufous white without spots; wing linings salmon rufous sparingly dotted with blackish.

Length about 25 inches; alar expanse 39 inches; weight about 30 ounces. (Compiled from Nuttall.)

N. Hudsonicus. Esquimaux Curlew.
Scolopax borealis of Wilson!
N. (Phacopus) Hudsonicus. Baird!

V.S.P. Bill black, purplish towards the base of the under mandible; legs and feet dark lead colour; irides hazel; eggs 4, dark bluish grey spotted with black or dark brown.

Dorsal aspect. Crown of head dark brown with a medial line of greyish white; an oval spot between the eye and nostrils, and line over the eye white; a streak of dark grey between the angle of the mouth and the eye; cheeks, sides of the neck, and nape greyish white with brown streaks; whole dorsal region, including the axillaries, wing and tail coverts, and rump, pale dusky brown, with an occasional violet iridescence, the edges of the feathers having a worn appearance, the outer vanes of the axillaries especially having a serrated and worn appearance; tail square, dusky brown inclining to a rufous tinge at the base, barred with blackish brown. The shaft of the 1st primary white, that of the next pale brown, all the others deep brown; the quills brownish black barred with greyish white on the inner vanes, and on the outer vanes of all except the three first primaries; the long axillaries not barred.

Ventral aspect. Chin, belly and vent white; throat and breast greyish white streaked with dusky which is darkest on the throat; flank and lateral tail feathers rufous white, barred with dusky brown; wing linings salmon colour barred with dusky brown; centre tail feathers white.

1st primary longest; long scapulary feathers equal to the 5th primary; length of the bill $3\frac{1}{2}$ inches; length of the bird $17\frac{1}{4}$ inches; alar expanse $28\frac{1}{2}$ inches.

N. borealis. Small Esquimaux Curlew.
N. brevirostris of Temminck!
Scolopax borealis of Forster!
N. (Phacopus) borealis. Baird!

V.S.P. Bill slender, brownish black; legs and feet olive black; irides hazel; eggs 4, spotted with light umber brown.

Dorsal aspect. Blackish with a medial line of greyish white; sides of crown brownish white; streak from the nostrils brown, prolonged behind the eye to above the auriculars; nape and sides of neck brownish, with streaks of a darker tint; interscapulary region, scapulars, long axillary feathers, greater and smaller wing coverts blackish brown, with rufous white marginal spots of a triangular shape; tail coverts and tail rufous white, barred with blackish brown; belly and vent rufous white.

Ventral aspect. Chin white; throat and breast, with the sides of the latter rufous white, streaked with blackish brown, and barred with a V shaped spot of the same colour on the breast;

flank feathers rufous white barred with brown; lateral tail coverts rufous white barred with brown on the outer vanes of the lateral ones; wing linings salmon colour barred with blackish brown; belly and vent rufous white.

1st primary longest; long axillary feathers longer than the 5th but shorter than the 4th; all the primaries except the 1st and 2nd tipped with white. Length 14 inches; alar expanse 25 inches; length of the bill 2¼ inches. In the female the medial line on the crown is obsolete.

Sub genus Scolopax.

Sub gen. char. Bill slender, long, compressed, soft, straight, with a turned tip, the tip of the upper mandible projecting over the lower and tuberculated; both mandibles furrowed for half their length; nostrils lateral, basal, linear, in the furrow of the mandible, and covered by a membrane; feet not palmated; the orbits placed far back on the head. In some species the external and middle toes are connected to the first joint.

S. grisea. Red-breasted Snipe.
S. noveboracensis of Latham and Gmelin!!
Macroramphus griseus of Leach!
Macrorhamphus griseus. Baird!

V S.P. Bill black towards the tip, the remainder dull olive; legs and feet bluish grey; irides hazel; eggs unknown.

Dorsal aspect. Crown blackish brown tipped with brownish chesnut; sides of the head commencing at the nostrils greyish white; a streak from the angle of the mouth to the eye, and another more faint beyond it greyish brown; cheeks greyish white; nuchal region grey; interscapulary region, scapulars, long axillary feathers blackish brown, tipped and striped on the margins with chesnut; small wing coverts and great wing coverts, dusky, the former tipped with grey, the latter with pale chesnut; rump, tail coverts and tail, white barred with blackish brown, the latter also tipped with pale chesnut; primaries brownish black.

Ventral aspect. Chin and throat greyish white; breast rufous with imperfect and irregular streaks of brown; flanks rufous white with faint wavy lines of brown; internal linings white with blackish brown bars; tail coverts rufous white with bars; belly and vent white tinted with rufous.

1st primary longest; 2nd considerably longer than the 3rd; long scapulary feathers longer than the 4th primary but shorter than the 3rd. Length $10\frac{3}{4}$ inches; alar expanse $16\frac{1}{2}$ inches; length of bill $2\frac{1}{3}$ inches. The shaft of the first primary is white, that of all the others pale brown.

S. Wilsonii. Common or Wilson's Snipe.
S. gallinago of Wilson!
Gallinago Wilsonii. Baird!

V.S.P. Bill black at the tip, the rest brown; legs and feet grey; irides hazel; eggs 4, olivaceous spotted with brown.

Dorsal aspect. Crown of head black, separated in two by a medial line of white; line from the ridge of the bill over the eye brownish white; and another from the nostrils to the eye blackish brown; the auriculars and cheeks greyish white, the former margined with brown; nuchal region ferruginous streaked with blackish brown; dorsal region and scapulars black, the latter edged with cream colour on the outer vanes, and spotted with chesnut on both; scapulary feathers edged with white on the outer vanes, spotted and barred with chesnut; great and small wing coverts dusky tipped with greyish white; rump and tail coverts brownish black barred with rufous brown, the bars caused by spots on the vanes of the feathers; tail rounded, jet black, with a subterminal band of bright chesnut succeeded by a narrow black border, and lastly tipped with rufous white; primaries dusky, the outer vane of the first white, and the outer vane of the second marginĕd with white, all of them faintly tipped with white.

Ventral aspect. Chin white; throat and breast brownish white spotted with brown; belly and vent white; flanks white elegantly barred with brownish black; tail coverts rufous barred with brown.

1st primary longest; 2nd subequal to it; long scapulary feathers subequal to the 3rd primary. Length 11 inches; alar expanse $16\frac{1}{2}$ inches; length of the bill $2\frac{1}{3}$ inches. The two lateral tail feathers of this bird are wholly white, with 7 equidistant blackish bars; these bars are imperfectly continued to the next ones, becoming less in number until we arrive at the centre ones where they are obsolete; the chesnut band commences at the third, and deepens in tint as it approaches the central feathers.

S. minor. Woodcock.
Rusticola minor of Nuttall!
Philohela minor. Baird!

V.S.P. Bill bluish black tinged with orange towards the base; legs and feet pale orange; irides dark hazel; eggs 4, olivaceous white blotched with yellowish brown.

Dorsal aspect. Frontlet and crown as far as the centre of the head cinereous tinted with pale rufous; occiput and nuchal region black with three transversal narrow bands of rufous, the lowest one tinged with cinereous, the remainder of the nuchal region cinereous; a line from the angle of the mouth to the eye black; cheeks and auriculars cinereous white, with irregular narrow wavy lines of black; dorsal feathers and scapulars black barred and tipped with bright chesnut; the outer vanes of the outermost row of both wholly cinereous, thus causing four broad streaks of cinereous down the back; great and small wing coverts with the secondaries dusky, barred with wavy zigzag lines of blackish brown, cinereous, and pale chesnut; primaries dusky, the outer vanes of the 1st, 2nd, 3rd, and 4th edged with whitish; rump black barred with bright chesnut in an irregular manner, and tipped with cinereous; central tail coverts black tipped with chesnut; the lateral ones bright chesnut with wavy lines of black; tail round, jet black, with a subterminal narrow band of chesnut, and broadly tipped with cinereous; all the primaries tipped with white.

Ventral aspect. Chin white; throat, sides of the throat, breast, belly, vent and flanks rufous, tinted with cinereous on the sides of the throat, pale on the belly and vent, and very bright on the flanks; tail coverts bright rufous, the lateral feathers tipped with white; tail jet black, with a broad terminal band of glossy white corresponding with the cinereous tip of the dorsal aspect.

3rd primary longest; 4th next; 1st and 8th equal; the longest scapulars subequal to the 3rd primary; from the comparative length of the primaries the wing is very much rounded. Length $12\frac{3}{4}$ inches; alar expanse 17 inches; length of bill $2\frac{5}{8}$ inches. This bird though considerably smaller than the European bird, has its bill of exactly equal dimensions.

Sub genus Limosa.

Sub gen. char. Bill longer than in the last sub-genus, straight, more or less incurved from the centre, soft and flexible; the nasal furrows extend nearly the whole length; nostrils basal, lateral, linear and pervious; middle and external toes connected at the base; thumb short and slender, scarcely touching the ground.

L. fedoa. Great Marbled Godwit.
Scolopax fedoa of Wilson!
Limosa fedoa. Baird!

D.C. Bill incurved; rump uniform in colour with the rest of the plumage; tail brownish banded with black. Summer plumage dusky brown varied with rufous, beneath pale ferruginous; winter dress cinereous, beneath whitish; male with the breast marked with undulating bars of dusky brown· This bird is very rarely met with in this district; an occasional straggler however has been seen as I have been informed.

L. Hudsonica. Hudsonian Godwit.
Scolopax Hudsonica of Latham! and Pennant!
Limosa Hudsonica. Baird!

V.S.P. Ridge and tip of bill brown, the rest purplish flesh colour; legs and feet black; irides dark hazel; eggs 4, dark olive spotted with pale brown.

Dorsal aspect. Crown of head and occiput spotted wood brown and greyish white; line from the nostrils over the eye, white with faint spots; another from above the angle of the mouth to the eye woody brown; neck, interscapulary region, and scapulars blackish brown with spots of rusty white; the long scapulars with ragged outer vanes and spotted with brownish white; rump white; tail white at the base, terminating in a deep blackish brown and tipped with white; great and small wing coverts dusky, with pale ragged edgings; the lower row of the great coverts edged with white; primaries clove brown, the shafts white to near the tips, and inclining to white on the inner vanes.

Ventral aspect. Chin white; cheeks white spotted with wood brown; neck, breast and belly ferruginous, the feathers with a subterminal band of blackish brown, generally zigzag, and tipped with white flank feathers, barred with blackish brown; tail coverts with their basal halves white, their distal halves ferruginous and elegantly barred with blackish brown; the lateral coverts paler than the central ones.

1st primary longest; the others graduated; longest scapular subequal to the 4th primary. Length $15\frac{3}{4}$ inches; alar expanse 25 inches; length of the bill 3 inches.

A young bird in the Museum of the Natural History Society, has its dorsal aspect, with the exception of the transversal band of the rump, which is white, dusky, barred with brown on the dorsal region and short scapulars; the long scapulars and quills clove brown, the latter tipped with white, the former with a few terminal bands of pale ferruginous; on the ventral aspect, the chin and cheeks are white; throat and breast dusky; belly, vent and flanks, with the tail coverts dusky white, the last with a streak of brown in the centre of each feather and margined with dusky; the line from the bill to the eye like the old bird. This bird is a rare one in the district of Montreal, and appears to associate with the curlews.

Sub genus Phaleropus.

Sub gen. char. Bill a little longer than the head, slender, straight, depressed at the base, furrowed on both mandibles to near the tip; tip of upper mandible inflected on the lower, and rather subulate; nostrils linear, lateral and basal; front toes connected at base by a membrahe, the inner toe to the first joint, the outer toe to the second joint; the membranous margin of the remainder of the toes broadly and deeply scolloped; hind toe short, scarcely touching the ground, and consequently scarcely used in walking.

