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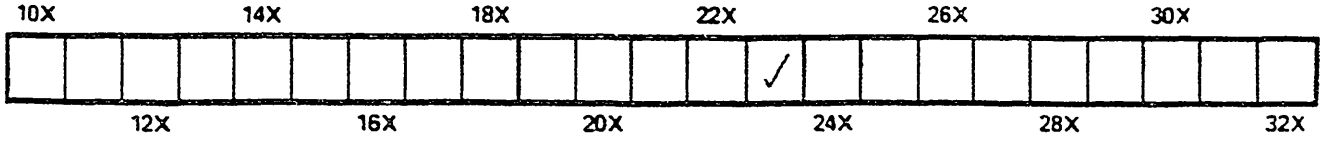

THE

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Naturalist & Geologist,

AND PROCEEDINGS OF THE

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ARTICLE XXIV.—*Recollections of the Swans and Geese of Hudson's Bay.* By GEORGE BARNSTON, Esq., of the Hon. Hudson's Bay Company.

(*Read before the Montreal Natural History Society.*)

The birds comprising the two Genera *Cygnus* and *Anser*, are, with slight exception, the largest of the palmipedes or web-footed fowls found in North America, and being generally difficult of approach, and at same time highly prized as an article of food, any account of their migrations and habits becomes interesting. Of the many who may have enjoyed the relish of a well-seasoned wild goose at the sumptuous banquet, few are aware of the distance the bird may have travelled, or of the many perils, by flood and field, through which it may have passed.

On the coast of Hudson's Bay their manners may be studied to great advantage. There they repose after a long and fatiguing flight, there they enjoy a perfect surfeit on the juicy roots of the swamps, and the tender sprouting herbage of the boundless downs; and there assembled in mass along the sea-girt shore, they follow the never-varying course of the points and headlands, that stand out revealed as the line of march of all their ancestors who have gone before them.

The swan, except in a few particular localities, is a scarce, rather than a plentiful bird, on the shores of Hudson's Bay. Of somewhat ponderous flight, swans are seen at the same time as the other migratory tribes, winging their way to the secluded recesses of the north, resting themselves throughout the interior, and losing units of their number here and there by the Indian's gun. In the scarcity of their favourite food—the tubers of the *Sagittaria sagittifolia*—they have recourse to the roots of other plants, and the tender under-ground runners of grasses, in the higher latitudes. They sometimes breed in the interior, before arriving at the coast. I had two eggs brought to me from the borders of a lake near Norway House, lat. nearly 55° N. But it was impossible for me to say, whether these were of the *Cygnus Americanus*, or *C. Buccinator*. The probability rests with the former.

Towards Eastmain James's Fort, in James's Bay, a considerable number of swans hatch;—a few are killed by the natives there, who watch the game as it passes up and down narrow rivers communicating with the sea, and flowing from lakes of some magnitude scattered over the interior. In the winter months all the northern regions are deserted by the swans, and from November to April large flocks are to be seen on the expanses of the large rivers of the Oregon territory and California, between the Cascades Range and the Pacific, where the climate is particularly mild, and their favourite food abounds in the lakes and placid waters. Collected sometimes in great numbers their silvery strings embellish the landscape, and form part of the life and majesty of the scene. These societies break up as they advance upon their long spring journey to the north. They are then dispersed in small bands and but few together, each of a pair at last separating and betaking to the cares of the season of incubation. In the most secluded and unfrequented districts, where there is ample water range, they rear the young.

Superior to the swans as an article of food, the geese of every species are tenfold in number, and they form the favourite dish of the Indians of Hudson's Bay. When the long and dreary winter has fully expended itself and the Willow Grouse (*Tetrao saliceti*) have taken their departure for more northern regions, there is frequently a period of dread starvation to many of the natives, who are generally at that time moving from their wintering grounds to the trading posts. The first note, therefore, of the

large grey or Canada goose, (*Bernicla Canadensis,*) is listened to with a rapture known only to those who have endured great privations, and gnawing hunger. The melancholy visages brighten, and the tents are filled with hope, to which joy soon succeeds, as the happy father, or hopeful son and brother, returning successful from the hunt, throws down with satisfaction and pride the grateful load.

The *Bernicla Canadensis* here alluded to is the largest of our geese, and is almost always first seen in the Hudson's Bay Company's Territories. It may be only a single straggler which has lost its mate, or at most five or six together. These are the advanced guard of the serried legions of other water-fowl, which nature and instinct send forth every spring from the south, to occupy during the productive summer, the land of the north, and to partake of the plentiful and luscious repasts that Providence has, during their absence, been storing up for them, in a hidden, yet nascent state.

The Canada grey goose, as if aware of the general favor in which it is held, spreads itself diffusively over the whole continent. Its disposition has less of wildness in it than that of the snow goose. We come upon it hatching in quiet recesses and corners, surrounded by reedy waters, where "rushes and grasses do most abound." It is at home over the whole wooded portion of the country, equally so in the extensive marshes of the sea coast, and on the mossy barrens of the Chipewyan and Esquimaux lands. During the winter, like other species, it takes refuge in the more temperate portions of the country, courting always open water. I have seen a flock in the strong open current of the St. Lawrence, above Lachine, near Montreal, in the month of January or February, but such an occurrence is rare. In this latitude, say 45° west of the Rocky Mountains, but especially on the coast of the Pacific, they are plentiful during the whole winter, in mild seasons. Before Oregon was settled by the Americans, the Hudson's Bay Company's post of Fort Vancouver used to be supplied by Indian hunters with grey geese, large and small, as well as with occasional swans and white geese; and this at times so liberally, that a day's rations twice a week could be furnished to an establishment of 30 to 40 men. Some of these geese had been killed by the bow and arrow. This game formed our best rations, but it was seldom in such condition as it is to be had in the north, after it has enjoyed a week or two on the feeding grounds. I have no

doubt that the great mass of the grey geese pass their winter to the south of the Platte waters, in the swamps of Florida and the Lower Mississippi, and on the waters of the western side of the continent, towards their outlets into the Pacific. Now that the rifle and fusee have been introduced so plentifully into California and Oregon, it is to be feared that the numbers of the larger wild fowl will decrease rapidly. The bow and arrow formerly thinned them considerably; now the gun, with an increasing population, will have more fatal effect.

The lesser grey goose, (*Bernicla Hutchinsii,*) arrives in subarctic regions later than the other, and about the same time or shortly before the snow goose, (*Anser hyperboreus.*) They are shot occasionally in the interior when they alight, and in considerable unmbers at Albany, and elsewhere along the coast of James's and Hudson's Bays. Unlike the large grey goose, it can scarcely be said that they incubate in a scattered and detached manner over the whole extent of the wooded country. They rather proceed in large and united bands, keeping a lofty flight, and making few stoppages until they reach the coast. On arrival there, about the beginning of May, they immediately commence feeding in the salt marshes, on the soft white rooted grasses, continuing to do so for a fortnight or three weeks, and at last becoming quite plump, and capital subjects for the table. When fully in good plight, they take their departure for more arctic regions, at nearly the same time as the snow geese, not to appear again until they return with their young broods in the month of September. These smaller grey geese are killed in fewer numbers than the larger species, on their passage to Hudson's Bay, which may be accounted for by their higher and more continuous flight, but once they settle upon their feeding grounds the tables turn upon them, and the slaughter committed in their ranks is wonderful, and would sate the greatest Nimrod that ever waded swamp.

The Brant goose (*Bernicla Brenta,*) the Calliwappemaw of the coast Crees, is but little looked after or cared for in Hudson's Bay, being a small species, keeping out to sea on the shoals, and towards lowest watermark, and affording a dish not in high estimation. Their arrival in the north is later than most of the waders and palmipedes.

The snow goose, (*Anser hyperboreus,*) although it plays a less conspicuous part in the interior of the country, where it seldom alights except along the margins of the larger lakes and streams,

becomes, from its consolidated numbers, the first and greatest object of sport after the flocks alight in James's Bay. The havock spread throughout their ranks increases as the season advances, and their crowds thicken, and even the Indian becomes fatigued with the trade of killing. In the fall of the year, when the flocks of young "wewais" or wavies as they are called are numerous and on the wing between the low tide mark and the marshes, or are following the line of coast southerly, it is no uncommon occurrence for a good shot, between sunrise and sunset, to send to his lodge above a hundred head of game. In such cases the hunter is stationed in what is called a stand—a space from four to five feet square, enclosed by willow twigs and long grass stalks—from which he fires, with forms of geese or "decoys" set up a short distance in his front. The geese fly towards these, when he gives out their peculiar call, and frequently he has his wife or son, or grown-up daughter, to load the discharged gun for him, while he fires with the loaded.

These wavies or white geese form the staple article of food, as rations to the men in James's Bay, and are the latest in leaving the coast for southern climes—an event which takes place towards the end of the month of September, although some weak broods and wounded birds linger behind until the first or second week in October. They are deliberate and judicious in their preparation for their great flight southwards, and make their arrangements in a very business-like manner. Leaving off feeding in the swamps for a day or more, they keep out with the retreating ebb tide, retiring, unwillingly as it were, by steps at its flow, continually occupied in adjusting their feathers, smoothing and dressing themselves with their fatty oil, as athletes might for the ring or race. After this necessary preparation the flocks are ready to take advantage of the first north or north-west wind that blows, and when that sets-in, in less than 24 hours the coast that had been covered patch-like by their whitened squadrons, and wildly resonant with their petulant and incessant calls, is silent as the grave —a deserted, barren, and frozen shore.

The friendly intercourse that exists between these geese and the blue wavies, (*Anser* or *Chen cœrulescens*) has induced some to suppose that they were merely varieties, which is a mistake. The young white wavies arrive from the north with their parents without mixture of other geese, and they have nearly the same white garb as the old birds, but with their heads of a dirty red-

dish tinge, exactly as if they had been rubbed by the hair-dresser with the red rust of iron; and the bill, as is always the case with the young of the feathered race, is tender, soft, and compressible. On the other hand the *A. cærulescens* comes down upon the Eastmain coast, also in perfectly distinct flocks, the young of a more diffused blue colour, as well as being of smaller size. The full-grown blue wavy is besides somewhat larger than the white, and has its flesh most decidedly of a much fairer hue. In the spring, James's Bay is frequently crossed by both species, as far north as Capes James and Henrietta Marie, and occasionally two or three of the blue may be observed in a large flock of the white on the Albany or west shore. White again are seen mixed up to a certain extent with the full flocks of blue on the Eastmain. This is not singular, their cry being almost the same and their habits similar, and they are, it must be allowed, closely allied species.

According to Indian report, a great breeding ground for the blue wavy is the country lying in the interior of the north-east point of Labrador, Cape Dudley Digges. Extensive swamps and impassable bogs prevail there; and the geese incubate on the more solid and the driest tufts dispersed over the morass, safe from the approach of man, or any other than a winged enemy. Neither fox nor wolverine can penetrate to them, nor pass over the deceitful quick bogs to disturb their quiet.

The *Anser Gambelii*, or white fronted goose, called by some the laughing goose, is seldom seen in the southern part of Hudson's Bay. At York Factory they are less rare, but at Churchill frequent enough. I am disposed to believe that this goose is more an inhabitant of Central and Western America during the winter months than of the eastern board. Proceeding northwards, therefore, in the end of April and early part of May, it comes upon the coast of Hudson's Bay towards York Factory, and is scarcely seen in James's Bay. I have not been able to ascertain whether any detachments are met with on the Atlantic coast of Labrador. Do they not feed on the productions of dry downs, and barren and rocky country, in preference to the swamp grasses and algæ? On the Lower Columbia, and in Oregon or the Willamette valley, they abound with other geese, sometimes in nearly equal proportions, and the snow goose still delighting to keep the sea coast, while the *A. Gambelii* and the grey geese take to the rivers and lakes of the interior. These are seldom frozen to the southward of latitude 45°, and very severe weather only

requires from this kind of game in that quarter a slight removal of one or two degrees to the southward.

Of all the geese I have enumerated, the *Anser cœrulescens*, or blue wavy, appears to be the least known in the settled and civilized portions of North America. In May it frequents only James's Bay and the Eastmain of Labrador, and it is probably the case that its hatching ground is on the north-west extremity of that peninsula, and the opposite and scarcely known coast of Hudson's Straits. In the autumn their bands, increased six or sevenfold by the young, return by the same route, but where they winter is the query. I have not seen them on the Columbia nor on the north-west coast. Do they adopt the seaboard on a lower latitude? Are they to be found in winter retreat in Southern California and Mexico?

It is very difficult to form anything like an accurate idea of the numbers of the various species of geese that have just been passed under review. Of the quantity shot at particular points where they become an article of provisions, we may arrive at a wide but still a better estimate. Seventeen to twenty thousand geese are sometimes killed by the Albany Indians in the autumn or fall of the year, and ten thousand or more in the spring, making a total for these coast Crees alone of at least..... 30,000
Not speaking so certainly of other natives, I would place
the Moose Indians as killing at all seasons..... 10,000
Rupert's River natives..... 8,000
Eastmain and to the north, including Esquimaux..... 6,000
The Severn coast I cannot compute as yielding less than. 10,000
The York Factory and Churchill Indians, with Esquimaux
beyond, must dispose of..... 10,000

Making a total of geese killed on the coast of..... 74,000

As many geese must die wounded, and others are got hold of by the foxes and wolverines, we may safely allow the total loss to the flocks while running the fiery gauntlet as equivalent to 80,000. I was at one time inclined to believe that two-thirds of this number was, or might be, the proportion for the autumn hunt, but it is probably nearer three-fourths, and we have thus 60,000 in round numbers brought down from the newly-fledged flocks, as they pass southernward along the bay. I have lately been informed by an old and experienced hunter, that he believes that for every goose that is killed, above twenty must leave the bay without

scaith, as although there is sometimes destruction dire among some lots that approach the gun, and that feed in quarters frequented by hunters, yet innumerable families of them alight on remote and quiet feeding ground, remain there unmolested, and take wing when the cold sets in, with their numbers intact. I must allow the correctness of this remark, and the deduction to be drawn from it is, that 1,200,000 geese leave their breeding grounds by the Hudson's Bay line of march for the genial south. Of the numbers to the westward along the arctic coast, that wend their way to their winter quarters straight across the continent, we can form but a very vague opinion, but computing it at two-thirds or more of the quantity supposed to leave the eastern part of the arctic coast, we cannot have less than two millions of geese, composing the numerous battalions which pass over the continent between the Atlantic and the Rocky Mountains, borne aloft generally like the scud, and as swiftly hastened on, by the force of the boreal blast.