P. hyperboreus. Hyperborean Phalerope.
P. fuscus of Latham!
Lobipes hyperboreus of Cuvier!
Tringa hyperborea of Linnæus!
Tringa lobata, young of do.!
Phaleropus hyperboreus. Baird!

V.S.P. Bill black; legs and feet blackish greeen; irides hazel; eggs 3 to 4, olivaceous, thickly spotted with blackish brown.

Young bird; dorsal aspect. Frontlet, line over the eye, and between the auriculars, and nuchal region white; spot in front of the eye, auriculars, and crown of head blackish brown, descending in a streak along the centre of the nape of the neck; the remainder of the nape of neck white tinged with cinereous; interscapulary region and scapulars blackish brown edged with tawny; rump blackish brown, the feathers tipped with white; lateral tail coverts white, central ones blackish brown tipped with tawny; tail blackish brown, the centre feathers tipped with tawny, the lateral feathers edged and tipped with white; small wing coverts plain blackish brown; upper and lower row of great wing coverts blackish brown tipped with white; quills blackish with white shafts, and edged with white on the inner vanes.

Ventral aspect. White, except on the sides of the breast and flanks, where the white is tinted with cinereous.

"The old male is black varied rufous; beneath white; sides of neck and breast bright rufous and ash; sides and front of neck bright brownish orange."

1st primary longest; the others graduated; long scapulars subequal to the 3rd primary. Length 7¾ inches; alar expanse 13 inches; length of bill 1 inch scarcely. I have never seen the old bird in its nuptial dress. The young birds however are not uncommon, and when they are met with the young and old resemble one another in their leading features.

Sub genus Tringa.

Sub gen. char. Bill of medium size, as long as, or a little longer than the head, rather curved, flexible, subcylindrical, compressed at the base, with a smooth tip, and with both mandibles furrowed to near the tip; nostrils situated in the furrows, basal, lateral and linear, covered by a membrane; feet 4-toed, tarsus slender; hind toe barely touching the ground.

T. alpina. The Dunlin or Ox Bird.
T. variabilis of Temminck!
T. cinclus of Linnæus!
Tringa (Shoeniclus) alpina, var. Americana. Baird!

V.S.P. Bill blackish; legs and feet blackish brown; irides hazel; eggs 4, oil green spotted liver brown.

Dorsal aspect. Frontlet, line over the eye, cheeks, and nape of neck white, with irregular blackish brown streaks; crown and occiput black, the feathers edged broadly with ferruginous; dorsal region, rump, and short scapulars black, with very broad ferruginous margins, almost chesnut, and tipped with white; the short scapulars with a subterminal band of blackish brown; long scapulars, and small wing coverts dusky; great wing coverts dusky tipped with white; central tail coverts black broadly edged with ferruginous; lateral ones wholly white; quills dusky with white shafts and white inner vanes; the 5th, 6th, 7th, 8th, and 9th with a touch of white on the centre of the margin of the outer vanes; tail dusky, the lateral tail feathers nearly altogether white.

Ventral aspect. Chin white; throat and breast cinereous white streaked with blackish brown; flanks, tail coverts and vent white with blackish brown streaks in the centre of the feathers; belly black, wi h white edgings to the feathers.

1st primary longest; the others graduated; the long scapulars which have a ragged appearance, longer than the 5th but shorter than the 4th primary. Length 9 inches; alar expanse 14 inches; length of the bill $1\frac{1}{2}$ inch. Described from a male in its nuptial dress.

T. pectoralis. Pectoral Sandpiper.
Pelidna pectoralis of Say!

V.S.P. Bill black at the tip, reddish yellow at the base; legs and feet olivaceous; irides dark hazel, almost black; eggs unknown.

Dorsal aspect. Crown of head, interscapulary region, and rump black, with ferruginous tips and edgings; nape of neck dusky streaked with brown; scapulars black margined with ferruginous and tipped with white on the outer vanes only; long scapulars black edged with ferruginous on both vanes; great and small wing coverts dusky, the latter tipped with pale ferruginous, the former with ferruginous on both vanes, except the extremity of the outer vane where it changes to white; tail with the lateral feathers dusky tipped with brownish white; the centre feathers jet black margined with ferruginous; lateral tail coverts white spotted with blackish on the outer vanes; quills plain clove brown; shaft of 1st primary white; the shafts of all the others brown; streak from the nostrils to and around the eye white; another from the rictus to the eye umber brown.

Ventral aspect. Chin white; cheeks, sides of throat, throat and breast brownish white with dusky streaks; flanks, axillaries, vent and tail coverts white.

1st primary longest; the others graduated; long scapulars shorter than the 4th, longer than the 5th. Length $8\frac{1}{2}$ inches; alar expanse 13 inches; length of bill about 1 inch and about a line; length of tarsus 1 inch; length of middle toe with the nail 1 inch, 1 line. The winter dress of this bird is cinereous brown with a white ventral aspect.

T. rufescens. Buff-breasted Sandpiper.
Tringites rufescens. Baird!

D.C. "Bill blackish, scarcely the length of the head, nearly straight, below pale ferruginous; inner webs of the primaries mottled; rump blackish; legs and feet brown; tarsus 15 lines long. Summer plumage varied with black and brownish rufous; beneath rufous much paler on the abdomen. Winter dress unknown."—(Nuttall). From the geographical range of this species I have no doubt but that it visits this District, although I have not hitherto met with a specimen of it.

T. Pusilla. Little Sandpiper.
T. Temminckii of Leisler.
Tringa Wilsonii. Baird ?

V.S.P. Upper mandible blackish; lower one orange at the base, black at the tip; bill shorter than the head; legs and feet brownish; irides hazel; eggs unknown.

Dorsal aspect. Line from the nostrils over and beyond the eye cinereous white; crown and interscapulary region black broadly edged and tipped with ferruginous; nuchal region cinereous; rump, scapulars blackish brown, edged with ferruginous on both vanes, except at the tip of the outer vane which is white; small and great wing coverts dusky tipped with ferruginous; lower row of great wing coverts tipped with white; central tail coverts black; lateral ones white; tail rounded, the two central feathers blackish brown, tipped with ferruginous white; lateral ones cinereous deepening in tint from the sides over to the center ones; quills plain clove brown with white shafts.

Ventral aspect: Cheeks, breast, and sides of the breast cinereous with dusky streaks; chin and remainder of the ventral aspect pure white.

1st primary longest; the others graduated; long scapulars longer than the 4th but shorter than the 3rd primary. Length 6 inches; alar expanse $10\frac{1}{2}$ inches; length of bill $\frac{5}{8}$ inch. The *Tringa minuta* and *Tringa Wilsonii,* from their geographical range, may visit us, but I cannot state so with certainty, having never met with either species.

T. rufa. Red-breasted Sandpiper.
T. cinerea. Winter plumage. Linnæus and Wilson ! !
T. canuta, islandica, cinerea, australis, nœvia, grisea of Gmelin !
Macrorhamphus griseus. Baird !

V.S.P. Bill, legs and feet blackish; irides hazel; eggs 4 dun colour spotted red.

Dorsal aspect. Crown, interscapulary region and rump, blackish brown margined with greyish white, which is tinted with rufous on the crown and back; nape of neck cinereous streaked with blackish brown; short scapulars blackish brown edged with pale rufous, and a couple of subterminal spots of the same colour, and tipped with cinereous; long scapulars plain dusky; great and small wing coverts dusky, the lower row of the former broadly tipped with white, and all of them with pale edgings; tail coverts white elegantly barred with blackish brown; tail square, cinereous; primaries clove brown, white on the internal vanes towards the base, with white shafts, and edged with white towards the centre of the outer vanes of all except the first and second.

Ventral aspect. Line from the angle of the mouth to the eye blackish brown; auriculars blackish brown; line from the nostrils to, over, and beyond the eye above the auriculars, pale rufous; throat, breast and sides pale rufous, with faint bars of blackish brown in the latter situation; belly and vent white tinged with rufous; flanks white with zigzag bars of blackish brown; tail coverts white with a subterminal triangular spot of blackish brown; axillaries cinereous with a terminal band of a deeper tint and tipped with white.

1st primary longest; long scapulars longer than the 4th, and shorter than the 5th; the bill is straight, flattened, and rather spoon-shaped at the tip; tip of the upper inflected over the lower and $1\frac{1}{3}$ inch long; legs of moderate size, stout; toes free, margins serrated. Length $10\frac{1}{2}$ inches; alar expanse 21 inches. The above description is taken from a specimen which is moulting from its summer to its winter plumage. Another in its complete winter dress lies beside me, constituting the *T. cinerea* of Wilson. The whole dorsal aspect, including the long scapulars and tail, is cinereous tipped with cinereous white; the lower row of great wing coverts tipped with white; tail coverts white barred with cinereous, and the ventral aspect is white tinged with rufous very dilutely, with specks of dusky on the throat breast, cheeks and sides. The rictu-orbital streak brownish black, and the streak from the nostrils to, over, and beyond the eye, above the auriculars, white. Perhaps there is not a bird whose varieties of plumage in its different ages and states, have caused it to be described under so many different names.

T. semipalmata. Semipalmated Sandpiper.
Ereunetes petrificatus. Baird!

D.C. "Bill shorter than the head, straight, somewhat depressed and enlarged towards the point; rump blackish; middle tail feathers longest. Summer plumage varied with blackish, olive grey, and pale rufous; beneath, except the breast white. Winter dress dark cinereous, beneath principally white; feet semipalmate."—(Nuttall).

Sub genus Totanus.

Sub gen. char. Bill moderate, slender, straight, furrowed to near the middle, compressed, acute, slightly curved at the point; nostrils basal, lateral, linear; inner toe cleft, outer toe connected to the middle as far as the first, sometimes to the second joint; thumb short, slender, barely touching the ground.

T. vociferus. Greater Yellow-shanks.
T. melanoleucas of Viellot and Buonaparte!
Scolopax vociferus of Wilson!
Gambetta melanoleuca. Baird!

V.S.P. Bill black changing to yellow at the base; legs and feet yellow; irides hazel; eggs uncertain or unknown.

Dorsal aspect. Line from the nostrils to, and circumventing the eye white; crown of head brown, margined with white; neck cinereous with brown streaks; interscapulary region, and rump cinereous, margined and occasionally spotted with white; great and small wing coverts, long and short scapulars cinereous, changing to glossy brown on the long scapulars, with marginal triangular spots of white on both outer and inner vanes; tail coverts white wth zigzag bars of brown; tail brown barred with white; quills plain clove brown; the shaft of the first primary white.

Ventral aspect. Chin, belly, vent, central tail coverts, white; throat streaked with brown; sides of the breast brown, with a terminal spot of white on each vane near the tip; flank feathers, axillaries, and lateral tail coverts pure white, with irregular distant zigzag bars of brown; lower surface of the quills hoary.

1st primary longest; long scapulars subequal to the 5th primary. Length $14\frac{1}{2}$ inches; alar expanse 22 inches; length of bill $2\frac{1}{3}$ inches; length of the tarsus $2\frac{1}{3}$ inches; length of middle toe $1\frac{1}{2}$ inch.

T. flavipes. Yellow-shank Tatler.
Scolopax flavipes of Wilson!
Gambetta flavipes. Baird!

V.S.P. Bill blackish; legs and feet yellow; irides hazel; eggs unknown.

Dorsal aspect. Line from the base of the bill to the eye white; another from the nostrils to the eye, brown; crown of head brown edged with white; nuchal region dark cinereous, faintly streaked with white; interscapulary region, long and short scapulars, great and small wing coverts glossy brown, with triangular marginal spots of white, which are tinted with brown on the back; rump white; tail coverts white barred with brown; tail square, white barred with cinereous brown; the two or four central feathers deepest in colour; the lateral ones pale irregularly barred; the side feathers wholly white on the inner vanes, and mottled on the outer; quills clove brown, from the 5th downwards tipped with white.

Ventral aspect. Chin, belly, vent, and central tail coverts pure white; auriculars brown; cheeks, throat, sides of the breast and sides cinereous, the feathers tipped with ashy white and white; flank feathers white, irregularly spotted with cinereous; lateral, tail feathers, and axillaries white, barred with cinereous brown.

1st primary longest; long scapulars subequal to the 5th primary, and longer than the 6th. Length $9\frac{1}{2}$ inches; alar expanse 18 inches; length of bill $1\frac{1}{2}$ inch; length of tarsus 1 inch and about 10 lines to 2 inches.

T. chloropygius. Green-rump Tatler.
Tringa solitaria of Wilson!
Rhyacophilus solitarius. Baird!

V.S.P. Bill black; legs and feet olivaceous brown; irides dark hazel; eggs unknown.

Dorsal aspect. Line from the base of the bill over the eye, white; rictu-orbital line brown; crown of head and nuchal region deep brown, the feathers faintly tipped with white; interscapulary region, long and short scapulars, and great wing coverts glossy olive brown, with a deep sea green iridescence; small wing coverts and rump, plain glossy olive brown; middle tail coverts and middle tail feathers olive brown, with faint marginal white spots; lateral tail coverts and tail feathers white, elegantly barred with blackish brown; primary quills dark blackish brown, with brown shafts.

Ventral aspect. Chin, belly, flanks, and lateral tail coverts with the vent pure white; throat and middle of the breast white, streaked with brown; sides of breast and sides barred with brown, very thickly so in the former place; axillaries white, barred with brown; central tail coverts white with a deep subterminal bar of brown.

1st primary longest; the others graduated; long scapulars equal to the 5th primary. Length 9 inches; alar expanse 15 inches; length of bill from the angle of the mouth $1\frac{1}{8}$ inch; length of the tarsus equal to the bill, *viz.*, $1\frac{1}{8}$ inch.

T. macularius. Sandlark or Spotted Tatler.
Tringa maculata of Edwards!
Tringa (Actodromas) maculata. Baird!

D.C. This bird although exceedingly common, I am unable at present to describe from a specimen, as I cannot obtain one. The following however is from Nuttal:

Glossy olive brown waved with dusky; rump and tail of the same colour as the rest of the plumage; one or more outer tail feathers white barred with black; quills dark olive brown with a large spot of white on the inner web. Adult beneath white with roundish dusky spots; bill yellow below, black towards the tip. Young, beneath white; wing coverts edged but not barred with waving dusky lines; upper mandible blackish.

I have never met the T. Bartramii in this district.

Fam. V. Macrodactyli.

Genus Rallus.

Gen. char. Bill longer or shorter than the head, thick at base, becoming suddenly compressed, grooved for the half length of the upper mandible, curved at the extremity, and the base projecting on the forehead; nostrils in the furrow basal, lateral, more or less linear; toes four; thumb long, not longer than a single joint of the middle toe; wings rounded; 2nd, 3rd, and 4th primaries longest, the flight consequently feeble; tail of 12 feathers, not longer than the coverts.

Subdivision 1st. Bill longer than the head, curved, nostrils linear.

R. Virginianus. Lesser Clapper Rail.
R. Virginianus. Baird!

V.S.P. Bill brown on the ridge, yellow on the lower mandible; legs and feet dusky reddish brown; irides red; eggs 6 to 10, cream colour sprinkled with brownish red and pale purple.

Dorsal aspect. Line from nostrils to the eye, and a spot below the eye white; in front of the eye to the angle of the mouth, a subtriangular black space having the orbits for its base, shaded to slate colour on the sides of the crown, cheeks, auriculars, and sides of neck; crown blackish slate colour; neck, interscapulary region, scapulars, rump and tail coverts, deep blackish brown, with olivaceous brown edgings; great and small wing coverts chesnut; primaries plain dusky; tail short, rounded, and in colour like the primaries.

Ventral aspect. Chin white; sides of the chin, throat, breast, and belly ferruginous; on the sides of the breast tinged with olivaceous, brightest in tint on the breast, and paler on the centre of the belly; flanks and vent black, with irregular whitish bars; tail coverts blackish brown, with a subterminal band of white, tipped with dilute ferruginous.

2nd and 3rd primaries subequal and longest; 1st equal to the 5th; long scapulars equal to the 5th. Length $9\frac{1}{2}$ inches; alar expanse $12\frac{1}{2}$ inches; length of bill $1\frac{1}{2}$ inch.

Subdivision 2. Bill shorter than the head, robust, acute at point; nostrils oblong.

R. Carolinus. Carolina Rail.
Gallinula Carolina of Latham!
Gallinula minor of Edwards!
Porzana (*Porzona*) *Carolina.* Baird!

V.S.P. Bill yellow with a blackish tip; legs and feet yellowish green; irides reddish hazel; eggs uncertain.

Dorsal aspect. Frontlet, space in front of the eye, and centre of the crown black; line over the eye and cheeks ashy; auriculars pale olive; sides of the crown and nuchal region olive; interscapulary region and scapulars olive, with a central streak of blackish brown, and edged with white on the outer vanes; the long scapulars with white on the inner vanes above rump, black, tipped broadly with olive; great and small wing coverts plain olive; tail coverts blackish brown edged with olive, a few of the central ones with white margins; tail cuneiform broadly edged with olive; outer edge of the 1st primary white; outer vanes of the 2nd speckled with white about its centre; all the rest of the quills olive brown.

Ventral aspect. Chin, and line down the throat black; sides of throat, commencing from the cheeks ashy; breast ashy barred with white; sides, and flanks olive barred with ash white; vent and centre of the belly white; tail coverts white, the central ones tinted with yellow.

2nd primary longest; long scapulars equal to the 4th primary; Length $7\frac{1}{4}$ inches; alar expanse $11\frac{1}{2}$ inches; length of bill $\frac{5}{8}$ inch; length of tarsus and middle toe together 3 inches.

R. Noveboracensis. Yellow-breasted Rail.
Gallinula Noveboracensis of Latham!
Fulica Noveboracensis of Gmelin!
Perdix Hudsonica of Idem!
Rallus ruficollis of Viellot!
Porzana (*Columnicops*) *Hoveboracensis.* Baird!

V.S.P. Bill dusky brown, greenish yellow at the base, and for a short distance on the ridge; legs and feet dusky flesh colour; irides hazel; eggs 10 to 16, white, (according to Richardson.)

Dorsal aspect. Frontlet, line over the eye and sides of the neck yellowish brown, faintly barred with dark brown; crown of head, and nape of neck black, with minute white tips to the feathers; interscapulary region, and scapulars, rump, great and small wing, and tail coverts black, with one to two narrow white bars on the feathers, and broadly margined, especially on the scapulars, with yellowish brown: tail cuneiform, short, black, with irregular, scarcely conspicuous, bars of white, not more than three in number; quills dusky, with a subterminal faint bar of white; auriculars brown, with a minute subterminal bar of white.

Ventral aspect. Chin yellowish white; throat, breast, and sides brown internally, the remaining half of the feathers, first faintly white, succeeded by yellowish brown, and tipped with brown, giving these parts a wavy appearance of brown, yellowish brown, and faint white; belly white; flanks and vent black, with a couple of narrow bars of white; tail coverts black with a subterminal narrow bar of white, succeeded by brown and tipped with white.

1st and 2nd primaries subequal and longest; the long scapulars subequal to the 3rd primary. Length $6\frac{2}{3}$ inches; alar expanse 10 inches; length of bill $\frac{2}{3}$ inch; length of middle toe and tarsus 2 inches and 1 line. This rail is very scarce indeed, having been only met with in the extensive swamps on the southern shore of the St. Lawrence in the neighborhood of Sorel.

Genus Fulica.

Gen. char. Bill shorter than the head, strong, conical, compressed, deeper than broad at the base; mandibles furrowed on each side at the base, equal; upper mandible projecting over the lower at the sides, and its base spreading on the forehead; lower mandible navicular; nostrils lateral, longitudinally cleft, semi-closed; all the toes connected at the bases with a scolloped membrane; 2nd and 3rd primaries longest.

F. Americana. Common Coot.
F. atra of Wilson!
Fulica Americana. Baird!

V.S.P. Bill yellowish at the base, succeeded beyond the nostrils by a chesnut ring, tipped horn colour; frontal callosity white, with a rhomboidal chesnut coloured spot; irides red; legs and feet yellowish green; eggs uncertain.

Dorsal aspect. Crown of the head, cheeks, nuchal region, slaty black; interscapulary region and scapulars slaty black, tinged with olive; tail coverts olive black, great and small wing coverts and tail slate colour; primaries dusky, the outer vane of the first primary edged with white, and the secondaries which are slate, tipped with white.

Ventral aspect. Chin and throat black; breast pale slate with faint tips of slaty white to the feathers; belly and vent pale slate colour, the whitish bars more numerous, but irregular, thus giving this part a whiter appearance; flank feathers slate tinged with olive; tail coverts white.

2nd primary longest, 1 and 4 equal; long scapulars equal to the 2nd primary; length $16\frac{1}{2}$ inches; alar expanse 27 inches; length of tarsus 2 inches; length of middle toe to the heel including the nail $3\frac{1}{4}$ inches.

(To be continued.)

ARTICLE XXXIV.—*On the Cattskill Group of New York. By* Prof. JAMES HALL. *A Letter addressed to Principal Dawson, dated Albany, October,* 1862.

Having furnished you with a considerable number of specimens of Devonian fossil plants, from the State collections, and from my own cabinet, for study and description, I have felt not only great interest in the matter, but much solicitude in regard to the geological position of some of them; and this feeling has been increased by studying your list of specimens with reference to the geological formations, for it seemed to me that there were some results not quite in accordance with palæontological laws, and that there was reason to question the geological order assigned to the specimens.

A considerable number of these had been collected by myself or under my immediate direction many years since, and of these I feel secure; but there were others which, though obtained from authenticated localities of the *Cattskill group*, had not been collected by myself; and in regard to some of these and some of the others not of my own collecting, I believe I expressed doubts, though the greater proportion were reliable.

Late investigations, combined with those heretofore made, have forced upon me the conviction that the greater part of the area colored on the geological map of New York as *Cattskill group*, is in fact occupied by the Portage and Chemung groups.

Several years since, in making sections across the country from north to south, and through the counties of Albany and Schoharie, I ascertained that the Hamilton group, as indicated by its well marked and characteristic fossils, extends to the southern limit of the coloring indicating Chemung group, on the geological map, I am now prepared to show that the Hamilton group in the counties of Albany, Greene, Schoharie, Otsego, and a part of Chenango, with the exception of some outliers on the higher hills, occupies nearly the entire belt colored as Chemung, the southern line corresponding very nearly with the limit assigned to that formation; thus leaving the Chemung group with its southern limits still unassigned.

The investigation of the extent and limitation of this group has been beset with difficulties, both towards the west and east of the typical region in southern central New York. In tracing to the eastward the strata of the Chemung group, we find them gradually assuming a coarser character, attended by a diminution of the number of fossils, both of individuals and of species. With the accession of coarse materials comes diagonal lamination, and abrupt changes in the nature of the sediment, with other attendant features indicating a deposit of littoral character.

Until within a few years the State collection had been nearly destitute of fossils from the rocks of Delaware county, which according to the map is occupied by the Cattskill group. Some time since Prof. Orton, late of the Normal School in Albany, sent to the State Cabinet numerous specimens from the so-called Cattskill group of that region, and they were thus arranged; but I readily recognised nearly all of these as characteristic Chemung fossils. Although obtained within the area colored as Cattskill group, it was still possible to suppose that they might have been derived from transported masses, and no investigation having been made to decide this question, the matter rested.