I ought to observe that the Brant geese, *Bernicla Brenta*, are not included in the above estimate. They are pretty numerous on the Atlantic coast, but are quite neglected by the Indians in general of Hudson's Bay.

Two small species of south-west habitat, the *Dendrocygna Autumnalis* and *D. fulva* never come north, as far as I know. I have never seen the first, but have shot one out of a pair of the latter on the banks of the Columbia, above Okanagan. This I daresay is usually its limit to the north, and I believe it has never been seen to the eastward of the great stony ridge. Neither of these elegant little geese ever visit Hudson's Bay.

ARTICLE XXV—*On the occurrence of Graptolites in the base of the Lower Silurian.* By E. Billings, F.G.S., Geological Survey of Canada.

In an excellent work upon the Lower Silurian rocks of *Ehstland* in Russia, by M. Friedrich Schmidt,* the following groups are made out and well authenticated by copious lists of fossils from every division.

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* *Untersuchungen über die Silurische Formation von Ehstland Nord-Livland und Oesel.* Von Mag. Friedrich Schmidt. 8vo. pp. 250. With maps. Dorfrat, 1858.

	EHSTLAND.	NORTH AMERICA.
Zone 3.	3. Borkholm'sche Schicht.	These six divisions represent the Lower Silurian of North America from the base of the Chazy to the top of the Hudson River group.
Zone 2.	2, a. Lyckholm'sche Schicht 2. Wesenberg'sche Schicht.	
Zone 1.	1, b. Jewe'sche Schicht. 1, a. Brandschiefer. 1. Vaginatenkalk.	
Lowest fossiliferous rocks of Russia.	Chloritische Kalk. Thonschiefer. Grünsand. Ungulitensandstein. Blauer Thon.	The Chloritische Kalk holds *Orthides* allied to those of Point Levi. The Thonschiefer graptolites like those of Norman's kill near Albany.

There is little doubt but that Schmidt's Zones, 1, 2, 3 are the equivalents of all the North American rocks from the base of the Chazy limestone to the top of the Hudson River. Schmidt, Eichwald and others have lately greatly added to the number of species in these rocks. In the lists of fossils given by Schmidt in the work cited there are thirty-one species recognized as occurring in the Lower Silurian of America from the Chazy upwards. None of them occur below the Vaginatenkalk in Russia, and none of them below the Chazy in America. In Ehstland the Cystidean *Sphæronites Leuchtenbergii* or *S. pomum* occurs in (1). *Echinosphærites aurantium* in (1), and *E. aranea* in (1). These represent the American Chazy genera *Malocystites* and *Palæocystites*. The genus *Bolboporites* is confined to (1) in Ehstland and to the Chazy in Canada. The genus *Illænus* is most abundant in both countries in the same formations. Of the two Russian species of *Maclurea*, one is found in (1) and the other in (2, a). *Ecculiomphalus Scoticus* occurs in (1), and *E. septiferus* in (1, a)

The Orthoceratites, with large lateral siphuncles, also abound more in the base of the Russian limestones than in the upper strata. Taking all these facts together it seems highly probable that Schmidt's No. 1 represents the Chazy and Black River of North America.

The "Chloritische Kalk," or Chloritic limestone, seems to represent the Calciferous sandrock in part. This rock consists of a calcareous sandstone, with green grains and small globular

concretions. In some localities such as at Reval, Pöddis, Chudleigh, and Narwa, it becomes a magnesian limestone.

In lithological characters it therefore resembles the Calciferous sandrock, which, in the western or undisturbed portion of Canada, abounds in magnesian strata; and in the eastern, where it is expanded to a great thickness by the addition of slates and sandstones holds much chlorite where partially metamorphosed. The fossils cited by Schmidt are *Orthis calligramma, O. extensa, O. parva, O. obtusa, Orthisina plana, Rhynconella nucella,* and fragments of trilobites of the genera Illænus and Asaphus. In the limestones of Point Levi and Phillipsburgh we have three species scarcely distinguishable from *O. parva, O. obtusa,* and *O. plana.* So far as we can judge from external characters *R. nucella* is a *Camerella,* differing from *C. calcifera* in having the beaks closely incurved. The aspect of the Calciferous Brachiopods, so far as they are known, is more like that of the same group of fossils in the Chloritic limestone of Russia than that of any other formation.

The THONSCHIEFER or clay slate lying next below the Chloritic limestone is for us a most interesting formation, as it proves that in Russia there is (in or near the horizon of the Calciferous Sandrock) a ZONE OF GRAPTOLITES. It is described as a bituminous clay-slate, or alum-slate, with no fossils except traces of *Obolus* and an abundance of graptolites. Of these latter Schmidt identifies the following:

Graptolithus Sedgewickii. (Portlock.)
G. serratulus. (Hall.)
Dictyonema flabelliformis. (Eichwald.)

It is not easy to identify species of graptolites, but with respect to the above it should be borne in mind that *G. serratulus* is a remarkable form consisting of two stipes diverging at an obtuse angle; and so Schmidt describes the Russian specimens. In New York it occurs at Norman's kill, associated with another species of the same type *G. divaricatus.* (Hall.) Schmidt may be wrong as to the perfect identity of the species, but his description shows clearly that his specimens must belong to the same group of graptolites. *G. Sedgewickii* is found in Dumfrieshire in Scotland in the Lower Llandeilo slates, far below the horizon of the Hudson River Group. *D. flabelliformis* very closely resembles a Quebec species. Setting aside all questions as to the identity of the species, it is an interesting fact that a naturalist in Russia should find below rocks which represent the limestones of the upper half of the Champlain group, a

slate full of graptolites, at the same time, that evidence is accumulating in Canada, which tends to prove the existence of graptolitic slates associated with the Calciferous Sandrock.

On comparing the Lower Silurian of England with that of America, it is found difficult to point out in the vast column of the British strata, the horizon representing the base of the limestones of the Champlain group. All that can be said on this question is, that there are about twenty species of fossils common to the Lower Silurian of the two countries, and that they all occur in England in the upper half of the Llandeilo and in the Bala group. None of them are found in the lower half. The place of the Calciferous Sandrock would appear thus to be about half way down the immense depth of the Llandeilo formation. But graptolites are found far below this level in England. The Skiddaw slates for instance are described by Prof. Sedgewick, as, "A group of vast thickness, and probably admitting of several subdivisions. In some of its upper beds a few graptolites and fucoids have been found. Generally it is without a trace of fossils. It is the supposed equivalent of the Longmynd Slate, (1*a*) of the Cambrian series.* These slates appear thus to be of the age of the Lower Llandeilo. Yet they hold the following species of graptolites.

G. sagitarius. (Hisimger.)
G. tenuis. (Portlock.)
G. latus. (Mr. Coy.)

Associated with these are compound graptolites allied to species found at Quebec.† According to Prof Hall, *G. sagitarius* and *G. tenuis* are found at Norman's kill along with *G. serratulus* in slates which he considers to belong to the Hudson River group. I fancy that no British Geologist would think of placing the Skiddaw slates at the top of the Lower Silurian.

Again in the lowest slates of the Llandeilo, near the Stiper Stones in Shropshire *G. geminus*, *G. pristis*, and *G. Murchisonii* occur associated with *Theca simplex* (Salter), a species scarcely distinguishable from a *Theca* of which I have specimens from the *Dikellocephalus* sandstone of Wisconsin. These slates belong to the very base of the Lower Silurian, and repose upon the Lingula

* British Palæozoic Fossils. Intr. p. xxi.

† See Salter's note "On new fossils from the Skiddaw Slates." Geologist, Vol. 4., p. 74.

Flags at the Stiper Stones, the true Primordial Zone as recognized in England.* *G. geminus* as I understand occurs in Sweden in the upper part of the Lower Silurian. *G. pristis* ranges through the whole formation in different countries, and I believe that *G. Murchisonii* has a similar extended vertical distribution. A species occurs in the slates of the Quebec group which is clearly allied if not identical with *G. geminus*. On comparing the works of the different authors it will be seen that other species are identified as having not only a great geological but a wide geographical range. It would appear thus that graptolites cannot always be relied upon to show that exposures of rock widely separated from each other are either of a different or of the same age.

In the Primordial Zone of Bohemia no graptolites have been discovered. Of the genus *Dictyonema* one species *D. sociale* (Salter) occurs in the *Lingula Flags* in England, but none of the ordinary graptolites have (unless very recently) been observed in that formation. In Sweden *Dictyonema flabelliformis* and a graptolite which Barrande says has "an appearance analogous to that of *G. pristis*" occurs in the slates of Andrarum, in Angelins Regio *B.* in the true Primordial Zone. It would appear from all this that graptolites are rare in the Primordial Zone and that they abound in every stage of the second Fauna being most numerous in slaty rocks and rare in limestones and sandstones.†

As to their value in identifying strata Barrande observes that as "in general they consist of forms very similar in appearance it is difficult to distinguish them especially when found in fragments. The study of the family is not sufficiently advanced to enable us to recognise with certainty among its types those which may characterise exclusively each one of the three faunæ of the Silurian."‡

I have prepared the above observations in order to show that the occurrence of graptolites in rocks so ancient as those of the Quebec group is not inconsistent with what we know of their geological range in other countries and consequently that we are not compelled to refer all the slates in which they are found in North America to the Hudson River group.

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* See Sir R. I. Murchison's 3rd Ed. of *Siluria*, pp. 39. 50.

† See Barrande's *Parallèle entre les dépôts Siluriens de Scandinavie et de Bohème*, p. 44. And also Angelins "*Palæontologia Scandinavica*," p. iv.

‡ *Documens anciens et nouveaux sur la fauna primordiale et le système Taconique en Amérique*, par M. J. Barrande, Bul. Geo. Soc. France. 2e Series, Vol. 18, p. 288.

ARTICLE XXVI.—*A short review of the Sylviadæ or Wood-Warblers found in the vicinity of Montreal.* By H. G. VENNOR.
(Presented to the Montreal Natural History Society)

Among the many families of birds visiting us during the summer months, and enlivening our woods and orchards with their songs, none are more interesting, agreeable, or useful than the subjects of our present review. Excepting the humming-bird, we find among them the most diminutive of the feathered tribes. Yet, small and insignificant as these tribes may seem to be, they are designed by Providence to fill an important sphere in Nature. If it were possible to strike them off the list, and to leave their post vacant, we would soon find out to our loss that a great blank existed. The chorus of our woods would have lost its charm, and would resemble a grand piece of music, with the lower-toned, and connecting notes taken away. Thus leaving disconnected strains, truly beautiful and sweet in themselves, but, by being disconnected, having lost their charm.

Who can stroll through our woods during spring without being struck by the grand chorus produced by many sweet-noted songsters? But, let him analyze this swelling chorus, and it will be found that the sweet warble of the tiny warblers connecting the rich notes of the tanager, red-bird, thrush, and robin, forms the gentle swell that is so pleasing. This, however, would only be a mere loss of music; worse effects would follow. Soon our groves and forests would have lost their green fresh looks, and our orchards would have ceased to bear fruit; and for this reason—there exist around all vegetation hosts of minute insects that, left unmolested, would soon spread devastation through the vegetable kingdom. Myriads of these insects fall a prey to the thrushes, flycatchers, and swallows, but myriads more lurk and lie concealed beneath the bark, and under the leaves of the trees where neither thrush nor flycatcher could reach them. To this post, or sphere of usefulness, the true warblers are confined. With their bills they probe every crack and crevice of the bark, with their quick eye they glance over and under every leaf.

Think of the amount of good accomplished by even one of these birds in the capture of a parent insect, ready to deposit its eggs; it at least equals the destruction of a thousand caterpillars. The following is the general form of bill:—Slender, straight, and awl shaped; higher than wide at the base, and furnished with bristles; lower mandible straight. It is curious to watch some of

these little birds when on first alighting they commence with the lower branches, and so course their way upward into the tree, searching every nook and corner as they run along. Every now and again by a gentle warble, he lets us know in what direction he is in. Their habits vary considerably in the different species, but in general they frequent woods, groves, and orchards, and subsist on the small insects found among the leaves and beneath the bark of the trees. Some writers have called the warblers a timid and retiring group, but we should say that what looks to be a timid hiding disposition is nothing more than an eager search after their food, in and out amongst the thick foliage of the trees. Instead of being timid, most of them are known to be of a bold and pugnacious disposition. Some of them are decked in the liveliest colors, while others are arrayed in sombre hues. The warblers in general make but a short stay in the Southern States on their way north to breed, so that little can be studied of their habits in that quarter. Here, however, we have abundant opportunity of watching their movements and manner of breeding. We also have a few warblers that pass us early in spring on their way to grounds further north, most of these breed partially here, but their proper breeding-places, as we have before stated, are farther to the north. In general their migratory movements are very quiet, swift, and seldom are observed.

Many of these birds are indeed charming songsters, but I think we may safely say that the majority have hardly any song; or at any rate only a few low notes uttered in a monotonous manner. These latter however are by no means to be despised, nor are their notes unpleasant. All the warblers are migratory here. When Spring with her genial breath has warmed into life the hosts of insects which have been dormant during the winter, Providence has wisely ordered the return of these birds to keep these insects in check; again in autumn when the insect tribes begin to diminish and no longer require to be kept in check, these useful birds speed their way to other climes.

Some of the flycatchers approach very near to the warblers in their general habits, seeming only to differ in shape of bill, that being the same as in the other species of flycatcher. In like manner the warblers in some of their species resemble the flycatchers in habits, but also differ in form of bill. For this reason there has been and still exists a great deal of difficulty in drawing a definite line between the warblers and flycatchers. Nature seems to

delight in joining her various tribes, by, as it were, intermediate species, thus beautifully and skilfully blending one form of structure with another. Audubon in his first genus of warblers, has classed together these intermediate forms, under the title of flycatching warblers. Of these we shall say something in the proper place.

The more we look into the habits of these little birds the more are we impressed with their adaptedness to their position. They are indeed an important wheel in the gigantic machinery of Nature. Audubon has divided this family into five genera, as follows :—

1st. The Flycatching warblers....Myiodioctes.
2nd " Wood " ....Sylvicola.
3rd " Ground " ....Trichas.
4th " Swamp " .....Helinaia.
5th " Creeping " ....Mniotilta.