More recently, Mr. J. M. Way, of Franklin, Delaware County, has directed his attention to the fossils of his neighbourhood, particularly to the fish remains, which he has found in considerable abundance. From loose and scattered masses he has been able to trace the specimens to their position in the hill slopes, and has ascertained the existence of no less than three distinct beds containing these ichthyic remains. Associated with the latter, he has found numerous shells which are typical species of the Chemung group; and these he has traced to near the tops of the highest hills in Franklin, and occupying large areas of what have been regarded as the unequivocal Cattskill group. Mr. Way has sent collections of these fossil remains to several geologists in the country, with a view of obtaining information to aid him in his researches.

Having since personally examined the region in question, I do not hesitate to say that we have in the fossil remains taken together the most unequivocal evidence of the occurrence of the Chemung group in these localities. A section from the north side of the Susquehanna river to the high hills in the south part of Franklin gives the following beds, the characters of which I have not yet studied in detail, and the thickness given may be regarded as approximate:—

1.—Greenish-gray sandstones and shaly sandstones; 100–150 feet to top of hills.

2.—Fossiliferous band with scales, bones, and teeth of fishes; *Aviculo pecten?* and a few Brachiopoda. (Remains of plants occur a little above the animal remains.)

3.—Greenish and gray sandstones, shaly sandstones and shales; about 150 feet.

4.—Fossiliferous band, containing bones and teeth of fishes; Brachiopoda and Lamellibranchiata, among which the *Spirifer mesostrialis*, Hall, is abundant, and *Cypricardites chemungensis* of Vanuxem is common.

5.—Sandstones and shaly sandstones, similar to those above, but less greenish, and sometimes more heavily bedded; between 100 and 150 feet.

6.—A fossiliferous band, similar to the one above, with the same species of fossils, and conspicuously marked by a compact argillo-calcareous band with carbonate of iron, and consisting largely of crinoidal remains in small fragments. Crinoidal bands of precisely similar character occur in the Chemung group in the central and western part of the State.

7.—Non-fossiliferous shale and shaly sandstone, embracing flagstones aud sandstones; about 100 feet.

8.—Red shale and shaly sandstone, with numerous fucoidal remains; 400 to 500 feet.

9.—Greenish and gray shales and shaly sandstones, with darker shales to the top of the Hamilton group; the thickness not well ascertained.

10.—Hamilton group.

Associated with these fossiliferous beds, and more conspicuously with the upper ones, we have bands of a peculiar greenish shaly conglomerate or cornstone, which likewise contain fish remains. These cornstones, with their fossil remains, were noticed by Mr. Vanuxem in his report upon the adjacent country.

There is a thickness of between 1,000 and 1,200 feet above the Hamilton group, the lower half of which is not yet known to be fossiliferous beyond the fucoids in the red shaly sandstone.

This red shaly sandstone and the dark and green shales below, together with the non-fossiliferous beds of No. 7 of the section, represent the Portage group; while the upper members are always marked by characteristic fossils of the Chemung group.

I have carried forward observations across the country from the Susquehanna to the Delaware river, and up to the "head of the Delaware" at Stamford; and I am satisfied that in the region to the north and west of the west branch of the Delaware, and to a great extent (if not entirely) the east and west branches of the Delaware, there are no beds of rock of more recent age than the Chemung; and, from what I have seen elsewhere, I am inclined to believe that until we ascend the slopes of the Cattskill mountains, and rise to an elevation of at least 2,000 feet above tide-water, we find no rocks of newer age than the Chemung group.

The Cattskill group has been compared with strata newer than the Chemung group, and consisting mainly of red and greenish shales and shaly sandstones. I am now satisfied that the red shaly sandstone near the base of the section, as here presented, has misled most of those who have heretofore investigated these rocks; while at the same time the harder and more arenaceous character of the Hamilton rocks in their eastern extension (in which character they simulate the Chemung rocks,) has caused them to be identified with the latter. I am satisfied, moreover, that through this means Mr. Vanuxem was misled; and though I have not re-examined the section at Mount Upton, the locality of the characteristic bivalve shells, I am not willing to believe it will prove to be newer than Chemung, even if it be much above the top of the Hamilton.

You will perceive, therefore, that all the specimens of plants sent you as coming from the Cattskill group are really from beds of the Chemung group proper; and, so far as possible in this hastily written note, I have given you my reasons for adopting this belief.

In looking back to the history of the adoption of the term Cattskill group, it would appear that there was not entire unanimity as to its signification in some points, among the geologists of the 1st, 3rd, and 4th districts.

Prof. Mather, in adopting the term, says it includes Nos. 9, 10, 11, and 12 of the Pennsylvania Survey; while Mr. Vanuxem restricts it to No. 9. As both these gentlemen placed it above the Chemung group as defined in central and western New York, I regarded it (without having made personal examination) as identical with a red shaly sandstone and conglomerate which clearly comes in above the Chemung in the adjacent counties of Pennsylvania bordering the 4th district. Having considered the Chemung group as No. 9 of the Pennsylvania Survey, I regarded the red rock with Holoptychus as No. 11; the conglomerate, No. 10, had not been recognised in my district, or adjacent to its southern limits.

I consider that at this time there can be no doubt that the Chemung group is identical with No. 9 in the original nomenclature of the Pennsylvania Survey; and the term Chemung group having been adopted, and well understood in its relations and signification, and well marked by its fossils, we cannot with any propriety continue to extend the term Cattskill group over a large area occupied by the older rocks, and well characterised by their contained fossils.

Mr. Mather, in his descriptions of the rocks, has recognized the Chemung group as lying below the Cattskill group, but, as I have shown, the area colored by him as Chemung, is really Hamilton group; and it now becomes necessary to restrict the term *Cattskill group* to the beds above, or to those formerly known as X and XI of the Pennsylvania Survey.

Adopting this view, which is imperatively required of us, some modification is necessary in the reference of certain fossils; but I am satisfied that it will remove one great cause of misunderstanding relative to the groups of strata on the confines of the coal measures; and we shall avoid the complication which must ensue from referring the same species of fossils to two distinct groups of strata, according to the present application of our nomenclature.

On reference to the Geological Reports of New York, you will observe that the fossils of the Cattskill group, given in the 1st and 4th Districts, are of plants, with two species of shells. The red shaly sandstone, (called old red sandstone or Catskill group,) resting in outliers on some of the higher hills in the 4th district and occuring in continuous strata in Pennsylvania near the southern limit of New York, did not afford specimens of these plants or shells; while the scales and other remains of Holoptychius are the characteristic fossils of the rocks in these western localities. But so far as I am aware, no scales of Holoptychius have been found in the area colored as Cattskill group in Delaware and the adjacent counties on its west.

In tracing the Chemung group westward, there are many indications that it may yet require to be restricted in its designation. The Waverly sandstone group of the Ohio Reports, at one time regarded as entirely equivalent to the Portage and Chemung groups, may in its upper members constitute a distinct group, though we do not yet know any line of demarcation between them.

ARTICLE. XXXV.—*Some observations relating to the physical condition of the superficial deposits in Canada.* By CHARLES ROBB, ESQ. C. E. Montreal.

(Read before the Natural History Society, Nov. 1862.)

I.

The structure of the fundamental rocks of Western Canada and their geographical boundaries, have been thoroughly ascertained and defined by the Provincial geologists; and from the simplicity of that structure, the regularity of their sequence, and the slight alteration both in position and mineral character, which they have undergone since their original deposition, this part of their task would have been comparatively easy, were it not for the thick masses of clay, sand and gravel which for the most part envelop and conceal them. Athough the *Drift*, as these superficial deposits are called, is one of the most recent of all the geological formations, its date being immediately before the creation of the existing species of organized beings, it seems remarkable that its precise nature and origin should be less clearly understood than those of the more ancient rocks on which it reposes. Apart from the interest attaching to the subject in a purely scientific point of view, its investigation is of the utmost practical importance in an agricultural country like this; as such knowledge is calculated to render material aid in understanding the nature and durability of our soils, and in determining the best methods of developing their resources and preventing their deterioration. To these investigations, in so far as they refer to Lower Canada, Dr. Dawson has devoted much attention and made many valuable contributions, and in the Upper Province the researches of Professor Chapman of Toronto, and of Mr. Robert Bell, under the direction of Sir Wm. Logan, have thrown much light on the subject; and we may shortly expect to be put in possession of the result of their combined labours in a lucid and condensed form by the publication of Sir Wm. Logan's elaborate General Report on the Geology of the Province.

The three accomplished observers whom I have named agree, upon independent grounds, in dividing the superficial deposits of Canada into a lower and upper member; the former consisting chiefly of dark blue and greyish clays, the debris of the underlying limestone, and nearly destitute of boulders; and the latter of sand and gravel of granitic and gneissoid origin, with numerous boulders. Throughout Lower Canada, and as far west as Kingston, the relative age of these deposits has been determined by appropriate fossils of recent or existing species; and although these are wanting in the Upper Province, the analogy is presumed to be established by other characteristic features. The fact to which I would desire to call your attention, and which I am not aware of having been previously observed, is that the older formation prevails almost exclusively in Western Canada on the elevated platform bounded on the east and north by the Niagara escarpment, which sweeps in a bold and abrupt manner from the Niagara river round the head of lake Ontario, and northwards to Cabot's head on Lake Huron, forming a very marked feature in the physical geography of the Province. The whole of the country, for a great distance to the east of this line, and especially towards the base of the escarpment, is thickly strewn with sand, gravel and boulders of Laurentian origin; while to the west these are of very rare occurrence, and are replaced by materials evidently derived from the disintegration of the underlying limestone rocks. From the Niagara escarpment westward to the height of land near Woodstock, this difference is less marked than from that point still farther west to the shores of Lake Huron. The influence which I would draw from these facts is one which corroborates the view which has been entertained by Sir Charles Lyell and others, who have examined the physical geography of Canada; namely that the contour of the fundamental rocks of the country has been impressed upon it at an epoch long anterior to glacial or drift period; and that the elevated platform of the western peninsula, if not actually above the level of the sea at that period, was sufficiently high to resist the intrusion of the ice islands charged with the debris of the Laurentian and other more ancient northern rocks, which would be drifted by the glacial currents from the north-east.

The chemical composition of the drift clays of the more westerly parts of the province, as compared with those of the east, offers a remarkable corroboration of this view. By the analysis of Mr. Hunt, a specimen of the sub-soil clay from a district west of London, and which may be taken as an exponent of the constituent elements of the clays of the whole western district, yielded not less than 29.40 per cent of carbonate of lime; while a similar specimen from the Niagara district gave only 15.30 per cent. In fact, in some of the few places in the west where the rocks and calcareous shales are exposed they may be seen decomposing into clay; while the fossils and fragments of stone found in the clay are sharp and angular, indicating that they have not travelled far from their native beds. Probably this fact of the great excess of calcareous matter in the western soils may account for the superior nature of the timber which grows there, as well as for the superior fertility and early period of their vegetation and harvests.

II.

Many of the facts connected with the physical condition of the superficial deposits in Canada, and especially of the vast ochre-beds and deposits of marl, bog iron-ore, &c., are attributable to the existence of powerful chemical actions which have been for indefinite periods, and still are in action at no great distance from the surface. I beg to call attention to certain phenomena illustrative of this subject, which have partly come under my own observation, and partly been related to me by trust-worthy witnesses. No doubt similar facts might be discovered in many other parts of the Province, should they happen to come under the notice of competent observers.

In the month of October, 1859, I visited the farm of a friend who resides on the 1st lot of the broken front range on the road passing through Arkona village, in the township of Bosanquet. This point is, according to the determination of our Provincial Geologists, immediately on the line of junction of the Corniferous limestone and Hamilton shales of the Devonian formation; and as it has been observed that metallic deposits occur most frequently in the neighborhood of such junctions, which may possibly affect their formation, it may reasonably be inferred that some connection exists between the phenomenon I am about to relate and the existence of such deposits. I am not prepared to give an exact explanation of the causes of the proximate chemical reactions which are found in operation at the locality in question; still less do I feel competent to offer any solution of the vexed question of the origin and mode of formation of mineral lodes; I shall simply relate the facts as a slight contribution to our knowledge of the chemical geology of some of the superficial deposits, and possibly also of the formation of metallic veins.

The river Sable flows through the lot in question at its northern extremity, and at the distance of about 200 yards to the south their occurs upon this lot a tract of low-lying ground running parallel with it, the intervening space being for the most part a marl-bed. In this dell or ravine numerous springs exist, which constantly pour forth large quantities of water strongly impregnated with iron; the water on coming to the surface is clear, transparent and colorless, but with a strong ferruginous taste; and very shortly after exposure to the air it yields an oleaginous-looking scum of a highly iridescent appearance, which floats on the surface of the ditches, but quickly dissipates and subsides to the bottom, forming a deposit of hydrated peroxide of iron or ochre, which is found here and in some of the neighboring lots in beds varying from one to three feet in thickness, and of an extent and quality which seems to be economically available, although much mixed with vegetable remains. The springs impregnated with this ferruginous matter penetrate a bed of clay about ten feet in thickness, and where they are strongest appear to have excavated holes in the clay-bed, forming natural wells; but it is a remarkable fact that they appear to run in veins in a south-easterly direction, as there occurs between two of the strongest springs at a short distance apart another very powerful and deep spring, which is comparatively free from ferruginous matter. This latter spring which has entirely cut away the clay to a diameter of about six feet, forming a well as regular as if artificially excavated, apparently yields remarkably pure and clear water, and is intermittent in its action, occasionally throwing up the water with great violence to the height of about eighteen inches above the surface, as if from the effects of gaseous pressure applied under the source of the water.

I should here state that the rocks of the country abound in iron pyrites, and loose masses of this substance are found abundantly strewed all around.

In this natural well, my friend who resides on the lot found, on probing the quick-sand at the bottom, with a pole to a considerable depth, a long straight wooden twig about an inch in diameter, with a little bag of deer-skin tied to one end with a thong of the same material, and coated all over with a bright metallic substance resembling tin, and which on submitting a portion of the stick to my friend Dr. Hunt, he pronounced to be of the following nature and origin: "The specimen of wood is very interesting, in as much as the hard metallic coating is *Iron pyrites*, formed by the decomposing action of the organic matter of the wood upon the sulphates in the water, in presence of a solution of iron. The same reaction takes place when oxide of iron is put into a close vessel with any vegetable matter, sulphate of lime being present; and such, or a similar process, I conceive to have intervened in every case where metallic sulphurets are found in nature."

For what purpose the twig with the leather bag had been used and how long it had been immersed in the water, I am unable to state, nor have I had any opportunity of ascertaining the chemical composition or temperature of the water yielded by the springs referred to. At one place I observed that the water was very sour to the taste, and probably contained a small proportion of free sulphuric acid. I was informed that occasionally the air in this ravine was oppressively hot and sulphurous, and that when a slight fall of snow would lie in other parts of the lot, it would rapidly melt here. A salt well occurs at no great distance from this place.

Towards the southeast of the spot more immediately referred to, and at a distance of about half a mile from it, there occurs a series of remarkable pits or depressions in the earth, some long and irregular, but mostly conical or funnel shaped, and ranging in a line with each other and with the hollow where the springs are situated, but at a considerably higher elevation. The conical pits are remarkably regular in shape, and judging by the eye, may be about 50 feet in diameter by about half that in depth. That they are of very recent origin is proved by the fact that in more than one instance I found trees of no very great age growing perpendicularly to their sloping sides.

I have now to direct attention to a very singular and interesting occurrence at the locality in question, which, taken in connection with the details I have already given may throw some light on the subject of earthquakes and their associated phenomena. The facts I have now to state are given on the authority of my friend who resides on the lot, and whom I know to be a very intelligent and trustworthy observer; and as it is best that facts of this nature should be given circumstantially, and in the language employed by the observer at the time of their occurrence, I shall quote from his own letter written within two days after the event; premising that the frame house in which he dwells is situated on a rising ground immediately above, and in full view of the hollow in which the remarkable springs occur.

BOSANQUET, 8th January, 1861.

.... "One singular occurrence which happened on the 6th inst., I will state as fully as my time will permit. Having retired to bed for the night about 9 o'clock, p. m., we had scarcely lain down when my wife became alarmed, by the appearance of flashes of light entering our bedroom windows; and supposing the house on fire, to satisfy her I got up, looked out and around, and found all right. I noticed the flashes of light before my wife did, but supposing she might be alarmed needlessly said nothing. After laying down, it appeared two or three times again, the light continuing for about two seconds or so each time, accompanied at this time by a dull rumbling noise of about six or seven distinct pulsations. The light appeared to shine and the noise to come from a point about four or five chains up the hollow above the large spring north of the house, and within two or three chains of the house. The sky was somewhat clouded at the time; the sounds were very distinct and abrupt; and the reflection of the light appeared a mixture of pale red and intensely bright but mild light.

"Next morning a neighbour met me on the road, and asked me what I thought of the curious 'phenomenon,' as he called it, we had lately. On asking him what he referred to, he stated that his son-in-law, who has lately built a house on the corner of the clearing next to us, and in the line of, and between two of those pits or depressions the range of which I pointed out to you the day you left us—the two pits and house range S. E. with the hollow below our house, where the deep spring is, and about 25 or 30 chains S. E. from the spring—his son-in-law told him that he heard curious noises the previous evening, that the log-house shook, and some tin dishes were thrown from the shelves to the ground, and that next morning he observed a line of vapor along the line of the depressions, which vapor seemed to be ejected upwards in several places with considerable force; it was about daylight the next morning that the vapor was seen. I noticed it too when I went out early in the morning, at which time there was a rapid thaw. I went to the great spring to see the effect of the thaw on the ditches. I did not then notice any difference, except a depression in a part of the hollow below the spring, as if of late occurrence, and a large increase in the limbs, twigs, etc., which still continue to be thrown up. For the last two weeks the spring has been precipitating in the channel flowing from it, a very large increase of coloring matter, and of a deep clear red color." ....

The inference which I would draw from all the circumstances I have so minutely detailed is, that powerful chemical reactions are at the place referred to, in constant operation at the surface or in fissures of the rocks underlying the superficial deposits, decomposing the pyrites and converting it into the sulphate of protoxide of iron, which is soluble in water and is brought to the surface by the springs, and then receiving oxygen from the atmosphere, and being affected by the alkaline solutions also contained in the water, is again changed with the insoluble peroxide and precipitated on the surface of the ground, forming an ochre bed. The abstraction of the material thus displaced will, in the long process of these operations, leave cavities under the surface which must be filled by the subsidence of the superincumbent earth in the same manner as is often observed in places where coal beds have been entirely excavated and abandoned. I have little doubt that the remarkable dell or ravine which I have described is of this nature and origin; and that the series of isolated pits or depressions ranging in the same line with it is only a continuation of it, but at a less advanced stage of formation.

To account for the oxidation of the pyrites, which I have supposed to be the primary cause of all these phenomena, is not such an easy matter, unless we can conceive it to exist in the bowels of the earth in a minutely subdivided state.

"It is well known," says Sir Charles Lyell, "that mixtures of sulphur and iron sunk in the ground and exposed to moisture give out sufficient heat to pass gradually into a state of combustion, and to set fire to any bodies that are near. If a large quantity of clean iron filings be mixed with a still larger proportion of sulphur, and as much water as is necessary to make them into a firm paste, let the mixture be then buried in the earth and the soil pressed firmly down upon it. In a few hours it will grow warm, and swell so as to raise the ground. Sulphurous vapors will make their way through the crevices and sometimes flames appear. There is rarely an explosion, but when this happens the fire is vivid and if the quantity of materials is considerable, the heat and fire both continue for a long time."

The spontaneous combustion of beds of bituminous shale and of the refuse coal thrown out of mines is also generally due to the decomposition of pyrites—and it is the contact of water, not of air, which brings about the change. A smouldering heat results from the various new combinations, which immediately take place when the sulphur and other substances are set free. Similar effects are often produced in mines where no coaly matter is present, when substances capable of being decomposed by water are heaped together.

This explanation may suffice to explain in a general way not only the production of the ochre beds from the decomposition of pyrites, but also the flames, vapors, and pulsations and subsidence of the ground.

The deoxidation of the protoxide of iron dissolved in the water, and its reconversion with the sulphuret through the agency of the organic matter of the wood, is a highly interesting and instructive fact, and throws much light on the origin not only of bog iron ores but on the formation of mineral deposits in general. It affords a striking illustration and coroboration of the theory now generally received among chemical geologists, that the origin of the metallic sulphurets found so copiously in nature is due to a similar reaction through the agency of organic matter on the soluble sulphates contained in the primeval waters; but on this point we cannot at present enter.

ART. XXXVI.—*Remarks upon Prof. Hall's recent publication, entitled: "Contributions to Palæontology."* BY E. BILLINGS.

I have this day (4th November, 1862) received by mail a publication by Professor James Hall of Albany, purporting to be a continuation of Appendix C, of the Fifteenth Annual Report of the Regents of the University of New York.

On page 169 there is the following notice:

"*Twelfth Annual Report of the Regents on the State Cabinet.*

THE first seventeen pages of the palæontological part of this Report were printed and stereotyped in January and the early part of February, 1859; and nearly one hundred copies were distributed immediately thereafter. The entire report was printed and published previous to the 20th September, 1859; and any person, procuring proof sheets from the printer "*in the beginning of the month of August,*" must have obtained the sheets at least as far as page 56, which had been printed in the early part of July. The proof sheets of the Tenth Report were in like manner *procured from the printer*, as fast as issued. Similar practices have been resorted to by interested parties, with respect to other reports; proof-sheets having been obtained from the printing-office, many months in advance of publication: and I wish simply to record the fact in this place. I had supposed that authors considered such proceedings disreputable, and I scarcely believe that there can be a difference of opinion among gentlemen in regard to acts of this kind. [See Canadian Journal of Industry and Science, N. S. No. 34, p. 355; and Canadian Naturalist and Geologist, Vol vi, No. 4, p. 317.]

The two articles, in the "Canadian Naturalist" and "Canadian Journal," referred to at the end of the above quotation were written by me and published under my name; and it would appear therefore that Professor Hall is desirous of having it understood that I procured the proof sheets of some of his works before publication. In answer to this charge, so unfairly made, I shall only say that I never procured either directly or indirectly a vestige of the proof sheets of any of his works either before or after publication, with one exception, and this by no fault of mine. The circumstances are as follows, and they are well known to him. In Silliman's Journal for July, 1859, p. 149, I saw a notice of a pamphlet of 18 pages, published by Prof. Hall. This was the portion of the Twelfth Annual Report referred to by him in the above quotation and which he says was printed in January and February, and published "immediately thereafter." As the criticism in that Journal pointed out that Prof. Hall had described one of my genera under a new name, I naturally felt desirous of seeing the work. No copy had been sent to our survey, although according to his own showing it had been published five months. I wrote to a friend in Albany to procure one for me. I did not ask for the proof sheets but for the work itself. My friend could not get a copy but sent me several loose leaves, some of which were evidently proof sheets, as they were printed only on one side and had some corrections in the margin. There were 25 pages and 17 of these had been published as above stated some months previously. The other 8 pages contain the genera *Nucleospira*, dated by him 1857; *Trematospira*, 1857; *Rhynchospira*, 1857, *Tropidoleptus*, 1856, and part of *Leptocœlia* 1856.* Now, when an author places dates after the

* It is of great importance that the dates of genera and species should be correctly given at first. Many of Prof. Hall's are either erroneous or ambiguous. I do not admit that those here cited are the true dates.

names of his genera, he gives the public to understand that he has described the genera in question in some other work, published at the time indicated by those dates. On Prof. Hall's own showing therefore, the first 17 or 18 pages of the sheets in my possession had been published about five months, and the substance of the other 8 pages two or three years before I procured them. He says that there must have been 56 pages, but this assertion is totally untrue; I received only 25.* An intimate friend of his saw them in my room, and informed him that I had some of his proof sheets. This same friend afterwards called and said he had been instructed by Prof. Hall to inquire into the matter. Fearing they might get some innocent person into trouble (although I could not see how), I refused to give him any further information than he possessed; and, besides, removed the sheets from my office, and never saw them again until this day. The above are all the facts relating to these proof sheets, and the reader can see that it was not intended to take any advantage of Prof. Hall; and, further, that the work came into my hands in the form of sheets quite accidentally, and with no desire on my part to procure it in that form. Prof. Hall is well aware of all the circumstances, and why cannot he give a true and fair account of them. By blending a mere particle of truth with a great deal that is not true, he has magnified 25 pages obtained unintentionally after publication, into whole volumes of proof sheets procured designedly before. This is only a continuation of the unfair treatment I have received from him during the last four years.