These five genera include all the wood-warblers known. It is now ours to enumerate as far as possible the species that breed or only visit here. Perhaps it will be as well to state here that although we are only taking notice of the wood-warblers or true warblers, another family of warblers exists, which although differing materially from the one now before us yet partakes somewhat of its characters. I refer to Audubon's family Sylvianæ, which includes the genus Regulus or crested wrens, and the Sialia or blue-birds. It is sufficient here to state that both these genera are represented in this vicinity. But to return, the first group of wood-warblers which claims our attention is that of the flycatching wood-warblers. The birds of this group are very nearly allied to the flycatchers, in their manner of catching their prey, also somewhat in form of bill, but their other habits and general formation class them among the warblers. The Canada flycatching warbler (*Myiodioctes Canadensis*, Lath.) is the sole representative of this group, I think I may say, in Lower Canada. This is truly a northern warbler, never migrating south of Pennsylvania. The majority breed even farther north than Montreal or Quebec, and it is only in spring they may be seen around our mountain; during the warm season they are never met with, and it is for this last reason I consider them to breed further north. However, it is only where the surrounding country is hilly, where the low woods or shrubbery grow in a tangled interwoven mass, where the trickle of the streamlet is heard as it flows laughingly amongst

the tall rank grass, that this warbler delights to dwell; there only, his nest may be seen suspended over the running brook, and his song, simple but not unmusical, heard in all its mellowness. Here he may be seen sitting beside his loved partner, and pouring into her ear notes of joy and love. Here, again, he is seen running along the branches, searching under every leaf, and into every crevice to secure some dainty morsel for his clamorous young. Sometimes he leaves the tree for an instant in pursuit of some favorite insect in the manner of a flycatcher. This flycatching warbler, truly seems to be as a link placed by Nature between the warblers and flycatchers; thus allowing no sudden change of form or habits. The migratory movements of this and indeed of all the warblers are very retiring and are seldom seen. This species has been seen in New Brunswick, Nova Scotia, Newfoundland, and also in the country of Labrador. In all of these places it seems likely it breeds.

Specific characters, (Wilson);—This species is four and a half inches long and eight in extent; front black; crown dappled with small streaks of grey and spots of black; line from nostril to around the eye yellow; below the eye a streak or spot of black descending along the sides of the throat, the breast being marked with a broad rounding band of black composed of large irregular streaks; black wings and tail cinereous brown; vent white; upper mandible, dusky; lower, flesh coloured; legs and feet the same; eye hazel. The female differs only in having the spots on the breast of a fainter hue.

The next group is much more largely represented in this neighbourhood, viz., the wood-warblers, birds of this genus are confined for the most part to the forests, orchards, hedges. They are in fact more useful to man than any of the other genera.

The Yellow-poll wood-warbler (*Sylvicola æstiva*, Wilson)—We have naturally taken this bird first, from its abundance, and also on account of its being so well known. Indeed we need only place its name on the list, without any remarks on its habits as they are so common.

It may be found in every garden in the city that is of any size, helping to rid the plants of vermin. Its nest may sometimes be found in the low bush, at others among the topmost branches of the maple, materials of nest generally flax, hemp, or cotton.

Among the many birds imposed upon by the cow-bunting is this little species, and it is remarkable the amount of ingenuity

displayed by it in baffling the purposes of its tormenter. According to Nuttall's account, this bird when a foreign egg has been deposited in her nest, at once builds a second flooring thus making two stories, the cow-bunting's egg with her own being buried in the lower story. She then lays her complement again, and generally proceeds without further molestation. But nests have been found three stories high thus showing her great perseverance. The following characters are all that are necessary. Color of the whole at first sight of a rich golden yellow, but the back is a little greenish, and the tips of the wings brown; length five inches; extent seven inches.

The Chestnut-sided Warbler (*Sylvicola ictrocephala*, Lath.) This delightful warbler, is one of the first seen in spring, as he darts in and out among the spreading branches of the bass-wood tree. Mountainous country is his favorite place of resort; seldom is he seen about orchards or gardens; being extremely shy, but not exactly timid. His notes resemble those of the preceeding species, but are not so loud. Among the many songsters on which nature has lavished her colours, few are there that can show a plumage as neat and diversified as that of the present species. He is more abundant during spring than at any other time; few individuals breed here. The front and top of our mountain is a favorite place of resort for this bird. It appears that Audubon ransacked the borders of Lake Ontario, and those of Lakes Erie and Michigan, without once meeting with this species. He gives very little account of its habits, as he so seldom met with it; nor could he find any person at that time, that was any more fortunate than himself. It is a pity that Audubon did not take a tour round in this direction, where he could have easily noted their habits.

Specific characters, (Wils.)—Length five inches, extent seven and three quarters. The front line over eye and ear feathers is pure white; upper part of the head, brilliant yellow; the lores and space immediately below, are marked with a triangular patch of black; the back and hind head is streaked with gray, dusky, black, and dull yellow; wings black; primaries edged with pale blue; coverts broadly tript with yellow; secondaries, broadly edged with the same; tail, black, forked, and edged with ash; from the extremity of the black, at the lower mandible, on each side, a streak of deep reddish chestnut descends along the sides of the neck and under the wings, to the root of the tail; the rest

of the lower parts are pure white; legs and feet ash; bill, black; irides, hazel. Female, hind head much lighter yellow, and the chestnut on the sides is considerably narrower, and not of so deep a tint.

The Yellow-crowned wood-warbler (*Sylvicola cornata*, Lath.) —This is another lively and beautiful little warbler, and is, we are happy to state, a regular visitor to our island. Like the preceding, however, they are most numerous during spring, as they pass northward; a few breed in our mountain. Though most of the warblers are extremely unsocial in their habits, this is an exception; they may be seen flying from tree to tree in company, chattering, one to another, as they roam among the branches. As is the case with the majority of the wood-warblers, it prefers low shrubbery to the higher trees; sometimes, however, it may be seen skipping about among the blossoms of the maple tree, in search of its favorite insects. It fixes its nest generally on a branch a few feet from the ground. It is an expert fly-catcher, and also devours great numbers of caterpillars. This species and the preceding are truly useful scavengers in our woods and forests. It indeed very much resembles the fly-catchers. Wilson says: "Though the form of the bill of this bird obliges me to arrange it with the warblers, yet, in its food and all its motions, it is decisively a flycatcher." Seldom is it seen very deep in the woods; the roadside, the garden, and orchard, are his favorite resorts. They are by no means timid, but let you approach very close to them. Labrador seems to be a favorite summer resort for many of our warblers; this species breeds there abundantly. The nest is generally lined with feathers and hair. Their notes are not worthy the name of song, they are nothing more than a twitter, as they fly from bough to bough. The snapping of their bill may be heard at a considerable distance.

Specific characters, (Wilson.)—This species is five inches and a half long and eight inches broad; whole back, tail-coverts, and hind head, a fine slate colour, streaked with black; Crown, sides of breast, and rump, rich yellow; wings and tail black; the former crossed with two bars of white; the three exterior feathers of the latter spotted with white; cheeks and front, black; chin line over and under the eye, white; breast, light slate, streaked with black, extending under the wings; belly and vent, white; latter spotted with black; bill and legs, black.

The Bay-breasted wood-warbler, (*Sylvicola Castanea*, Wilson.)—This warbler is much rarer here than the preceding species, and very few individuals breed in our vicinity. It is very rare all through the U. S., and from all accounts must breed farther north. Likely thay breed in Newfoundland and Labrador. Low thickets and tangled shrubbery are favorite resorts of this species; sometimes they are to be seen running along fence-rails, searching every crevice and hole for their prey. This species, not being mentioned by any European naturalist, must be foreign to that continent.

Specific characters,(Wilson.)—Length of this species,five inches; extent, eleven; throat, breast, and sides under the wings, pale chestnut, or bay; forehead, cheeks, line over, and strip through the eye, black; crown, deep chestnut; lower parts, dull yellowish white; hind head and back, streaked with black, in a grayish buff ground; wings, brownish black, crossed with two bars of white; tail, forked, brownish black, edged with ash, the three exterior feathers marked with a spot of white in inner edges; behind eye is a broad oblong spot of yellowish white. Female has much less of the bay color on her breast. Bill, black; irides, hazel.

The black-poll wood-warbler, (*Sylvia striata*, Lath. and Wilson.)—We have now before us a plain plumaged, but neat bird. He seems, like the yellow-crown warbler, to hold an intermediate place between the flycatchers and warblers, having the manners of the former, and the form of bill of the latter. They are rare around this city. Thickets are their favorite breeding places, as they there find their favorite food, and are safe from all intrusion. It may sometimes be seen among the branches of the tallest trees, and while there, their notes are so low, that they can scarcely be heard from below. Labrador is again a favorite breeding place for this species. I have not heard of a specimen being shot for the last three years.

Specific characters.—Length, five and a half inches; extent, eight and a half; crown and hind head, black; cheeks, pure white; from each lower mandible runs a streak of small black spots; those on the side larger; the rest of the lower parts, white; the wing, black, edged with ash; first and second row of coverts, broadly tipt with white; back, ash, tinged with yellow ochre, and streaked laterally with black; tail, black, edged with ash, the three exterior feathers, marked on the inner webs with white;

bill, black above, whitish below, furnished with bristles at the base: iris, hazel; legs and feet, reddish yellow. Female differs very little from male.

The black-throated blue wood-warbler, (*Sylvicola Canadensis*, Lath. and Wilson.)—This delightful little warbler is exceedingly rare in Lower Canada. Although nothing of a songster, his colours are very bright and rich, and his plumage in general neat. A small chirp is all that is heard from him, as he flies from bush to bush. This warbler is seldom met with in our vicinity; one was shot here some four years ago, and I have not heard of any having been seen since. Our museum has a very good specimen of this rare bird. Certainly they do not breed here regularly, if at all, a stray individual may sometimes remain, to rear its brood on our mountain, but not often. Audubon traced this warbler, through the upper parts of the State of New York, into Maine, the British Provinces, and the Magdalen islands, in the bay of St. Lawrence. According to his account, the nest is usually placed on the horizontal branch of a fir tree, seven or eight feet from the ground; nest composed of slips of bark, mosses and fibrous roots, lined with fine grass, and an inner lining of feathers. When this warbler is feeding among the branches of a tree, one can hear quite distinctly the snapping of his bill, as he pursues the insects from twig to twig. He is extremely active, but as we have mentioned before, no real song. Not even during the pairing season, does his note become more musical. Before dismissing this interesting bird, I may be allowed to quote a few lines Wilson has written respecting it. He says:

"It is highly probable that they breed in Canada; but the summer residents among the feathered race, on that part of the continent, are little known or attended to. The habits of the bear, the deer, and beaver, are much more interesting to those people, and for a good substantial reason, because more lucrative; and unless there should arrive an order from England, for a cargo of skins of warblers and flycatchers, sufficient to make them an object worth speculation, we are likely to know as little of them hereafter, as at present."

Specific characters.—Length, four and a half inches; extent, seven and a half; the front and upper part of the head, is a fine verditer blue; the hind head and back, of the same colour, but not quite so brilliant; a few lateral streaks of black mark the upper part of the back; wings and tail, black, edged with sky

blue; the three secondaries next the body edged with white, and the first and second row of coverts also tipt with white; tail coverts, large black, also broadly tipt with blue, so as to appear nearly wholly of that tint; sides of the breast, spotted or streaked with blue; belly, chin, and throat, pure white; the tail is forked; the five lateral feathers on each side with each a spot of white; the two middle more slightly marked with the same; from the eye backwards extends a line of dusky blue; before and behind the eye, a line of white; bill, dusky above, light blue below; legs and feet, light blue. (Wilson.)

The black and yellow wood-warbler, (*Sylvicola maculosa*, Lath.)—Few of the warblers are so highly gifted as the species now before us. His varied and beautiful plumage, his sweet, soft warble, his lively habits, and his general usefulness, all tend to interest every beholder. He cannot be said to be common with us; some, no doubt, always breed here, but the majority go farther north. Low woods are his favorite resorts; there he may be heard singing to his beloved partner, from sunrise to sunset; there you may see his tiny nest. The motions of this bird are quick and interesting. Suddenly his song ceases, and he darts forth from the thick foliage of the maple, and remains poised, with quivering wings, before a cluster of blossoms, every now and again darting into them, after some favorite insect. Again he returns to the tree, and with spread tail and drooping wings commences his search among the leaves, seeming to try and show off his beauty to the best advantage. He makes no clicking sound with his bill, while feeding. His nest is always placed in the thickest part of the foliage, and is seldom seen. Audubon says the eggs are five, rather elongated, and white, with reddish spots on the larger end. Our Museum of Natural History contains a good specimen of this pretty species.

Specific characters.—Length, five inches; extent, seven and a half inches; front, lores, and behind the ear, black; over the eye, a fine line of white, and another small touch of the same immediately under; back, nearly all black; shoulders, thinly streaked with olive; rump, yellow; tail coverts, jet black; inner vanes of the lateral tail feathers, white, to within half an inch of the tip, where they are black; two middle ones, wholly black; whole lower parts, rich yellow, spotted from the throat downwards with black streaks; vent, white; tail, slightly forked; wings, black, crossed with two broad transverse bars of white; crown, fine ash; legs, brown; bill, black. Female like male, but smaller.

The Blackburnian wood-warbler, (*Sylvicola Blackburniæ*; Lath.)—A person seeing this little warbler engaged among the branches securing his food, would at first sight take him for the American redstart, as he much resembles this little flycatcher in his movements among the branches.

Perhaps as you stand by you see him emerge from the thick foliage of some tree after a fluttering insect; he returns, and for a time you lose sight of him, but soon again your eye is attracted to another spot by his bright colour, and there he is, running in and out among the branches, prying into every crevice and hole, that may be in the branch. On first hearing his song you will not believe that the notes you hear proceed from that small orange coloured bird high up among the branches, so loud are they in comparison with his size. His notes are five or six in number. It is rare in Lower Canada, not so much so in Upper Canada. This warbler is found in Labrador and Newfoundland. Its nest has been found in this last mentioned place, but it likely breeds in both places.

Specific characters.—"Length, four and a half inches; extent seven inches; crown, black, divided by a line of orange; the black again bounded on the outside by a stripe of rich orange passing over the eye; under the eye, a small touch of orange yellow; whole throat and breast, rich fiery orange, bounded by spots and streaks of black; belly, dull yellow, also streaked with black; vent, white; back, black, skirted with ash; wings the same, marked with a large lateral spot of white; tail, slightly forked; the interior vanes of the three exterior feathers white; cheeks, black; bill and legs, brown; the female is yellow where the male is orange; the black streaks are also more obscure and less numerous." Wilson.

The pine-creeping wood-warbler, (*Sylvicola pinus*, Wilson and Lath.)—This trim little warbler seems nearly allied to the certhial-creepers; he is generally known as the creeping warbler. Like the creepers it may often be seen ascending the larger branches of trees, scraping and hopping against the bark to frighten out the lurking larva. It is only where pine trees abound that this warbler may be seen in any great numbers. They prefer lowlands to mountainous countries. For this and other unknown reasons, they are seldom met with in this neighbourhood. In the western Province they are not rare. The Museum of Natural History here, contains a very neat specimen of the male

bird. I believe he was shot here some time ago. Sometimes they pursue insects on the wing, but only as an exception to the general rule. This species differs from the majority of the warblers, in flying and associating in flocks. As far as we can learn, they have not been seen at Newfoundland nor Labrador. The Southern States seem to be their general breeding ground. The following is from Wilson: "The food of these birds is the seeds of the pitch pine, and various kinds of bugs. The nest according to Mr. Abbot, is suspended from the horizontal fork of a branch, and formed outwardly of slips of grape-vine bark, rotten wood, and caterpillars' webs, with sometimes pieces of hornets' nests interwoven; and is lined with dry pine leaves, and fine roots of plants. The eggs are four, white, with a few dark brown spots at the great end."

Specific characters.—"Length, five and a half inches; extent, nine inches; the whole upper parts are of a rich green olive; throat, sides and breast, yellow; wings and tail, brown with a slight cast of blueish; tail, forked; middle of the belly and vent feathers, white. The female is brown, tinged with olive green on the back; breast, dirty white, or slightly yellowish. The bill in both is truly that of a warbler, and the tongue slender, as in the Motacilla genus, notwithstanding the habits of the bird." Wilson.

The genus Trichas or ground-warbler, is represented here by two species only. Their habits are very retiring and secret; so much so, that their migratory movements are seldom noticed. Swampy land and tangled thickets are their places of resort; seldom are they seen higher than the top of a low bush, but often down among the roots and lower branches. In such situations they quietly but actively pursue their avocations. The nest is placed near the ground, and generally amongst the tangled roots.

The Mourning ground-warbler, (*Sylvicola Philadelphia*, Wilson.)—It is to be regretted that so little is known concerning this beautiful little bird's habits. He is very retiring but not timid; lives and rears his little family in low swampy marshes. As an exception, I have found him sometimes on our mountain, near a swamp at the east end. I have also seen the young birds on the mountain, and know they breed there. Few birds are more beautiful in respect to plumage, yet in song he decidedly ranks as inferior to most of the warblers.

Specific characters.—"Length, five inches; extent, seven; the whole back, wings and tail, are of a deep greenish olive; the tips of the wings, and the centre of the tail feathers excepted, which are brownish; the whole head is of a dull slate colour; the breast is ornamented with a singular crescent of alternate transverse lines of pure glossy white, and very deep black; all the rest of the lower parts are of a brilliant yellow; the tail is rounded at the end; legs and feet, a pale flesh colour; bill, deep brownish black olive, lighter below; eye, hazel." Wilson. The other species is the Maryland ground-warbler, (*Sylvicola Trichas*, Lath.)—It is to be found in the same situations as the former species. Its simple note may be heard among the tangled shrubbery of low watery situations. The nest is formed in the ground among the roots of the bushes; this it arches over, leaving a small hole for an entrance; the eggs are five, white, with touches of reddish brown. It seems to be pretty common through all the United States. Around the swampy thickets of Maryland it is exceedingly abundant. The only place in the vicinity of our city in which I have seen this bird, is a small bushy swamp on the Lachine railway, beside the aqueduct road. In this place they breed, returning south as early as the middle of August. They only raise one brood here. *Insects and larvæ* are their general food. The song or rather the notes of this bird are confined to a simple but not disagreeable twitter.

Specific characters.—"Length, four and three quarter inches; extent, six and a quarter inches; back, wings and tail, green olive, which also covers the upper part of the neck, but approaches to cinereous on the crown; the eyes are inserted in a band of black, which passes from the front on both sides, reaching half way down the neck; this is bound above by another band of white, deepening into light blue; throat, breast and vent, brilliant yellow; belly, a fainter tinge of the same colour; inside coverts of the wings also yellow; tips and inner vanes of the wings, dusky brown; tail, cuneform, dusky, edged with olive green; bill, black, straight, slender, of the true motacilla form, though the bird itself was considered as a species of thrush by Linnæus, but removed to the genus motacilla by Melin; legs, flesh-coloured; iris of the eye, dark hazel. The female wants the black band through the eye, has the bill brown, and the throat of a paler yellow." Wilson.

The fourth genus *Helinaia* or Swamp-warblers, is represented

here by a single species. Indeed I was about setting it down as having no representatives here, when I accidentally fell upon this little species. It is the Nashville swamp-warbler, (*Sylvia rubricapilla*, Wilson.) This is a beautiful and interesting little bird; rare in our neighbourhood. Like the birds of the last genus, they are found only in low swampy grounds, and feed in much the same manner. The point of difference between the two genera, is chiefly in the form of bill, which in the present genus is much longer and of a slenderer form. A few years ago the Nashville warbler was not so rare on our mountain as at present. His notes are very singular, much resembling the breaking of small twigs. The female I have never seen, nor have their nests ever been discovered here. The specimens shot by Wilson were procured near Nashville.

Specific characters.—"Length, four inches and a half; extent, seven inches; the upper parts of the head and neck, light ash, a little inclining to olive; crown, spotted with deep chestnut in small touches; a pale yellowish ring round the eye; whole lower parts, vivid yellow, except the middle of the belly, which is white; back, yellow olive, slightly skirted with ash; rump and tail coverts, rich yellow olive; wings, nearly black, broadly edged with olive; tail, slightly forked, and very dark olive; legs, ash; feet, dirty yellow; bill, tapering to a fine point, and dusky ash; no white on wings or tail; eye, hazel." Wilson.

The fifth genus *Meriotilla* or creeping-warblers, contains only one species, and it is very abundant with us during spring. The term creeping, explains the difference between this and the preceding genera. This species is the black and white creeper, (*Sylvia varia*, Lath.) A person who is taking an early stroll over the brow of our mountain, on a spring morning, cannot but help hearing often repeated a sharp twee-a-twee-a-twee, which from its singular shrillness strikes his attention. Looking round to try and discover the creature which emits these sounds, he sees descending the large trunk of a tree, a small bird of striped plumage, and busily engaged in gleaning the bark of all injurious insects. Seldom is this bird seen among the smaller branches of the tree, but nearly always on the large branches and trunks. Its tongue is beautifully adapted to its purpose, being long and horny, and of course, therefore, better fitted for extracting insects from beneath the bark of trees than for excelling in song; "as the hardened hands of the husbandman are better suited for clearing

the forest or guiding the plough, than dancing among the keys of a piano-forte. Which of the two is the most honourable and useful employment is not difficult to determine. Let the farmer, therefore, respect this little bird for its useful qualities, in clearing his fruit and forest trees from destructive insects, though it cannot serenade him with its song."

A beautiful account of this little species may be found in Audubon's works.

Specific characters.—"Length, five and a half inches; extent, seven and a half inches; crown, white, bordered on each side with a band of black, which is again bounded by a line of white passing over each eye; below this is a large spot of black covering the ear feathers; chin and throat, black; wings, the same, crossed transversely by two bars of white; breast and back, streaked with black and white; tail, upper, and also under coverts, black, edged and bordered with white; belly, white; legs, and feet, dirty yellow; hind claw the longest, and all very sharp pointed; bill, a little compressed sidewise, slightly curved, black above, paler below; tongue, long, fine pointed, and horny at the extremity." Wilson.

The female has not the black on the throat.

ARTICLE XXVII.—*Additional notes on Aboriginal Antiquities found at Montreal.*

(Read before the Natural History Society of Montreal.)

Since the publication of my former paper on this subject,* the excavations on the site of the ancient Indian village, described in that paper, have proceeded to completion, and now the whole of the superficial layer of sand having been removed, the spot has forever lost its original contour and appearance, and little probability remains of farther discoveries. Throughout the past year the progress of the work has been carefully watched, and special excavations have been made in the more promising places. By these means many additional objects have been obtained, some of them of much interest. Mr. E. Murphy, of this Society, has also aided in the work of exploration, and has accumulated a large collection; and I am indebted to Mr. Dand, the overseer in

* Canadian Naturalist, vol. 5, p. 430.

charge of the workmen, for several specimens, as well as for pointing out some of the more interesting spots for exploration.

The additional facts obtained do not induce me in any way to modify the statements of my former paper respecting the certainty of this having been the site of an ancient Indian village, and probably of that mentioned by Cartier under the name of Hochelaga. These conclusions are indeed strengthened by the observations more recently made.

The space in which the remains occur extends from Mansfield Street to a little west of Metcalfe Street in one direction, and in the other from a little south of Burnside Place to within 60 yards of Sherbrooke Street. In this limited area, not exceeding two imperial acres, twenty skeletons have been disinterred within twelve months, and the workmen state that many parts of the ground excavated in former years was even more rich in such remains. Hundreds of old fire places, and indications of at least ten or twelve huts or lodges have also been found, and in a few instances these occur over the burial places, as if one generation had built its huts over the graves of another. Where habitations have stood, the ground is in some places to the depth of three feet, a black mass saturated with carbonaceous matter, and full of bones of wild animals, charcoal, pottery, and remains of implements of stone or bone. Farther, in such places the black soil is laminated, as if deposited in successive layers on the more depressed parts of the surface. The length of time during which the site was occupied, is also indicated by the very different states of preservation of the bones and bone implements; some of those in the deeper parts of the deposit being apparently much older than those nearer the surface. Similar testimony is afforded by the great quantity and various patterns of the pottery, as well as by the abundance of the remains of animals used as food, throughout the area above mentioned.

All these indications point to a long residence of the aborigines on this spot, while the almost entire absence of articles of European manufacture in the undisturbed portions of the ground, implies a date coeval with the discovery of the country. The few objects of this kind found in circumstances which prevented the supposition of mere superficial intermixture, are just sufficient to shew that the village existed until the appearance of Europeans on the stage. Other facts bearing on these points will appear in

the course of the following detailed notice of the objects found since the publication of my former paper.

1. *Human Remains.*—Several additional skulls have been disinterred, but many of them in a state too fragile for preservation. All are of the same type of cranial conformation with those previously described. The measurements of five of the most perfect are as follows:—

	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Longitudinal diameter,...	6¾ in.	7 in.	7¼ in.	8¼ in.	7 in.
Parietal " ...	5½	5½	5⅛	5¾	5¾
Frontal " ...	4⅝	4⅜	4½	4¾	4½
Vertical " ...	5 1/16	5¾	5½	5⅝	5½?
Intermastoid arch,.....	11¾	12	—	14¼	12?
Intermastoid line,.....	5	5	—	5¾	——
Occipito-frontal arch,....	13½	13¾	14½	15½	13½
Horizontal circumference,.	19½	20	20¼	22	20

No. 4 is in Mr. Guilbault's collection. The others are in my possession. Nos. 5 and 6 belonged to a female and male skeleton buried together.. They have the Wormian bones largely developed, which is not the case with the others. No. 8 is remarkable for a lateral distortion which seems in part to have existed during life, but must have been increased by the pressure of the soil after the decay of the soft parts.

I have been very desirous to ascertain if the measurements of the skulls were capable of throwing any light on the question of the particular Indian race to which these people belonged. Prof. Wilson of Toronto, has kindly furnished for the purposes of this comparison, the following table, presenting the average measurements of about forty Huron skulls, and of about thirty believed to be Algonquin.

	Huron.	Algonquin.
Length,.....	7.37 inches.	7.23 inches.
Breadth,.....	5.47 "	5.58 "
Height.....	5.42 "	5.37 "

From this it would appear that the Algonquin skull is shorter, broader and lower than that of the Huron. The measurements of skulls from Hochelaga, given in this and my previous paper, present so great diversities among themselves, that any comparison with the averages above stated would seem impossible. Nos. 3, 4 and 8, approach very nearly to the Algonquin type; Nos. 6 and 7 to the Huron. No. 7 is remarkable for its length, and contrasts in

this respect very strongly with No. 4. Either the cranial type of the Hochelaga tribe presented within itself much greater diversities than those indicated by Prof. Wilson's averages, or the individuals whose remains have been found, belonged to more than one tribe. In either case a much larger number of skulls would be required to give satisfactory data for comparison; and it would then perhaps be possible to eliminate abnormal forms and those which might be of foreign origin. Nor must the consideration be omitted, that in a central locality, at the confluence of two great rivers, and at a time when Hochelaga may have been the point of union of various tribes, giving way before the inroads of the Iroquois and Hurons, its population may have been of a very mixed character.