It may be that the proof sheets of the tenth and other reports mentioned by him were obtained by parties interested in their contents, but they never were by me; and yet by a special reference to two articles well known to have been written by me, he makes it appear that I procured them. I would recommend all persons

* In one of my papers I have said 18 pages, but I had not the work before me, and supposed I had only the number mentioned in Silliman. I have, in order to make certain, looked them up and find that there are 17 leaves, the first nine of which were printed on both sides, and the other 8 on one side only. There were thus, just 25 printed pages besides the title page. The fact of the last 8 leaves being printed on one side only, convinces me that the work had only proceeded as far as page 25 when these sheets were procured. I shall always believe therefore that the description of *Triplesia* on page 44 (of the 12 Rep.) was drawn up after Prof. Hall had seen my description of *Camerella*.

who may have occasion to read Prof. Hall's papers to examine them closely, as it is not unusual for him—especially in questions of priority—to arrive at decidedly erroneous conclusions.

I shall now proceed to point out a few palæontological errors in his new work.

1. The genus *Cryptonella*, illustrated on Pl. 3, p. 133, is precisely identical with *Charionella*, described by me in the Canadian Journal of March, 1861, p. 148 and illustrated in the May number, p. 273, 274. It includes the species described by Prof. Hall in the Thirteenth Report under the names of *Meristella Haskinsi*, *M. Barrisi*, *M. Doris*, *Terebratula Lincklœni*. *T. rectirostra* *T. lens*, *and T. planostria*. Besides these the *Atrypa scitula* of the N. Y. Reports, *C. Circe*, and apparently a number of European species belong to it. *Cryptonella* was first published in July or August, 1861, three or four months after the learned author became acquainted with its characters through the study of my papers.

2. *Centronella impressa*, Pl. 3, figs. 1–5, is *C. Hecate* published by me in the Canadian Journal, May 1861, p. 272. The date of Prof. Hall's description is July or August of the same year.

3. *Euomphalus* (*Straparollus*) *Clymenioides*, Pl. 6, fig. 3, is *Straparollus Canadensis* described by me in the begining of July 1861, in the Canadian Journal Prof. Hall's species was published in October 1861.

4. At page 166 we have the plate with the suppressed figure of Conrad's genus *Cypricardites*, well copied in full. Palæontology is indebted to me for the publication of this important plate. Had I not described the genus *Cyrtodonta*, I fear it would have remained for ever in the dark. The reason given by Prof. Hall for publishing it now is simply that I charged him, in a respectable journal, with holding it in his hands for eighteen years without publication. I here reiterate that charge. There was no mention made of this figure in any of Prof. Hall's publications from the time it was drawn in 1840, or thereabouts, until the yea 1859. His ideas with regard to the laws of scientific nomenclature are not correct. The rule applicable in this case is, that if a name imply that the genus belongs to a family, order, or class different from that to which it does actually belong, then it should be changed. For example, if the Trilobite *Bathynotus* were to be called *Bathyocrinus* or *Bathy-*

osaurus, it could not be retained, no matter how long in use, because it would be absurd to give a Trilobite a name which would imply that it is a Crinoid or a Saurian. So with *Cypricardites*. The name implies a close affinity with *Cypricardia*, a genus of the family CYPRINIDÆ, while the fossils to which Prof. Hall would apply it belong to a different family, ARCADÆ, or rather to a group which appears to form a passage between that family and AVICULIDÆ. The name *Athyris*, quoted by Prof. Hall as affording an analogous case, is quite a different instance. It does not refer the genus to any family, and is only objectionable when used for species with a perforated beak. And for this reason, some of the best palæontologists reject it altogether. Even Mr. Davidson who still uses it, says that he would have adopted D'Orbigny's generic name *Spirigera*, had he not been influenced by other authors (British Carboniferous Brachiopoda, p. 79). The greatest authority on the Brachiopoda thus retains *Athyris* for shells with perforated beaks, simply in deference to the views of others and contrary to his own convictions.

5. The genus *Zygospira*, p. 126, is not separable from *Atrypa*. The connection of the two spires is not of generic importance. The same structure occurs in *Spirifera*, some species of which have the spires connected and others not. *Atrypa modesta* is scarcely distinguishable from *A. erratica* (*Orthis erratica* of the Pal. N. Y., Vol. 1), and this latter again passes into *A. Headi*. In these two species the shell structure is precisely that of *A. reticularis*. I have referred them to *Athyris*, at the same time stating that it would become necesssary to place them in the genus *Atrypa*, should the position of the spires be found similar to those of that genus. (See New Species of Lower Silurian Fossils, June 1862, p. 146.)

6. *Orthis emacerata*, Pl. 2, figs. 1, 2, 3, is not separable from *O. testudinaria*.

7. The mistakes with respect to *Barrandia* and *Clioderma* were first pointed out by me, and so were the affinities between *Rhodocrinus* and *Thysanocrinus*. The corrections are published in this book as if they were original.

8. Specimens of *Phragmostoma* from Tennessee in my possession have a circular aperture in the septum.

ART. XXXVII.—*Remarks on* Tænia pectinata. *In a letter from Dr. T. Spencer Cobbold, M.D., F.L.S., London (England), to Professor Lawson, Queen's College, Kingston.*

(For the Canadian Naturalist.)

39 Norland Square, Notting-Hill, LONDON, W.,
Monday, September 22nd, 1862.

MY DEAR SIR,—You have rightly conjectured that I am still interested in Entozoa, and I thank you much for your thoughtful consideration in troubling yourself to send me some Cestode parasites. You may be sure Pouchet and Verrier's observations have not escaped me, and I flatter myself very few other authors who write on Entozoology are unknown to me by name or otherwise.

The tape-worms you have so kindly sent are very interesting specimens.* I make no doubt that they are referable to the

TÆNIA PECTINATA, Goeze.

T. pect. also of Schrank, Gmelin, Rudolphi, Batsch, Bremser, Dujardin, and Diesing.
T. acutissima Leporis of Pallas.
T. Leporina, Limbourg.
T. Cuniculi sylvestris, Doubrenton and Marigues.
T. Marmotæ, Frölick.
Alyselminthus pectinatus, Zeder.
Halysis pectinata, also of Zeder.

Nine out of every ten zoologists would have described your worm as a new species, but I protest against the system which some here adopt of never looking up the older writers.

Hitherto this worm has only been noticed in the hare (*Lepus timidus*), rabbit (*L. cuniculus*), and marmot (*Arctomys Marmota*), and therefore its occurrence in *Hystrix dorsata* is a novel fact of very considerable interest.

This Cestode is very like (at first sight) a new tape-worm just discovered by Leuckhart, as infesting the human body and dogs in North Greenland (*Bothryocephalus cordatus* of Leuckhart); but its essential characters are very different. In *B. cordatus* the

* The specimens were obtained from the intestines of the Canada porcupine (*Hystrix dorsata*), male and female individuals of which were shot by Mr. Fox and Mr. Moore during one of Prof. Lawson's expeditions to the Rideau and Gananoque Lakes.

head (as seen under the microscope) presents quite a different appearance, whilst the reproductive organs are differently disposed. In those you sent me they are *all on one side*, but some of the above-mentioned authorities state that their position is sometimes reversed. This I suspect is an error.

Yours very truly,

T. SPENCER COBBOLD.

Prof. George Lawson, LL.D.

ARTICLE XXXVIII.—*Col. E. Jewett, of Albany, on the geological age of the rocks of New York, heretofore referred to the Old Red Sandstone.*

The following account of the important discovery made by Col. Jewett is given in the Fifteenth Annual Report of the Regents of the New York University.*

"A few week since, an interesting collection of teeth and plates of fishes, supposed to be from the Old Red Sandstone of Delaware county, was received at the Geological Rooms. The Curator was directed to visit the locality, for the purpose of enlarging the collection. The following is his report.

ALBANY, September 20, 1862.

DR. WOOLWORTH, Secretary of Regents, &c.

Agreable to your directions, I went to Delaware county, to collect fossils from the Catskill group, or Old Red Sandstone.

At Franklin I found Mr. J. M. WAY, a gentleman who for years has been examining the rock and collecting the fossils ; and although he is unacquainted with any other localities, and has never seen a collection of fossils, he has succeeded in investigating the whole strata of the neighborhood, and collecting many fossils. With his assistance, I was able to make a section from the Oleout creek to the top of a hill about three miles southwest of the vil-

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*I received a letter from Col. Jewett in September last, containing the results of his researches in the so-called Catskill group. It will be observed by another paper published in this number that Prof. Hall indirectly associates himself with the discovery; but I am informed that he did not visit the locality until after Col. Jewett had been there and decided the question.—E. B.

lage of Franklin, more than 800 feet in thickness. The base is a brick red shale, with occasional red argillaceous sandstone, about 400 feet. On this is about fifty feet of greenish shale; on which lies a stratum of gray sandstone, with teeth and plates of fishes, and fossils of the *Chemung group.* Seventy feet of green shale lies on this fossiliferous stratum; when another thin band of fossils, with gravel and the same formation, continues with alternate shale and gray sandstone and fossils to the top of the hill, where the Chemung fossils are more numerous. Spirifers, Rhynchonellas, Pectens and Athyres are found in all the strata of the upper three hundred feet, and the whole formation is undoubtedly Chemung.

I examined other localities with the same result.

Mr. Way has examined the rock as far as Deposite (twenty-five miles southwest), with great care, and finds the same formation. He has also collected the same fossils at Delhi, seventeen miles southwest.

From my investigation, I believe there is no Old Red Sandstone in this State. I found no forms among the fish remains like those of the Old Red Sandstone of Great Britain, but we have plates far larger than those found there.

The Teeth closely resemble those described by Dr. Newberry, from the Corniferous rocks of Ohio and New York.

Respectfully your obedient servant,

E. Jewett."

MEETING OF ENTOMOLOGISTS.

In accordance with the suggestion made in the June number of the *Naturalist*, that a meeting of those interested in the study of Entomology, should be held in Toronto, during the Provincial Exhibition, a number of ardent votaries of this branch of science assembled at the residence of Professor Croft, on Friday evening, September 26th. The following gentlemen were present:—Rev. Prof. Hincks, F.L.S., and Prof. Wilson, LL.D., of University College; Thomas Cottle, Esq., Woodstock; Thomas Cowdry, Esq., M.D., York Mills; W.L. Lawrason, Esq., London, C.W.; Beverley R. Morris, Esq., M.D., Toronto; E. Baynes Reed, Esq., and William Saunders, Esq., London, C. W.; and Rev. C. J. S. Bethune, B.A., Cobourg:—a very fair representation, on the whole, of the Entomologists in the western portion of the Province. Several gentlemen signified their regret at being unable to attend, in consequence of other engagements, while they expressed at the same time their hearty approval of the objects of the meeting.