The following remarks on the deformed skull noticed above, are from a paper by Dr. Wilson, in the *Canadian Journal* of September:

"In an interesting paper on "Aboriginal Antiquities recently discovered in the Island of Montreal," published by Dr. Dawson in the "*Canadian Naturalist*," he has given a description of one female and two male skulls, found along with many human bones, at the base of the Montreal Mountain, on a site which he identifies with much probability, as that of the ancient Hochelaga, an Indian Village visited by Cartier in 1535; and which he assigns on less satisfactory evidence to an Algonquin tribe. Since the publication of that paper, my attention has been directed by Dr. Dawson to two other skulls, a male and female, discovered on the same spot, both of which are now in the Museum of McGill College, Montreal. One of these furnishes a still more striking example of a cranium greatly altered from its original shape subsequent to interment. It is the skull of a man about forty years of age, approximating to the common proportions of the Iroquois and Algonquin cranium, but with very marked lateral distortion, accompanied with flattening on the left, and bulging out on the right side. There is also an abnormal configuration of the occiput, suggestive at first sight, of the effects produced by the familiar native process of artificial malformation. This tends to add, in no slight degree, to the interest which attaches to the investigation of such illustrations of abnormal craniology; as the occurrence of well established examples of posthumous deformation among crania purposely modified by artificial means exhibits in a striking manner the peculiar difficulties which complicate the

investigations of the naturalist when dealing with man. The evidence which places beyond doubt the posthumous origin of the distorsion in this Hochelaga skull is of the same nature as that which has already been accepted in relation to an example recovered from an Anglo-Saxon cemetery at Stone, in Buckinghamshire. The forehead is flattened and greatly depressed on the right side, and this recedes so far, owing to the distorsion of the whole cranium, that the right external annular process of the frontal bone is nearly an inch behind that of the left side. The skull recedes proportionally on the same side throughout, with considerable lateral development at the parietal protuberance, and irregular posterior projection on the right side of the occiput. The right superior maxillary and malar bones are detached from the calvarium, but the nasal bones and the left maxillary remain in situ, exhibiting, in the former, evidence of the well developed and prominent nose characteristic of Indian physiognomy. The bones of the calvarium, with one slight exception, have retained their coherence, notwithstanding the great distorsion to which it has been subjected, though in this example ossification has not begun at any of the sutures. The exception referred to is in the left temporal bone, which is so far partially displaced as to have detached the upper edge of the squamous suture. Part also of the base of the skull is wanting.

"The posthumous origin of the distorsion of this skull is proved beyond dispute on replacing the condyles of the lower jaw in apposition with the glenoid cavities, when it is found that, instead of the front teeth meeting the corresponding ones of the upper maxillary, the lower right and left incisors both impinge on the first right canine tooth, and the remaining teeth are thereby so displaced from their normal relation to those of the upper jaw, as to preclude the possibility of their answering the purpose of mastication—which their worn condition proves them to have done,—had they occupied the same relative position during life.

"The extreme distorsion which this skull has undergone is still more apparent when looking on it at its base. The bone has been fractured, and portions of it have become detached under the pressure, while the mastoid processes are twisted obliquely, so that the left one is upward of an inch in advance of the right.

"The circumstances under which this Indian skull was found tend to throw some light on the probable process by which its posthumous malformation was effected. It was covered by little

more than two feet of soil, the pressure of which was in itself insufficient to have occasioned the change of form. The skull, moreover, was entirely filled with the fine sand in which it was embedded. If, therefore, we conceive of the body lying interred under this slight covering of soil until all the tissues and brain had disappeared, and the infiltration of fine sand had filled up the hollow brain-case; and then, while the bones were still replete with the animal matter, and softened by being filled with moist sand and embedded in the same, if some considerable additional pressure, such as the erection of a heavy structure, or the sudden accumulation of any weighty mass, took place over the grave, the internal sand would present sufficient resistance to the superincumbent weight, applied by nearly equal pressure on all sides, to prevent the crushing of the skull or the disruption of the bones, while these would readily yield to compression of the mass as a whole. The skull would thereby be subjected to a process in some degree analogous to that by which the abnormal developments of the Flathead crania are effected during infancy, involving as it does, great relative displacement of the cerebral mass, but little or no diminution of the internal capacity. The discovery of numerous traces of domestic pottery, pipes, stone implements and weapons in the same locality, furnishes abundant proof that it was the site of the Indian village as well as a cemetery, and thereby demonstrates the probability of the erection of such a structure, or the accumulation of some ponderous mass over the grave at a period so near to that of the original interment, as would abundantly suffice to produce the change of form described. To some such causes similar examples of posthumous cranial malformation must be ascribed; as they are so entirely exceptional as to preclude the idea of their resulting from the mere pressure of the ordinary superincumbent mass of earth.

"Another skull found in the same ancient Indian cemetery, apparently that of a female, and now in the collection of Mr. Guilbault, of Montreal, has also the appearance of having been modified in form by artificial means, whether posthumous or otherwise. The supercilliary ridges are prominent, the frontal bone is receding, but convex, and the occipital bone has considerable posterior projection, which is rendered the more prominent by a general flattening of the coronal region, and a very marked depression immediately over the lambdoidal suture, pro-

bably the result of unequal posthumous compression. The abnormal conformation of this skull is shown in the proportions of the intermastoid arch, which measures only 11.75, while the normal mean, so far as ascertained by me from measurements of thirty-three examples of Algonquin crania is 14.34, and of thirty-six examples of Huron crania is 14.70."

The teeth of most of the skulls found are remarkable for their regularity, though in old age they were much worn, and many were lost by decay. In two examples however, both of persons who must have died in youth, the teeth were very unequally developed. All the entire skeletons repose in a crouching posture, not erect, but inclined or lying on one side, and usually with the head towards the west. In a few instances, skulls and portions of skeletons were found detached; but these seem to have been disturbed by the plough or by modern excavations. Two very remarkable exceptions to the general mode of occurrence of the human remains deserve special notice.

Near one of the cooking places, and at the depth of about 2 feet, intermixed with the bones of wild animals and fragments of pottery and charcoal, were found portions of a human jaw, which had belonged to an immature individual, and had evidently been broken, or gnawed by animals, when recent. This might raise a suspicion of occasional cannibalism on the part of the inhabitants of Hochelaga, were it not for the possibility that it may be a memorial of the destruction of the village, in which it is probable that many of its people both young and old, may have perished in the ruins of their dwellings. It can scarcely be connected with the tortures or indignities inflicted on prisoners of war, as these remains were not those of an adult; but it may possibly refer to the practice indicated by the specimens next to be described.

These are two vessels, possibly drinking cups, formed of portions of human skulls. One of them was given to me by Mr. Dand, the other is in the collection of Mr. Murphy. Both have been formed of parietal bones, rudely cut and smoothed around the edges, and one has a round hole in the margin for a handle or string. These relics, no doubt, point to the custom, attributed to several of the primitive tribes of the old world, of using the skulls of slain enemies as vessels for domestic uses. Whether this practice is to be ascribed to the inhabitants of old Hochelaga, or to the enemies by whom it was destroyed, is less certain, and

it may be well, perhaps to give the hospitable entertainers of Cartier the benefit of the doubt.

2. *Beads or Wampum.*—Only a single specimen of the shell wampum, or "Esurguy" as Cartier calls it, has been found. It is represented in Fig. 1, and is of small size, neatly formed, and the material is apparently the pearly shell of a Unio, probably *U. ventricosus.** Such beads, from their small size and the labour required in their manufacture, must have been very valuable, while their pearly lustre would render them more beautiful than the wampum of the coast Indians. If this single specimen really represents the beads to which Cartier alludes, it accords with his statement that the material was obtained in the river, but does not explain his curious account of the mode in which it was procured.

Fig. 1.

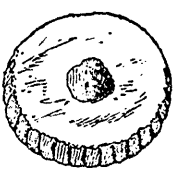

Fig. 2.

Many examples have been found by Mr. Murphy and myself, of discs of baked clay, rudely ornamented and perforated through the centre, as in Fig. 2. These seem to have been a cheaper and commoner kind of beads.

3. *Bone Implements.*—These are very numerous and of various forms. Fig. 3 represents the point of a barbed fish spear; Fig. 4 may have been a spear point or arrow head, and Fig. 5 represents a bone needle. A great number of pointed implements, perhaps daggers, spear heads or skewers, have been found, some of them very neatly formed, but without any attempt at ornamental carving. Bone stamps for impressing patterns on pottery are not uncommon, and numerous examples have been found of objects of unknown use formed of bones of the feet of quadrupeds, ground flat on one side and hollowed in a peculiar manner, with a small hole bored in one end. Bone seems to have been largely used by these people for implements of various kinds, and the

* Or *U. Canadensis* of Lea, which is perhaps only a variety of the species named in the text.

neatness with which these have been shaped and polished, is very creditable, in the case of workmen not provided with metallic tools.

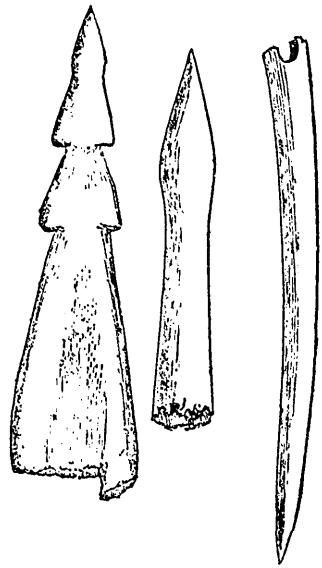

Fig. 3. Fig. 4. Fig. 5.

4. *Pipes.*—The taste and skill of the Indian potters have been expended on these more than any other objects of their art.

Fig. 6.

Many of them are formed in the elegant and simple pattern figured in my former paper. Others have very regular revolv-

ing bands or rings, relieved by round impressions, (Fig. 6.) One has a square stem ornamented with delicate transverse lines. Another has a rude attempt at a human countenance on the front of the bowl. The most elaborate, though perhaps not the most tasteful of the whole, is in the collection of Mr. Murphy, and is represented in Fig. 7, *which is a side view* of half the actual size. The front, which is not represented in the figure, is broad and flat, and has a rude human face, surrounded by a sort of halo composed of rectangular indentations arranged in consecutive rows. The only example of a stone pipe is a small fragment of a stem formed of serpentine, similar to that of the "Calumets" on the Ottawa.

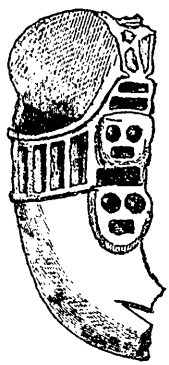

Fig. 7.

5. *Earthen Vessels.*—Large quantities of fragments of these have been collected; all in [illegible]s similar to those figured in the former paper, and which may be characterised as the *basket* patterns,* and *corn-ear* patterns,† though presenting great varieties in detail. In some of the more elaborate the ornamental lines are not mere scratches, but consist of series of impressions made by a pointed instrument, giving a very rich effect. In some of the examples more recently found, the sides are unusually thin and the material very fine, while others appear to have been large, thick, and composed of coarse and slightly baked material. In many of the vessels the mouth is square with the corners thickened and expanded, perhaps for convenience of hand-

* Fig. 7. Canadian Naturalist, vol. 5, p. 435.

† Fig. 10. Canadian Naturalist, vol. 5, p. 435.

ling or of suspension over the fire. In one example found by Mr. Murphy, (Fig. 8,) this corner is fashioned into a human head, which though rude in execution displays some artistic taste in its design. The vessel to which it belonged must have been used for culinary purposes, for like many others in the collection, it is crusted with the carbonised remains of some vegetable pottage.

Fig. 8.

6. *Stone Implements.*—These consist of chisels of the ordinary form, made of greenstone and gneiss; hammers, some with grooves for attachment to handles, and others rounded for use with the naked hand, after the fashion of those represented on Egyptian monuments; flat stones for baking or for preparing skins, and whet-stones with grooves made by sharpening implements upon them. There are also great quantities of stones which have been heated in the fire, probably for baking cakes of corn meal in the Indian manner.

7. *Metallic Articles.*—Of the few objects of this kind which have been found in such circumstances as to render accidental intermixture improbable, the most interesting are a small knife resembling a scalpel; a nail deprived of its head, and rounded and sharpened at the point; and a small rectangular piece of sheet brass, apparently cut by a stone chisel or some similar implement from a larger piece. These are sufficient to shew European intercourse before the final disappearance of the Indian settlement.

8. *Articles of Food.*—The bill of fare of old Hochelaga appears to have included nearly all the wild mammals of the country, and many birds and fishes; but the beaver largely predominates, and remains of the bear, more especially lower jaws, are quite numerous. Grains of Indian corn were mentioned in my former paper, and in one spot rich in the debris of pottery, and recently excavated, these are very abundant, and apparently of the ordinary variety still cultivated in the country. In the same place I found a single bean, apparently the *Phaseolus vulgaris*, bearing witness to the cultivation of this plant as well as corn. The grains of corn and beans which have been preserved, are those which have been accidentally charred in the cooking fires. They are perfectly black and very friable. In one spot was found a large quantity of charred acorns, which may have been used as food in times of scarcity. The stones of the wild plum are very common, and Mr. Murphy has found specimens of butternuts.

Suites of specimens of the objects referred to in this paper, will be deposited in the collections of the Natural History Society, and of McGill College, to secure the preservation of these slender memorials of the rude arts and simple lives of our predecessors in the occupancy of the Island of Montreal—so unfortunate in the early extinction of their name and race, but happily preserved from oblivion in the record of their hospitality and kindness to the old French voyager, and by the confirmations of his veracity which have now so unexpectedly occurred.

In the Report of the Smithsonian Institution for 1856, there is a notice by Mr. Guest of the remains of Indian villages near Prescott, C. W.; and it is very interesting to observe the similarity in details between the relics found there and those obtained at Montreal. The dimensions of the trees which are stated to have grown on the sites of these forts or villages at Prescott, would indicate a date for their abandonment earlier than the discovery of Canada. They appear to deserve further investigation, more especially with a view to the question whether they belonged to the Hurons or to a preceding population akin to that of Hochelaga.

J. W. D.

ARTICLE XXVIII.—*Mr. Barrande on the Primordial Zone in North America, and on the Taconic System of Emmons.* By T. Sterry Hunt, M.A., F.R.S.

We are indebted to the courtesy of the author for a copy of his paper on this subject, extracted from the 18th volume of the Bulletin of the Geological Society of France, and including three communications made to that Society, November 5 and November 19, 1860, and February 4, 1861. The communications of Sir W. E. Logan, and of Mr. Billings, which have appeared in the *Naturalist*, have already made our readers acquainted with the most important facts bearing on the question before us, and we may also refer to our paper on American Geology in the April number, written before the reception of Mr. Barrande's memoir. This the author has divided into eight chapters, in the first four of which he discusses the evidences of a primordial fauna in Canada, Vermont, Tennessee, Texas and Nebraska. Our readers are already aware that in 1859, Mr. Hall described three species of *Olenus* from Georgia, Vermont, besides which the observations of Roemer, Shumard, and Safford, have shown the existence of related genera, in Tennessee, Nebraska and Texas, where they occur in strata which are recognized by these authors as being at the base of the palæozoic series. The observations of Mr. Barrande upon the remarkable fauna from Point Levis, are so important that we translate them at length, referring to Mr. Billings's description of the four groups of fossils, which will be found in the *Naturalist* for August 1860, Vol. V., p. 301.

"The group No. 1 is distinguished from all the others by several very remarkable characteristics. Of the eight genera of fossils, two are brachiopods and six trilobites, so that the latter furnish three-fourths of the types of the group. If we compare the species, the brachiopods are three and the trilobites eighteen in number, or six-sevenths of the known species of the group. These numerical relations, indicating a great predominance of trilobites, recall in a striking manner one of the principal characters of the primordial fauna.

"Among the trilobitic types are four forms which up to the present time, have been found to belong exclusively to the primordial fauna; namely, *Conocephalites, Arionellus, Menocephalus* and *Dikellocephalus;* besides which the genus *Agnostus* furnishes

three distinct species, in place of the single one which is found in the group No. 2.,

"The two genera, *Lingula* and *Discina*, which complete the fauna of the first group, are among those which are found in the primordial fauna almost everywhere that it has been observed; but here, as elsewhere, the number of species of these genera is very limited.

"With these facts before us, it would be impossible, from a palæontological point of view, not to recognize the primordial fauna in the group No. 1. It will be understood that if for the time being, we neglect all other considerations, it is because stratigraphy has not as yet furnished any facts which can be appealed to for the solution of the question.

"We will now compare the fossils of the 2nd group. They consist of seventeen genera, of which only three are trilobites; of these two, *Agnostus* and *Bathyurus*, occur in the first group, while *Cheirurus* is here met with for the first time, so that the crustaceans have no longer the great predominance which is apparent in the preceding group. Besides *Cheirurus* is a type which has never yet been observed in any country earlier than the second fauna, and the same is true of the genus *Amphion*, of which Mr. Billings thinks he has discovered a pygidium which is figured in his memoir, although the genus is not mentioned in the list which he has given. On the other hand, we know that *Agnostus*, although it ascends to the summit of the second fauna, never goes above it, so that the crustaceans of the second group taken together, represent the second fauna.

"The cephalopods are here represented by the two genera, *Orthoceras* and *Cyrtoceras*, furnishing together nine species, and we may remark that the species of the latter genus, four in number, are relatively numerous for such a horizon. Now the cephalopods, which are not rare in the second fauna, have never been observed in the primordial fauna. In the table which we published in 1859 (*Bull. of the Geol. Society of June*, XVI. 543), we have it is true indicated, with a doubt, the presence of an *Orthoceras* in the primordial fauna of Scandinavia. We however take advantage of the present occasion to correct this indication, which as we have mentioned in our *Parallele* p. 43, was furnished by Mr. Angelin. This savant, who is now with us, informs us that he has lately established in the most positive manner, that the orthoceratite in question really occurs in his region *B C*=*Cerato-*

pygarum, that is to say in the alum slates with limestone beds, which contain the first portions of the second fauna in Sweden. In accordance with this fact, it would appear that the cephalopods indicated by Mr. Billings in his 2nd group must be referred to the second fauna.

"The gasteropods furnish to the second group six genera, which are commonly found in the second fauna of various countries, but as these types are reproduced in the third fauna, their presence here has no bearing upon the question before us.

"The acephala are only represented by the new genus *Cyrtodonta* lately established by Mr. Billings, according to whom the eleven species of this genus already described, belong to the Black River and Trenton limestones, i. e., to the second fauna of Canada, although allied forms may also occur in the third fauna. (*Canadian Naturalist*, December 1858, p. 331.)

"The class of brachiopods, which is relatively but little developed, offers four genera, *Lingula*, *Orthis*, *Strophomena* and *Camarella*, which last genus was founded by Mr. Billings in 1859, to include several species of the second fauna of Canada, (*Canadian Naturalist*, August, 1859, p. 301). Nothing however indicates that similar forms may not also occur in the third fauna, as is the case with the three other genera mentioned. Thus the fossils of this class, generically considered, establish nothing as to the geological horizon of the second group, although it is very probable that the study of their specific forms may aid us in finding its horizon.

"The bryozoa furnish to the second group a form of *Dictyonema*; a type which although signalized in the Primordial Zone of different countries, does not appear to be confined to that horizon. The specific nature of the form in question has not yet been determined.

"In conclusion we may say that the association of *Agnostus* with the various other genera which we have just passed in review, seems to shew in a positive manner that the second group belongs to the second fauna. This conclusion may be extended with still greater reason to the group No. 3, which contains only the genus *Asaphus*, represented by two species. This type has never been signalized either above or below the second fauna, of which it constitutes one of the most marked and most constant characters. The second and third groups considered palæontologically, then represent simply phases of the second fauna.

"The 4th group only containing two types, *Orthis* and *Tetradium*; the latter, a polyp, presents no certain sign enabling us to give the epoch to which it belongs. The palæontological data furnished by Mr. Billings, considered apart from the stratigraphical relations yet to be determined between the four groups, lead us to recognize the existence both of the primordial and the second fauna in the calcareous rocks of Point Levis. It is important to remark that these faunas, although occurring in beds very near each other, have as yet offered but few evidences of connection, since Mr. Billings has only indicated two species common to the groups 1 and 2.

"Such are the only deductions which we believe ourselves entitled to draw from the interesting facts above mentioned. We do not wish to pass the limits of the most prudent reserve in the case, because the facts briefly expressed by Mr. Billings in the introduction of his descriptions of the Point Levis fossils, indicate that there are some difficulties yet to be resolved. We observe in the first place, that all these limestones, without distinction, are indicated as being intercalated in a great schistose formation, which has furnished about thirty forms of graptolites, and other analogous fossils, with two Lingulas, one Orthis, one Discina, and one small unknown trilobite. It would be very important to establish whether the species belonging to these schists are found indifferently at various heights, above, below and between the limestones. Without very precise observations to determine and limit the distribution and the extension of these fossils in the schists, it would be impossible to form an exact idea of the relations which may exist between the representatives of the first and second faunas contained in these limestones.

"In the second place, the introduction of Mr. Billings concludes by the following passage which merits special attention. 'It is not yet certain whether the fossils of the limestones are included in the boulders or the paste of the conglomerate.' There exist then in the limestones in question, two rocks of different origins, the one represented by boulders, which we may suppose to have been transported from a distance, and the other formed upon the spot by ordinary sedimentation. While waiting for light upon these points, we will add the following considerations:

"I. It is established by Mr. Billings that the four groups of fossils are each enclosed in a rock distinct in appearance, and that these rocks form different beds, between which there are yet but

very few species in common. With these facts, even if it should one day be proved that the fossils belong to the broken and transported fragments of rock which enter into the conglomerate, it will not be less true that the primordial and secondary faunas must have belonged to separate formations in the region which furnished the transported materials, for it is evident that if these fossil species had been originally mingled in a common formation, no physical cause could have assorted and separated them, so as to form the two distinct groups which represent the primordial and secondary faunas in the rocks at Point Levis.

"II. We must also remark that if any admixture of the species of the two faunas should ultimately be found in these conglomerates near Quebec, it would in no wise prove that there had been a similar commingling in the locality which had furnished the boulders of these conglomerates, for the fact of their having been transported, would of itself suffice to explain such an apparent co-existence or confusion of the two faunas."

In the fifth chapter Mr. Barrande discusses the Taconic system of Dr. Emmons. This geologist, while engaged in the survey of a part of the State of New York, recognized the existence of a series of sedimentary rocks, which he regarded as older than those supposed by his colleagues to represent the Silurian series. A similar view had been maintained by Eaton, but was rejected by most of the American geologists, who up to this time have regarded these Taconic rocks of Emmons as belonging to the Lower Silurian series. In 1844 Dr. Emmons described certain fossils from these rocks, which he supposed to be new and to distinguish what he called the Taconic system, regarded by him as the true palæozoic base. In 1846 Mr. Barrande discovered in Bohemia, beneath the horizon of the hitherto recognized Silurian fossils, a new and extensive fauna in what he designated the Primordial Zone. The fossils described by Dr. Emmons consisted, besides some imperfect trilobites, of a few graptolites, mistaken by him for fucoids, and several very doubtful forms which are valueless for the purpose of determination. According to Dr. Emmons this system, which he divides into an upper and lower portion, has a thickness of 30,000 feet, and extends throughout the whole Appalachian chain. He has described it as composed in ascending order of, 1st. Granular quartz; 2nd. The Stockbridge limestone; 3rd. Magnesian slates; 4. Sparry limestone; 5. Roofing slates (graptolitic); 6th. Silicious conglomerate; 7th. Taconic slates; 8. Black slates.

This is not their apparent order of superposition, but Dr. Emmons conceives that the whole series has been inverted since its deposition. In fact the schistose strata 5, 6, 7 and 8, pass successively beneath the magnesian slates and limestones, which in their turn are overlaid to the east by the Green Mountain gneiss. This latter formation Dr. Emmons regards as a primitive azoic rock, upon which were successively deposited the members of the Taconic system, commencing with the quartzite, which forms its base, and crowned by the black and Taconic slates, which are now, from an immense overturn, placed at the bottom of the series, while the ancient gneiss lies at the top. It is hardly necessary to say that this supposition is wholly unwarranted by the facts. In the paper on American geology already cited, we have shown that the apparent succession of the rocks of the Quebec group is the true one. The black slates are really at its base and successively overlaid by the conglomerates, roofing slates, limestones and quartzites, and the gneiss is a newer rock, being no other than the Sillery sandstone in an altered condition, and as we have there shewn, entirely distinct from the Laurentian gneiss. Dr. Emmons has fallen into an error, similar to that of Prof. Nichol with regard to the gneiss of the Scottish Highlands, so well refuted by Murchison, Ramsay and Harkness, and has consequently been driven, in order to explain the structure of the Green Mts. to admit not merely an upthrow with Nichol, but a complete overturn of the whole palæozoic series in question. As to the geological age of this series, Dr. Emmons maintains that his Taconic system occupies a position inferior to the Champlain division of the New York system, and is consequently beneath the Lower Silurian system of Murchison. As we have before shown however, the fossils of the Quebec group prove it to be the palæontological equivalent of the Calciferous sandrock. The Stockbridge and sparry limestones, with their accompanying slates (excepting only 7 and 8,) we conceive to be no other than the Quebec group, of which they have both the stratigraphical position and the lithological characters. Dr. Emmons has maintained that limestones of the age of the Calciferous are found overlying the black slates, and has appealed to this in proof of the antiquity of the whole series, of which he imagined these slates to form the summit, but inasmuch as these slates are really older than the Quebec or Calciferous strata, his argument falls to the ground. Mr. Billings has lately found *Conocephalites* in the red sandrock of Highgate,

Vermont, which is supposed to overlie the black slates in question. As this primordial genus occurs also in the Potsdam sandstone of Lake Champlain, the question arises whether these slates are palæontologically distinct from the Potsdam, or are only its deep sea equivalent, sustaining to the littoral formation of quartzose sandstone on Lake Champlain, the same relation as the great Quebec group does to the Calciferous sandrock of the New York geologists. Dr. Emmons claims that the whole of his Taconic system is inferior to the Potsdam sandstone, which is the admitted base of the Champlain division, but we have already shown that the whole of his system, with the probable exception of these slates, is of the age of the Calciferous sandrock, the second member of that division. Unless then these lower black slates contain a fauna distinct from and older than that of the Potsdam sandstone, there remains absolutely nothing of the Taconic system which Dr. Emmons placed below the base of the Champlain division, that is to say, below the Potsdam sandstone. If, however, as is probable, these slates contain a fauna distinct from the Potsdam, they might be retained under the name of the Taconic formation, as a lower member of the Primordial Zone, to which the Potsdam sandstone unquestionably belongs.

These lower slates in Georgia, Vermont, have as already remarked furnished certain trilobites of primordial type which Mr. James Hall has described under the name of *Olenus Vermontana* and *Olenus Thompsoni*, though they are provisionally referred by Barrande to the genus *Paradoxides*. In the meantime the only trilobite as yet met with in the typical Potsdam sandstone of this region, which is rarely fossiliferous, is *Conocephalites*.* A collection of fossils recently made by Mr. James Richardson in exploring the Straits of Bellisle for the Geological Survey of Canada, fortunately furnishes the means of determining the relations of the trilobites described by Mr. Hall. On the north side of the Straits he found reposing on the Laurentian rocks a coarse reddish sandstone holding *Scolithus* like that from the Primal sandstone of Pennsylvania. Resting upon this, and dipping gently southward, is a limestone in which occur both *Olenus*

* Mr. Barrande refers to three species of *Dikellocephalus* indicated by Dr. Bigsby as occurring in the Potsdam of New York. It will be seen by referring to his memoir (Quar. Jour. Geol. Soc. 1858, p. 339, compared with p. 420,) that Dr. B. alludes only to the existence of these species as described by Owen in the Mississippi valley.

Thompsoni and *O. Vermontana*, with what appears to be an *Arionellus*, besides *Obolus*, *Capulus*, and a large spirally marked coral resembling *Zaphrentis*. These rocks, which evidently represent the Primordial Zone, are overlaid by others containing the characteristic fossils of the Calciferous sandrock and the compound graptolites of the Quebec group. These primordial trilobites then overlie the sandstone with *Scolithus*, but as we have elsewhere observed, that species appears unlike the *Scolithus* from the Potsdam of Lake Champlain, and should not be too much relied upon for fixing the geological age of this formation. It is not improbable that the true equivalent of the Conocephalites and Lingula sandstones of Lake Champlain will be found in some of the strata above the Olenus beds of Bellisle.

We have seen that Emmons, guided by a false notion of the age of the Green Mountain gneiss which led him to admit an inversion of the whole series, placed the shales which form a portion of the Primordial Zone high in the second fauna, above the whole Quebec group. On entirely different ground, Hall assigned the shale containing *Olenus*—two species of which genus he described in 1847 in the 1st Vol. of the Palæontology of New York,—to the Hudson group. In this, as Barrande shows, Mr. Hall felt himself justified by the authority of Hisinger, who in his great work on the fossils of Sweden, *Lethæa Suecica*, 1837, gives the succession of palæozoic rocks in Sweden as follows in ascending order; 1. Fucoidal sandstone; 2. Orthoceratite limestone; 3. Alum slates with *Olenus*; 4. Argillaceous slates with graptolites, etc.