Its first and great object was, naturally, the formation of an Entomological Club, or Society. After some discussion upon the subject, it was decided that, in consequence of the smallness of the number present, no definite organization should be formed as yet; but that another meeting should be held during the ensuing spring, due notice of the time and place being previously given to all interested. It was further agreed upon, that the objects of the contemplated society should be,—first, the formation of as complete a collection as possible of Canadian Insects, to be kept in some central place for general information and reference; secondly, the charge of a depository of duplicate specimens contributed by Entomologists for distribution among its members; and thirdly, the holding of meetings from time to time for mutual information, and the advancement of the science throughout the country at large.

The greater portion of the evening was most pleasantly spent in examining and admiring the very extensive and beautiful collections of Prof. Croft, as well as those of others kindly contributed for the occasion. A brief enumeration of their several points of interest will not, it is hoped, be out of place here. First and foremost, must be mentioned the large and varied collections of both native and foreign Insects displayed by Prof. Croft,—among the former, his Longicorns and several other families of Coleoptera, attracted general observation, both from the rarity of many of the specimens, and the completeness of the series; and among the latter, his huge Chinese beetles—including the *Dynastes Herculi*,—and magnificent moths, were very much admired. Too much indeed, cannot be said of his various collections, the inspection of which so greatly enhanced the enjoyment of the evening.

Dr. Morris exhibited a number of rare specimens of Lepidoptera, among which may be mentioned *Polyommatus epixanthe*, a new addition to our Canadian butterflies; *Darapsa myron*, *Sphinx Kalmiæ* and other Sphinges; that pretty Lithosian *Gnophria vittata*, etc. He also brought a number of Coleoptera, as well as several interesting specimens of both orders collected by him in the neighbourhood of Portland, Me.,—of these last, his specimens of *Satyrus alope*, *Strangalia fugax*, *Chrysochus auratus*, and *Meloe ?*—were particularly fine.

Mr. Saunders (who took the first prize for his collection of Insects at the recent Provincial Exhibition) brought a number of the rarer specimens to the meeting. The most remarkable among them were :—that magnificent butterfly *Papilio thoas*, not itself a native specimen, but yet highly interesting as being a representative of a species occasionally found in Canada; *Terias liza*, *Melitœa phœton*, *M. ismeria*, *Thecla acadica*, (a new species discovered by Mr. S.,) *T. niphon*, *Lycœna Scudderii*, (with specimens of which he will be happy to supply any Entomologist,) *Polyommatus dorcas*, *P. Comyntas*, and other rare butterflies. His undetermined specimens of Hesperidæ, and Sphingidæ also attracted notice. This gentleman with characteristic liberality, brought also a large case of duplicate specimens for distribution among all who wished for them.

Mr. Reed, who had just returned from a visit to the old country, exhibited a complete collection of English butterflies, the specimens of which were very perfect, and also some ingenious apparatus for collecting purposes, including a pocket butterfly net, lantern for attracting Noctuadæ, etc.

Mr. Lawrason brought a very remarkable specimen of the group *Sphingina*, captured in the vicinity of London, C. W. It has been submitted to the inspection of several eminent Lepidopterists and is considered by them as quite *sui generis*, differing from anything they had ever seen before.

Dr. Cowdry exhibited a number of English specimens of Lepidoptera and Coleoptera, chiefly conspicuous among which were the moths *Anthrocera filipendulœ*, *Callimorpha Jacobœœ*, several *urculionidœ*, etc.

Rev. Mr. Bethune contributed specimens of several rare insects, including the butterfly *Melitœa mylitta;* a very beautiful sphinx, *Thyreus nessus;* a new species of *Cicindela*, some foreign *Cetonias*, etc.

Mr. B. Billings, of Prescott, though unable to attend himself, kindly sent up several cases of interesting specimens, among which were a number of rare and beautiful *Longicorns*, several *Elaters*, some very fine *Noctuadœ*, and a butterfly new to Canada *Polyommatus cratœgi*.

His brother, Mr E. Billings, of the Geological Survey, Montreal, also contributed a few handsome Chinese specimens, and several rare and interesting native Coleoptera.

On the whole, it may be safely affirmed that never before in Canada had such large and varied collections of insects been brought together; the only cause of regret was that there were not more Entomologists to inspect them. The few that were present, however, enjoyed the occasion to the utmost, only separating at a late hour, with grateful thanks to Prof. Croft for his kind hospitality, and unanimous expressions of delight at the pleasant evening they had spent.

Thus passed the first meeting of Entomologists ever held in Canada, the inauguration, it is trusted, of better days and brighter prospects for this, hitherto, much-neglected branch of natural science. May the recollection of it serve as a stimulus to incite those who were present to increase their exertions in this delightful pursuit, and induce others also to look into the world of insects,—an investigation which cannot fail to be replete with unalloyed pleasure!

C. J. S. B.

PROCEEDINGS OF THE NATURAL HISTORY SOCIETY OF MONTREAL.

Aug. 25th. Ordinary monthly meeting; Dr. Hingston, Cor. Sec. in the Chair.

Messrs. B. Hutchins, J. McArthur, B. Dawson, T. C. Griffith, J. Lovell, and C. Freeland were elected ordinary members.

After the usual business, the following donations were presented:—

A crab, several fishes and aquatic plants, for the aquarium. By Jas. Ferrier, Junr. Esq.

Skin of white American Pelican, a field mouse (*Arvicola*), also five skins of fishes from Lake Superior. By G. Barnston, Esq.

Specimens of *Limulus polyhemus* from Orchard Beach. Dr. Dawson.

With several other donations for which the thanks of the Society were voted.

Sept. 29. Ordinary monthly meeting; Dr. Dawson, Vice-President, in the Chair.

Messrs. D. M. Patterson, Percival Winning, and G. A. Holland, were elected ordinary members.

After the usual business, the following papers were laid before the Society and discussed:

On the Physical Geography of Newfoundland, by M. H. Perley, Esq., President of the Natural History Society of New Brunswick. Communicated by the Nat. Hist. Soc. of New Brunswick for publication in the *Naturalist.*

On the Footprints of *Limulus* as compared with the *Protichnites* of the Potsdam sandstone; by Dr. Dawson. This paper published in the *Naturalist*, was explained and illustrated by the author with the aid of specimens and drawings.

On the Apple-tree Borer; by W. Couper, Esq., Quebec. This paper, also published in the *Naturalist*, was illustrated by specimens of the animal and its work, presented by Mr. Couper.

A specimen of the Silkweed (*Asclepias cornuti*) was exhibited by the Hon. Mr. McGee, and a discussion ensued as to the value of its silky coma, and the tough fibres of its bark, as substitutes for cotton and hemp.

The following donations were presented:

Specimens of the young of *Limulus polyphemus.* By Mrs. P. Redpath.

Gold-fish and eels, for the aquarium. By Jas. Ferrier, Junr. Esq

A collection of fish from the St. Lawrence; a large specimen of *Amia ocellicauda* from Lake St. Peter; a specimen of the Canada jay; eggs of *Emys picta.* By Mr. William Hunter.

Continuation of the voyage of the frigate Eugenies. From the Academy of Stockholm.

Oct. 27th. Dr. Dawson, Vice-President in the Chair.

The following donations were presented:—

From James Ferrier, Junr. Esq., Fishes for the Aquaria.

From G. Barnston, Esq., several skins of fishes from Lake Superior, also the skin of a young beaver.

From Mr. W. Hunter, a specimen of *Picus hirsutus.*

From Dr. Van Courtlandt, specimens of *Gasterosteus* and *Leucisus.*

From Dr. Dawson, a paper on Carboniferous Reptiles from Nova Scotia, by Prof. Owen.

From the Lit. and Phil. Society of Manchester, vol. 1, and vol. 2, part 1st, of its Memoirs; with various periodical publications from different donors.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF AUGUST, 1862.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in tenths.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	29.914	29.894	29.831	60.1	85.1	72.0	.456	.775	.601	.88	.65	.78	N. E. by E.	N. E. by E.	S. by E.	60.00	2.0	....	....	Hazy.	Cum. Str. 2.	C. Cirr. Str. 4.
2	794	753	832	60.1	89.9	68.5	.456	.894	.642	.88	.64	.92	W. S. W.	S. W.	S. by W.	22.80	2.5	....	....	Fog.	C. C. Str. 6.	Clear.
3	853	818	814	65.1	92.0	73.3	.583	.768	.617	.94	.51	.77	S. by E.	S. S. W.	S. S. W.	2.80	2.5	....	....	Fog.	Cu. Str. 4.	Str. 2.
4	797	748	832	68.1	93.6	76.5	.543	.755	.765	.79	.48	.84	S. by W.	S. by E.	S. W.	64.20	1.0	....	....	Cirr. 2.	Clear.	Hazy. Aur. Bor.
5	680	615	724	70.1	89.0	70.1	.592	.802	.557	.83	.57	.77	S. by W.	S. S. W.	N. N. E.	142.70	2.0	....	....	Cirr. Str. 2.	C. C. Str. 4.	Clear.
6	863	859	796	61.1	79.2	64.3	.398	.658	.563	.79	.67	.94	N. N. E.	N. N. E.	N. N. E.	56.50	1.5	....	....	Clear.	Cirr. 2.	Cu. Str. 4.
7	30.005	886	830	57.6	89.1	69.6	.378	.093	.572	.81	.64	.72	E. by N.	S. S. E.	S. S. E.	51.00	2.0	....	....	"	C. C. Str. 8.	Rain.
8	29.641	646	834	61.1	79.8	72.1	.480	.850	.631	.91	.85	.81	S. W.	S. S. W.	S. W.	166.80	2.0	0.563	....	Cu. Str 10.	C. Cum. 4.	Clear. Aur. Bor.
9	627	514	469	63.7	89.9	73.0	.409	.942	.624	.70	.68	.79	W. by N.	S. S. W.	W. S. W.	99.70	1.0	....	....	Clear.	Cu. Str. 2.	"
10	382	735	779	68.9	85.6	69.3	.510	.643	.485	.75	.48	.72	S. S. E.	S. W.	W.	96.30	1.0	....	....	Cirr. Str. 10.	Clear.	"
11	745	796	624	62.4	88.4	72.1	.376	.778	.496	.69	.59	.64	S. W.	S. W.	S. W.	90.20	1.5	....	....	Clear.	"	Cu. Str. 8.
12	585	714	866	68.3	81.6	57.0	.457	.738	.357	.69	.69	.78	S. W.	W.	W. by S.	280.80	1.0	....	....	Clear. Dist. thu. in ni.	C. Cum. 4.	Clear.
13	933	885	921	51.4	78.3	60.2	.252	.588	.374	.68	.62	.73	W.	S. W.	S. W.	1.00	1.0	....	....	"	Clear.	Str. 4. Aur. Bor.
14	730	667	646	56.4	75.7	64.2	.336	.484	.497	.75	.56	.88	S. W.	S. W.	S. W.	137.50	2.0	....	....	C. C. Str. 10.	Cu. Str. 10.	Rain.
15	666	645	706	48.1	73.2	59.0	.285	.624	.439	.85	.70	.88	S. W.	W. by N.	W.	295.60	2.5	0.161	....	Cirr. Str. 10.	" 4.	Cirr. Str. 10.
16	899	875	957	49.2	71.1	54.2	.272	.509	.308	.78	.68	.74	W.	W.	W.	129.90	1.0	....	....	Clear.	C. C. Str. 4.	Clear.
17	30.101	30.094	30.056	43.1	74.2	61.6	.209	.376	.406	.75	.47	.74	W. S. W.	W. S. W.	S. W.	56.40	1.5	....	....	Light frost.	Clear.	"
18	29.900	29.857	29.751	51.4	79.2	65.0	.270	.612	.278	.72	.62	.83	S. W.	S. W.	S. W.	39.60	1.5	Inapp.	....	C. C. Str. 4.	C. C. Str. 8.	Cu. Str 4. Aur. Bor.
19	797	30.000	830	61.8	78.2	64.0	.390	.626	.464	.74	.65	.77	S. W.	S. W.	S. W.	63.20	1.0	....	....	Clear.	Clear.	Clear. Aur. Bor.
20	841	29.853	928	60.4	82.2	65.1	.426	.610	.483	.82	.56	.78	S. W.	S. W.	N. by E.	84.20	1.5	....	....	"	C. C. Str. 8.	Cu. Str. 10.
21	962	860	928	51.4	71.6	64.1	.296	.365	.464	.79	.47	.77	N. E. by E.	N. E. by E.	S. by W.	126.70	2.0	0.160	....	C. C. Str. 10.	Cu. Str. 4.	Clear Solar Halo.
22	656	541	588	60.1	69.2	70.1	.487	.635	.537	.94	.90	.77	N. E. by E.	N. E. by E.	S. by W.	149.10	3.0	0.601	....	Rain.	Rain.	" Comet visible.
23	566	30.100	922	64.2	74.6	53.3	.464	.577	.251	.77	.64	.68	W.	S. W.	W. by N.	252.24	2.0	Inapp.	....	Cum. Str. 4.	Cum. Str. 10.	Clear.
24	30.140	110	30.077	43.8	74.1	54.2	.209	.396	.314	.75	.48	.86	W. by N.	S. W.	S. W.	82.40	1.5	....	....	Frost.	Clear.	"
25	29.918	29.780	29.725	47.2	77.2	70.1	.273	.689	.516	.85	.60	.70	S. W.	S. W.	S. W.	134.60	1.0	....	....	Frost.	"	Cu. Str. 10.
26	691	644	710	67.9	77.2	67.8	.516	.689	.556	.77	.69	.84	S. by W.	S. by W.	S. W.	61.20	1.5	Inapp.	....	C. C. Str. 10.	Rain.	C. C. Str. 4.
27	750	730	731	52.1	76.2	54.2	.334	.577	.308	.86	.64	.74	N. E. by E.	N. E. by E.	S. by E.	72.50	1.5	....	....	Cu. Str. 4.	Clear.	Clear.
28	604	513	446	60.2	72.1	62.2	.456	.631	.449	.88	.81	.85	S. E.	S. by E.	S. by E.	10.00	1.0	Inapp.	....	C. C. Str. 10.	Cirr. Str. 10.	Cu. Str. 4.
29	625	698	750	51.1	60.3	53.0	.296	.255	.321	.79	.49	.80	W. by N.	W. by N.	W. by N.	310.40	1.0	....	....	Clear.	" 4.	" 4. Aur. Bor.
30	30.030	30.010	971	40.1	70.0	56.2	.182	.516	.363	.73	.70	.81	W. by N.	S. W.	S. W.	140.40	1.5	....	....	Frost.	Clear.	Clear.
31	29.887	29.806	654	52.0	80.6	62.2	.315	.711	.429	.83	.68	.77	S. W.	S. W.	S. W.	155.00	1.5	....	....	Clear.	"	"

REPORT FOR THE MONTH OF SEPTEMBER, 1862.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	29.346	29.204	29.214	60.1	64.2	63.2	.487	.529	.543	.94	.89	.94	S. W.	S. W.	S. W.	201.90	3.0	0.976	....	Rain.	Rain. Dist. Thunder.	Rain.
2	347	564	797	49.1	55.2	45.2	.297	.263	.206	.85	.64	.69	S. W.	W.	W. by N.	325.58	1.5	....	....	Cu. Str. 8.	Cirr. Str. 4.	Clear. Aur. Bor. at 2 a.m.
3	892	896	30.022	40.1	66.1	54.0	.203	.438	.335	.82	.68	.80	W. by N.	W. by N.	W.	63.20	1.5	....	....	Frost.	Clear.	" Aur. Bor.
4	902	820	29.830	50.0	83.4	70.4	.290	.597	.586	.82	.53	.80	S. W.	S.	S. W.	109.40	1.0	....	....	C. C. Str. 9.	Cu. Str. 8.	"
5	821	772	840	70.2	77.2	70.1	.592	.841	.621	.83	.91	.85	S. W.	S. W.	W.	116.60	2.0	Inapp.	....	C. Cum 4.	Rain.	"
6	811	798	890	57.1	57.7	54.0	.436	.459	.396	.94	.97	.96	N. E. by E.	N. E. by E.	N. E. by E.	237.20	3.0	1.261	....	Rain.	Rain.	Rain.
7	727	656	710	47.4	66.2	61.1	.311	.509	.449	.93	.81	.85	N. E. by E.	N. E. by E.	S. by E.	92.20	2.0	0.130	....	Cu. Str. 10.	C. C. Str. 10.	Cu. Str. 9.
8	649	534	611	69.2	81.0	63.2	.671	.751	.478	.95	.72	.83	S. E.	S. W.	W.	202.90	2.5	0.587	....	Rain.	Cu. Str. 4.	Clear.
9	937	999	30.037	58.1	72.4	56.0	.400	.631	.363	.84	.81	.81	W.	W.	S. W.	203.10	1.0	....	....	Clear.	Clear.	" Aur. Bor.
10	30.047	30.019	025	50.2	79.7	68.2	.290	.606	.577	.82	.60	.85	S. W.	S. W.	S. W.	18.60	1.0	....	....	"	"	"
11	29.984	29.904	29.868	50.1	84.7	67.2	.309	.577	.496	.85	.49	.77	S. W.	S. W.	S. by W.	7.50	1.5	....	....	"	"	"
12	747	720	816	65.1	74.1	62.1	.549	.436	.491	.89	.53	.88	S. by W.	S. by W.	N. N. E.	136.59	1.5	0.110	....	C. Cirr Str. 4.	Rain.	Cum. Str. 8.
13	904	30.014	30.134	60.4	68.4	50.0	.396	.356	.283	.76	.53	.78	N. E. by E.	N. E. by E.	N. E. by E.	249.40	1.0	....	....	Clear.	Clear	Clear.
14	30.241	150	030	45.2	69.1	54.2	.251	.543	.335	.94	.79	.80	N. E. by E.	S. E.	S. E.	68.50	1.0	....	....	Cirr. Str. 10.	Str. 2.	"
15	29.938	29.954	29.963	54.1	64.0	53.0	.335	.497	.321	.80	.83	.80	S. W.	S W.	S. W.	0.80	2.0	0.304	....	C. C. Str. 4.	Rain.	"
16	30.050	30.000	30.004	45.0	66.1	53.0	.251	.400	.328	.84	.61	.83	S. W.	S. W.	S. W.	6.80	1.5	....	....	Clear.	Clear.	"
17	29.951	29.964	29.976	42.0	68.4	56.3	.244	.443	.351	.91	.65	.87	S. W.	S. W.	N. E. by E.	102.89	1.5	....	....	Fog.	"	"
18	704	575	700	56.7	71.3	69.1	.398	.537	.571	.90	.71	.82	S. W.	S. W.	S. W.	139.20	1.0	....	....	Cu. Str. 4.	Cu. Str. 10.	"
19	736	785	937	64.0	70.9	59.2	.490	.571	.410	.81	.84	.82	S. W.	S. W.	S. W.	66.10	1.5	Inapp.	....	C. C. Str. 8.	C. Cum. 4.	" Faint Aur. Bor.
20	970	940	816	39.1	79.4	63.0	.195	.386	.491	.82	.87	.88	S. W.	S. W.	S. W.	19.90	1.5	....	....	Clear.	Clear.	"
21	913	30.927	30.106	48.1	72.0	50.2	.285	.496	290	.85	.64	.82	S. W.	S. W.	S. W.	24.10	1.0	....	....	"	"	"
22	30.047	29.910	29.926	42.1	78.2	62.1	.222	.671	.466	.83	.71	.85	S. by E.	S. W.	S. W.	11.10	2.0	....	....	"	"	"
23	29.870	675	580	44.4	86.2	68.4	.202	.557	.543	.74	.54	.79	S. S. W.	S. by W.	S. W.	36.90	1.5	....	....	"	"	"
24	612	739	839	54.2	65.6	45.0	.341	.542	.258	.83	.87	.88	N. W.	W.	W.	116.20	2.5	0.164	....	Rain.	Cu. Str. 4.	" Faint Aur. Bor.
25	430	789	832	44.2	67.9	56.0	.224	.431	.391	.79	.66	.87	W.	S. W.	S. W.	30.30	1.0	....	....	C. C. Str. 10.	Clear.	" " " "
26	819	797	863	45.1	73.0	60.1	.228	.476	.439	.76	.59	.88	S.	S. W.	S. W.	103.40	1.5	....	....	Clear.	"	" " " "
27	855	847	864	57.0	83.4	64.0	.413	.597	.497	.90	.53	.83	S. W.	S. W.	S. W.	148.19	1.0	....	....	"	"	" Aur. Bor.
28	805	712	741	54.1	78.6	64.2	.362	.619	.497	.87	.64	.83	S. W.	S. W.	S. W.	10.70	1.5	....	....	Cu. Str. 4.	Cirr. Str. 4.	" Faint Aur. Bor.
29	704	654	842	56.0	66.6	54.1	.398	.463	.362	.90	.71	.87	S. W.	N. E. by E.	N. E. by E.	39.30	1.5	....	....	" 4.	C. C. Str. 10.	Cu. Str. 8.
30	972	978	30.071	39.1	44.2	34.0	.261	.157	.162	.91	.55	.87	N. E. by E.	N. E. by E.	S. by E.	105.90	2.5	....	....	Cirr. Cum. 4.	" 4.	Clear.
...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

REMARKS FOR AUGUST, 1862.

Barometer....... Highest, the 24th day, 30·140 inches.
Lowest, the 28th day, 29.446 "
Monthly Mean, 29.792 "
Monthly Range, 0.694 "

Thermometer... Highest, the 4th day, 93°6.
Lowest, the 24th day, 34°0.
Monthly Mean, 65°61.
Monthly Range, 59°6.

Greatest intensity of the Sun's rays, 105°3.
Lowest point of Terrestrial radiation, 31°2.
Mean of Humidity, ·727.
Amount of Evaporation, 2.97 inches.
Rain fell on 9 days amounting to 1.425 inches; it was raining 15 hours and 40 minutes.

Most prevalent wind, S. W.
Least prevalent wind, the N. by E.
Most windy day the 29th day, mean miles per hour, 12.92.
Least windy day the 13th day, mean miles per hour, 0.04.
Aurora Borealis visible on 6 nights.
Comet visible.
The Electrical state of the Atmosphere has been marked by Moderate Intensity.
Temperature of Thermometer in ground, 65°.0.
Solar Halo on the 21st day.
Frost on 4 mornings.

REMARKS FOR SEPTEMBER, 1862.

Barometer. ...... Highest, the 21st day, 30.106 inches.
Lowest, the 1st day, 29.204 "
Monthly Mean, 29.832 "
Monthly Range, 0.902 "

Thermometer. Highest, the 14th day, 84°9.
Lowest, the 3rd day, 32°2.
Monthly Mean, 59°48.
Monthly Range, 52°7.

Greatest intensity of the Sun's rays, 98°0.
Lowest point of Terrestrial radiation, 30°1.
Mean of humidity, ·791.
Amount of Evaporation, 1.38 inches.
Rain fell on 9 days, amounting to 3.533 inches; it was raining 64 hours.

Most prevalent wind, S. W.
Least prevalent wind, S.
Most windy day, the 2nd day; mean miles per hour, 13.59.
Least windy day, the 15th day. Inapp.
Aurora Borealis visible on 9 nights.
Temperature of the ground at 18 inches. 63°.2.
The Electrical state of the Atmosphere has indicated feeble intensity.

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