The *Olenus* slates, said by Hisinger to overlie the orthoceratite limestone, (corresponding to the Trenton,) Mr. Hall unhesitatingly regarded as the equivalents of the Hudson group, in which *Olenus* was to be looked for as a characteristic fossil, and hence the strata containing these trilobites were, on the authority of Hisinger, regarded as belonging to the summit of the second fauna. In reality however this order assigned by Hisinger to the formations of Sweden is false, since the alum slate with *Olenus* lies below, and the graptolitic slate above the orthoceratite limestone. This error of Hisinger is the more strange since he had long before, as Barrande shows, indicated the true succession of these rocks, and is perhaps a mistake of the copyist or printer; it is the more to be regretted as his authority had caused it to be adopted by Mr. Hall in America. (*Geol. of Lake Superior, Foster and Whitney*, II. pp. 298—318.) The alum slate with the underlying sandstone represents in Sweden the primordial zone.

To Dr. Emmons undoubtedly belongs the merit of having recognized for the first time the trilobites which are known to belong the primordial zone, although from incorrect notions of stratigraphy he placed the slates containing them at the summit of the series of rocks to which he gave the name of the Taconic system. We have shown that the true place of these shales is at the base of the series, and that the remainder of the Taconic system is the palæontological equivalent of the Calciferous sandrock; it is not yet certain whether these lower shales with a primordial fauna do not sustain a similar relation to the Potsdam sandstone, in which case the whole of the Taconic system would be the equivalent of the two lower groups of the Champlain division. It yet remains to be seen whether Dr. Emmons can retain from the wreck of his system, the lower slates as a Taconic formation older than the Potsdam sandstone of Lake Champlain, and subordinate to the Primordial Zone, whose fossils he was the first to recognize.

Mr. Barrande refers to the opinion expressed by Mr. Marcou that the rocks beneath the fall at Montmorenci, near Quebec, are Primordial, and are overlaid unconformably by the Trenton limestone found above the fall, contrary to the statement of Sir William Logan in his report for 1852-53, that these rocks are the upper members of the Lower Silurian series, brought down by a fault. A reference to Sir William's paper in this Journal for June last, will show that the strata at the base of the fall, so far from being Primordial, contain in abundance the fossils of the Trenton and Utica formations, and that the latter may be traced over to the north side of Orleans Island, beyond which is the overlap that brings to the surface the rocks of the Quebec or Calciferous group.

Mr. Barrande then observes that "the results from the study of the Quebec group are another proof of the prompt and efficient aid which palæontology lends to geology, when local circumstances put at fault all the resources of stratigraphy." He next proceeds to analyze Sir William Logan's letter of December last, (this Journal Jan., 1861) and expresses his entire accordance with the views therein advanced, concluding with the following tribute to the labors of the Geological Survey, which we may be pardoned for reproducing.

"The vast regions of Canada have only within a few years been made known to geologists, and that they have already greatly attracted the attention of savants, is due solely to the rapid and productive labours of the Geological Commission which

is charged with the survey of the country. Let us remember that one of the most honourable distinctions that France has ever accorded to geology was in 1855, conferred on this commission, that is to say, on Sir W. E. Logan who directs it, and his learned colleagues. All of us, simple laborers or volunteers in the science, then applauded these international honours, for we well knew how to appreciate the difficulties and the merits of explorations made on so vast a scale. It is therefore with gladness that we seize the opportunity now again offered us, to express to our Canadian *confrères* all our personal sympathies, and our best wishes for the successful completion of the arduous and honourable task which has been committed to them."

ARTICLE XXIX.—*List of Coleopterous Insects.* Collected in the County of Lincoln, C. W., by D. W. BEADLE, of St. Catherine's, C. W.

[The specimens were submitted to Dr. John L. Le Conte of Philadelphia, and to him the collector is indebted for their names.]

CICINDELIDÆ.

Cicindela purpurea. Say.
C. sexguttata. Fabr.
C. duodecimguttata. Dej.
C. vulgaris. Say.
C. punctulata. Fabr.

CARABIDÆ.

Galerita bicolor. Drury.
Lebia atriventris. Say.
Brachinus ——— ?
Calosoma calidum. Fabr.
Omophron Americanum. Dej.
Elaphrus ruscarius. Say.
Chlænius sericeus. Forst.
C. Pennsylvanicus. Say.
Dicælus elongatus. Say.
Agonum punctatum. Fabr.
A. cupripenne. Say.
A. excavatum. Dej.
Poecilus lucublandus. Say.
Amara impunctícollis. Say.
Agonoderus lineola. Fabr.
Harpalus erraticus. Say.
Stenolophus conjunctus. Say

Bembidium inequale. Say.
B. patruele. Dej.
B. 4 maculatum. Lec.
Tachys inornatus. Say.

DYTISCIDÆ.

Dytiscus Harrisii. Kirb.
Acilius fraternus. Harris.
Agabus ——— ?

HYDROPHILIDÆ.

Helophorus lineatus. Say.
Hydrocharis obtusatus. Say.
Hydrobius regularis. Lec.
Cercyon ——— ?

SCAPHIDIIDÆ.

Scaphidium ——— ?

SILPHIDÆ.

Necrophorus orbicollis. Say.
Necrodes surinamensis. Fabr.
Thanatophilus caudatus. Say.
Silpha inequalis. Fabr.

NITIDULIDÆ.

Ips fasciatus. Oliv.
I. 4 signatus. Say.
Trogosita castanea. Mels.

CUCUJIDÆ.

Cucujus clavipes. Oliv.
Brontes dubius. Fabr.

EROTYLIDÆ.

Dacne fasciata. Fabr.
D. heros. Say.
Triplax thoracica. Say.
Languria Mozardi. Latr.

MYCETOPHAGIDÆ.

Mycetophagus flexuosus. Say.

DERMESTIDÆ.

Dermestes lardarius. Linn.
D. nubilus. Say.

THROSCIDÆ.

Lissomus geminatus. Say.

HISTERIDÆ.

Hister interruptus. Beauv.
Platysoma depressum. Lec.

LAMELLICORNIA.

Copris ammon. Fabr.
Onthophagus Hecate. Panz.

Aphodius fimetarius. Fabr.
A. inquinatus. Fabr.
A. granarius. Linn.
Trox æqualis. Say.
Geotrupes Blackburnii. Fabr.
Lucanus dama. Thunb.
Dorcus parallelus. Say.
Platycerus quercus. Web.
Passalus cornutus. Fabr.
Pelidnota punctata. Linn.
Cotalpa (Areoda) lanigera. Linn.
Phyllophaga quercina. Knoch.
Serica (Omaloplia) sericea. Illig.
Dichelonycha subvittata. Lec.
Hoplia trifasciata. Say.
Osmoderma scabra. Beauv.
Trichius affinis. Gory and Perch.
Erirhipis (Cetonia) inda. Linn.
E. fulgida. Fabr.

BUPRESTIDÆ.

Chrysobothris femorata. Fabr.
C. dentipes. Germar.
Agrilus ruficollis. Fabr.
A. fallax. Say.
Brachys tessellata. Fabr.

ELATERIDÆ.

Cratonychus communis. Schönh.
Adelocera marmorata. Fabr.
A. aurorata. Say.
A. pennata. Fabr.
Alaus oculatus. Linn.
Elater linteus. Say.
Cryptohypnus silaceipes, Germ. Zeitschr.
Corymbites hieroglyphicus. Lec.
C. acutipennis. Lec.
Agriotes mancus. Say.

LAMPYRIDÆ.

Ellychnia corrusca. Linn.
Chauliognathus Pennsylvanicus. Geer.
Telephorus Carolina.
Podabrus modestus. Say.

CLERIDÆ.

Trichodes humeralis. Lec.
Thaneroclerus sanguineus. Say.

CURCULIONIDÆ.

Cryptorhynchus (Conotrachelus) nenuphar. Hbst.

Centrinus scutellumalbum. Say.
Magdalinus ———— ?
Lixus ———— ?
Hylobius pales. Hbst.
Arrhenhodes maxillossus. Oliv.
Arrhenodes (septentrionis.) Herbst.
Cratoparis lunatus. Fabr.
Bruchus pisi.

CERAMBYCIDÆ.

Parandra brunnea. Fabr.
Orthosoma cylindricum. Fabr
Prionus brevicornis. Fabr.
Asemum moestum. Hald.
Arhopalus fulminans. Fabr.
Physocnemum brevilineum. Say.
Clytus colonus
C. flexuosus. Fabr.
C. erythrocephalus. Oliv.
Euderces picipes. Fabr.
Graphisurus fasciatus. Geer.
Monohammus confusor. Kirb.
Tetraopes tetrophthalmus. Forst.
Saperda tridentata. Oliv.
S. vestita. Say.
Oberea ———— ?
Rhagium lineatum. Oliv.
Leptura (Strangalia) fugax. Fabr.
Leptura vittata. Oliv.
L. sphæricollis. Say.

CHRYSOMELIDÆ.

Lema trilineata. Oliv.
Hispa (Anoplitis) quadrata. Fabr.
Cassida pallida. Herbst.
Diabrotica trivittata. Mann.
Phyllobrotica discoidea. Fabr.
Disonycha Pennsylvanica. Illiger.
D. ———— ?
Systena frontalis. Fabr.
Crepidodera violacea. Mels.
Labidomera trimaculata. Fabr.
Chrysomela scalaris. Lec.
C. Bigsbyana. Kirby.
C. elegans.
C. polygoni.
Paria (Colaspis) 6 notata. var. Say.

COCCINELLIDÆ.

Hippodamia 13 punctata. Linn.
Coccinella bipunctata. Linn.
C. novemnotata. Herbst.
C. munda. Say.
Mysia 15 punctata. Oliv.
Chilocorus bivulnerus. Mulsant.

ENDOMYCHIDÆ.

Endomychus biguttatus. Say.

TENEBRIONIDÆ.

Platyderma ruficornis. Sturm.
Diaperis hydni. Fabr.
Hypophloeus parallelus. Mels.
Tenebris castaneus. Knoch.
T. tenebrioides. Beauv.
Bolitophagus cornutus. Panzer.
Meracantha Canadensis. Kirby.
Helops micans. Fabr.
Penthe obliquata. Fabr.
P. pimelia. Fabr.

MELANDRYIDÆ.

Pytho Americanus. Kirby.

MORDELLIDÆ.

Mordella melaena. Germ.
M. ———— ?

MELOIDÆ.

Lytta (Epicauta) vittata. Fabr.
L. ferruginea. Say.
Asclera ruficollis. Say.

LAGRIDÆ.

Statyra cenea. Say.

PYROCHROIDÆ.

Pyrochroa flabellata. Fabr.
Dendroides Canadensis. Latr.
Schisotus cervicalis. Newm.

ANTHICIDÆ.

Anthicus formicarius. Ferté.

STAPHYLINIDÆ.

Staphylinus villosus. Gravenhorst.
S. vulpinus. Erichson.
S. cinnamopterus. Gravenh.
S. violaceus. Gravenh.
Philonthus apicalis. Say.

REVIEWS AND NOTICES OF BOOKS.

Memoirs of George Wilson, M.D., F.R.S.A., Regius Professor of Technology in the University of Edinburgh, &c. By his Sister, Jesse Aitken Wilson. Edinburgh, Edmonston & Douglas: Montreal, B. Dawson & Son.

This memoir has been undertaken by its accomplished authoress at the urgent solicitation of attached friends of George Wilson. Although written by his sister, as a true work of affection, there is yet no such partiality manifested in its pages as the character of the beloved brother will not justify in the estimation even of strangers. An honest and earnest attempt has been successfully made throughout truthfully to delineate the character of the man, the Christian, and the philosopher. From the mass of letters which the warmth and generosity of Dr. Wilson's friendship led him to write to his intimate associates, the life, in a great measure, partakes of the character of an autobiography. Nor are these letters mere common-place pieces of correspondence; they possess all the beauty of the letters of Walpole and the Christian simplicity of those of Cowper; they have besides a feature which the familiar productions of neither of these eminent men possess, in any appreciable degree,—they are radiant with the sunshine of a large and happy heart; they have, in short, a fine commingling of literature, science, poetry, and joyous affection.

There was nothing of what may be styled an eventful kind in the life of this esteemed minister of science. He took no part in any movements of historical importance; he inaugurated no new era of science; and while his original investigations were both important and numerous he still cannot be said to have been a great discoverer. What was it then that gave such a charm to the productions of his pen and to his public and private expositions of science? It seems to have been the rare combination of poetic genius and careful observation of physical phenomena and their mutual relations, together with a wakeful and Christian philanthropy. All his writings thus sparkle with original observations, teem with beautiful and fit analogies, and present fact and truth

in their relations to human welfare. He died at a time when his mental powers had attained a ripeness, and his scientific knowledge a fulness, that gave promise of bold incursions into the secret treasures of nature. We can conceive of him, as standing on the boundless shores of truth, and prepared, from the utmost limits of discovery, to penetrate with unwearied ardour into the yet unknown, that he might bring to light some new glories of the Divine wisdom by which the sum of human happiness might be increased. Those who love the beautiful in literature and science and who can appreciate manly Christian gentleness will find in this volume a rich repast.

We might quote many choice paragraphs from the pages of this memoir, but we confine ourselves to the following from the "Estimate by Dr. J. H. Gladstone" contained in the appendix, commending our readers to this delightful volume itself for a complete delineation of George Wilson's life and character.

AS A TECHNOLOGIST.

"Long before Dr. Wilson's appointment as Regius Director of the Industrial Museum of Scotland, he had, in his laboratory practice, been led to investigate several of the chemical arts. He had even published papers bearing more or less on some of them, as, for instance, that already referred to, which elucidated the theory of bleaching. But when his mind was specially turned to the subject of Technology, he put all his heart into it. It appealed at once to his intellectual and his moral nature: there was a vast range of inquiry, not too profound; and what was better still, that inquiry had a direct bearing on the happiness of his fellow-men. In the formation of the Industrial Museum he worked hard; and those who have enjoyed the advantage, as I have, of being conducted by him through the rich stores in readiness for the future building, can alone appreciate the care and thought which must have guided him in the selection and arrangement of such varied materials. Most wonderful and refreshing too was it to behold the enthusiasm with which he bore his feeble body over a manufactory, peeping into every process, collecting samples, and gathering the workmen around him, who always seemed delighted to tell him all they knew, or to listen to his kind and instructive remarks. His technological course, too, was largely attended, and in his inaugural lecture for 1855[1] he explained the nature of

[1] 'What is Technology?' Sutherland & Knox.

Technology as the science of the utilitarian arts, and expressed his intention of at once giving a systematic course, "so that the Museum will minister to the Chair, not the Chair wait upon the Museum."

AS A TEACHER AND EXPOUNDER.

"While many of Dr. Wilson's contemporaries could pursue a train of research with greater ability, none perhaps could render the new truth thus obtained so attractive by copious imagery and varied illustration. The expansiveness of his style, which led to his strictly scientific works being considered in some quarters too diffuse, is a beauty in those where he appears as the illustrator of our physical knowledge, for every figure tells, and every fresh point of view has its own peculiar value. His popularity as a lecturer, both with his students and with the public at large, was very great. This arose partly from his thorough knowledge of the subjects he handled, but more from the felicity of his descriptions, the clearness of his explanations, and the poetry and pathos which rendered the whole beautiful. His little book on chemistry in 'Chambers's Educational Course,' which is adapted for those who desire a knowledge of the fundamental principles and leading facts of the science, without entering into any great detail, has already attained a sale of upwards of twenty-four thousand, and that prose poem, the 'Five Gateways of Knowledge,'[1] has led many to find a new world of thought and enjoyment in the old region of their five senses. His treatise on Electricity and the Electric Telegraph[2] gives a most intelligible account of this wonderful agency; the 'Chemistry of the Stars' shows how he could carry the fancy of his readers forward from the results of dry analysis."

"As instances of the extraordinary clearness with which Dr. Wilson illustrated difficult points, I would refer to his exposition of the numerical laws of chemistry in the educational treatise just mentioned, which I think the most easily comprehensible in existence, and to his more popular description of the nervous system, given in Dr. Reid's Life."

"The beauty of Dr. Wilson's discourses and writings depended not a little on his religion, and on his fine æsthetic taste. His quotations from the Holy Scriptures, and references to spiritual

[1] Macmillan & Co., Cambridge.

[2] These are printed together, and constitute Part 26 of the 'Travellers' Library.'

things, were frequent, not in the form of a pious deduction dragged in uncomfortably at the end of a lecture, but as the natural reflections of a mind thoroughly embued with the love of God and man, and accustomed to refer every good gift to the Father of Lights. In his addresses to medical or other students, he delighted to draw attention to the great facts of the spiritual world; but his 'Chemical Final Causes'[1] is the only one of his scientific writings which has a deliberately theological character. In it he attempts to add to the ever-accumulating proofs of design, by showing especially that phosphorus, nitrogen, and iron, are the best adapted of the known elements for the purposes they are required to fulfil in animal organisms."

"As to Dr. Wilson's æsthetic taste, he was an instance that a chemist is not one (to quote his own humorous description[2]) whose "vocation has been so prowl around, like a very demon, seeking what of the poet's property he might lay hands on and devour; to prove himself a man of the earth, earthy alike by profession and by relish for the work of a disenchanter, to whom a mystery is interesting only because it may be explained, and an object beautiful because the cause of its beauty may be discovered." The popular impression about some chemists, that "the aquafortis and the chlorine of the laboratories have as effectually bleached the poetry out of them, as they destroy the colours of tissues exposed to their action," certainly never arose from an acquaintance with Dr. Wilson. In his writings there is often a rhythmical charm and balance of expressions which suit well with the poetic quotations in which he sometimes freely indulges. As instances, I take almost at random from his discourse on the Progress of the Telegraph:—"We nicely discuss whether *telegram* is a proper word or not, and invoke the heroes of Homer to side with us for or against a term which would have tried every Greek tongue in its utterance, and vexed every Greek ear in its hearing; and all the while the bees who rejoice amidst the sugar plantations of our heather warn and welcome each other in songs which the bees of Hymettus sang to each other: and the grasshoppers signal from meadow to meadow as they did of old, when the musical shiver of their wings rang over Greece as its cradle-psalm." And again, speaking of the compass-needle "as the guide of Vasco de Gama to the East Indies, and of Columbus

[1] 'Edin. Univ. Essays,' 1856.
[2] In 'The alleged Antagonism between Poetry and Chemistry.'

to the West Indies and the New World, it was pre-eminently the precursor and pioneer of the telegraph. Silently, and as with finger on its lips, it led them across the waste of waters to the new homes of the world; but when these were largely filled, and houses divided between the old and new hemispheres longed to exchange affectionate greetings, it removed its finger and broke silence. The quivering magnetic needle which lies in the coil of the galvanometer is the tongue of the electric telegraph, and already engineers talk of it as speaking."

"One might almost think that Dr. Wilson was the living analogue of that astronomical fact which he thus describes:[1] "I would liken science and poetry in their natural interdependence to those binary stars, often different in colour, which Herschel's telescope discovered to revolve round each other. 'There is one light of the sun,' says St. Paul, 'and another of the moon, and another of the stars: star differeth from star in glory.' It is so here. That star or sun, for it is both, with its cold, clear, white light, is SCIENCE: that other, with its gorgeous and ever-shifting hues and magnificent blaze, is POETRY. They revolve lovingly round each other in orbits of their own, pouring forth and drinking in the rays which they exchange; and they both also move round and shine towards that centre from which they came, even the throne of Him who is the Source of all truth and the Cause of all beauty."

Contributions to Palæontology. By Prof. JAMES HALL.

Prof. Hall has for some time been in the habit of publishing annually in the Report of the Regents of the University of New York, the more important new species described by him during the year. These reports have the useful purpose of giving early notice of Prof. Hall's discoveries to those who may be working in the same field. We can here only direct attention to those in our hands, that those concerned may take due notice of their contents. The report for 1859-60, relates to species of *Orthis* and *Cyclonema* from the Hudson R. group of Ohio and the Western States, to the distinctions between Bellerophon and some allied genera, with descriptions of new species; to a new genus of shells resembling Cleodera, and named Cleoderma, of which six species are described, and to a number of new species from the

[1] In 'The alleged Antagonism between Poetry and Chemistry.'

Upper Helderberg, Hamilton and Chemung groups. The report for 1860-61, (dated August and September, 1861,) continues the latter subject, and is of much greater length, extending to 84 pages, and containing descriptions of a large number of new forms of gasteropods, cephalopods, and crustaceans, with one annelid and spirorbis.

Explorations and Adventures in Equatorial Africa; with Accounts of the Manners and Customs of the People, and of the chase of the Gorilla, the Crocodile, Leopard, Elephant, Hippopotamus, and other Animals. By PAUL B. DU CHAILLU; with numerous illustrations. New York: Harper & Bros. Montreal: B. Dawson & Son.

Notwithstanding the suspicion that has been cast upon the integrity of Du Chaillu's statements, and the reality of his explorations, by certain critics in England, the reading public seem to have received the book with confidence and enthusiasm. It has passed through many editions both in England and America, and is read with avidity by all classes of the community. There is an unquestionable truthfulness in the style and substance of the book. It appears as if impossible, that the great part of it could be written by one who had not actually seen what it describes. That there are some confusion and mistake in the dates of the several journeyings recorded is manifest to the careful reader; and the author has himself acknowledged that some of the illustrations were copied, without acknowledgment, from the works of another. With these exceptions nothing has been alleged against the book which cannot be satisfactorily accounted for. There is the fact that Du Chaillu has with him, to verify all his strange accounts of the zoology of the regions in which he travelled, the skins and skeletons of the animals which he hunted and discovered. When one so competent to judge as Owen has recognized the importance of the author's discoveries, and when the British Museum, at Owen's recommendation, has purchased for their collection some of the rarer and finer specimens, the ordinary reader need have no hesitation in accepting the book as containing a genuine account of the countries professed to have been visited. But even if the book is not true, we can assure our readers that it is worth perusing, inasmuch as it is as curious and interesting as the charming fiction of Robinson Crusoe.

In four years Du Chaillu travelled, unaccompanied with other

white men, 8000 miles through the equatorial regions of Africa. He shot, stuffed, and brought home more than 2000 birds, of which upwards of 60 are new species. He killed above 1000 quadrupeds, of which 200 were stuffed and brought home, with more than 80 skeletons, not less than 20 of which are species hitherto unknown to science. In the course of his travels he suffered 50 attacks of the African fever, endured much famine, was exposed to heavy tropical rains and attacks of ferocious and venomous insects. The book is full of strange incidents pertaining to the customs and habits of the African race. The Cannibal Jans he introduces for the first time to the knowledge of Europeans. They are evidently a fine and hopeful race of people, and with the exception of their liking for human flesh, seem to be more agreeable savages to live among than many of the tribes around them. The author had a proper dread of eating native cookery, fearing, lest unconsciously, he should be feasting upon some portion of a fellow-creature. These races of *colored* people —many of them are not black—have features of character which give much promise. They are by no means destitute of capacity or sense, and their ways of acting in civil and social life are not different from those which we find among people of another skin. Were they only Christianised and civilized they might become a great people, and raise their country to a high place among the nations. This country is yet a virgin ground to the missionary and the trader. The author's aim is to open it up to both. The geographical portion of the work is of great interest. The mountain ranges and the river courses have been noted with precision, and much that is new has been discovered. We commend this book to all readers. To the young it will be "as interesting as a novel," and to the lover of science it will be no common treat.

MISCELLANEOUS.

BOTANICAL SOCIETY OF CANADA.

Regulations for the exchange of Specimens. The laws of the Society provide for the formations of the public herbarium and the extension and improvement of private herbaria. In order to accomplish these important objects, arrangements have been made for receiving from members contributions of dried specimens of

plants, and for supplying in return the desiderata of such members. The following regulations have been framed for regulating the exchange of specimens:

1. The distribution of specimens shall be conducted by the Curators, and shall commence on the 15th November annually, before which time all contributions of specimens must be sent in by members who desire to participate in the distribution.

2. To entitle a Fellow or Subscriber to a share of the Society's duplicate specimens at any of the annual distributions, he shall have transmitted to the Society before the 1st November not less than 50 species of plants, with as many duplicate specimens of the rarer ones as possible.

3. All specimens contributed to the Society must be carefully prepared, by being pressed between sheets of paper in the usual way, but not fastened down to paper in any way. Each specimen is to be accompanied by a lable containing the name of the plant together with the locality where collected, the date of collection, and the collector's name.

4. Universities and societies forming herbaria and corresponding with the Society will be permitted to take precedence of the members in the annual distributions. The Society's public herbarium will be invariably supplied with such specimens as may be required before any distributions takes place.

5. Members are required to send, along with annual contributions of specimens, a list of those species which they desire to receive in return, or otherwise to specify in sufficient explicit terms the nature of the plants wished for.

The above rules will be strictly observed. Foreign botanists, in various parts of the world, have expressed a desire to contribute to the Society's collections. There are spontaneous and liberal offers from Tuscany, Sicily, France, Australia, and other distant parts. It remains for the botanists of Canada to say, by their contributions this autumn, whether the Society will be able to enter upon such advantageous exchanges.

All the communications for the Botanical Society of Canada are to be addressed to Prof. Lawson, Kingston, C.W.

The Areas of Botanical Distribution throughout the central part of British North America.—James Hector, M.D., accompanied the late expedition sent out by the British government, un-

der command of Captain Palliser. Dr. Hector is chiefly known as an able geologist, and the results of his observations have been, in part, published in the English scientific journals. But he is also sufficiently known as a botanist, and was chosen a corresponding member of the Botanical Society of Canada at one of its early meetings. On the 13th ultimo, he read to the Botanical Society of Edinburgh an interesting account of the general features of vegetation in the central part of British America.

Dr. Hector's remarks were of course founded on the botanical results of the late Government expedition. It was accompanied by Mons. Bourgeau as botanist, and the collection made, as named and distributed from Kew, consists of 819 species of flowering plants and ferns, which is nearly one-half the total flora of British North America. An extensive collection of seeds and vegetable products were also obtained by M. Bourgeau, and from the former many interesting and beautiful plants have already been raised for the first time in this country at the Royal Botanic Gardens at Kew. The country from which the collection was made extended from Lake Superior to the Rocky Mountains, and may be divided into four areas, each characterized by its peculiar vegetation. From Lake Superior to Lake Winnipeg is a low mountainous region, covered by an extension westward of the characteristic forest vegetation of Canada. This does not extend far beyond the Red River settlement, however, near which place the oaks true sugar maples, cedar, ash and plane trees cease to be met with, only a few of the ash-leaved maple (Negundo) and the "bastard elm" straggling west in the river courses to the Saskatchewan; but as far as the forest is concerned for the whole distance from Lake Winnipeg to the Rocky Mountains, the "subarctic province," in which the only trees are spruce, scrubby pines, with balsam and aspen poplars and birch, bounds the northern limit of the Central Continental arid tract, which is characterized by the cactus and artemisia. Between the northern zone, which is occupied by extensive morasses and sombre forests of worthless timber and the arid plains where the tough clay soil being without any vegetable mould to protect it bakes under the heat of the sun in early early spring, so that it only serves to support a sparse growth of wiry grasses and carices, there exists, however, a valuable belt of land from which the timber has been slowly cleared by successive fires. This has arisen from the "Edge of the Woods," the favorite camping-grounds of the Indian Tribes who live by the chase

of the bison; and the great fires which every year start from their encampments and sweep the country have gradually carried the limit of the "Thickwoods" eighty to a hundred miles north of its original position, and thus there has been naturally prepared a valuable and continuous fertile track stretching across the continent, and adapted for easy agricultural settlement. This region is covered with luxuriant natural pasture abounding in vetches and other nutritious plants, and having an undulating surface dotted with groves and clumps of as few poplars, which though worthless as building timber, are yet sufficient for firewood, and add greatly to the beauty of the country. The northern province and the arid tract being the second and third areas, the fourth is that along the eastern base of the Rocky Mountains, where many of the plants of the western slopes of the continent are first met with, among which is the *Douglas pine* and a few others of the pine group. The Alpine region in the Rocky Mountains is from 6500 to 9000 feet above the level of the sea, but it is very variable from their abrupt and craggy aspects. Of fifty plants collected at 8500 feet, fifteen were common alpine forms of the Scotch mountain.

Much of the paper was occupied by a description of the physical geography and *meteorology* of the region, with a view to show the proper position which its flora occupies in relation to the other botanical areas of the northern part of the continent, and Dr. Hector's views on this subject were explained by reference to a map on which the different areas were coloured. The very marked *representative similarity* was alluded to between the Canadian flora and that of the Pacific coast, many of the forest trees having no well marked specific differences; and as there are no trees of any similar forest growth in the central part of the continent, intermediate in character and position, the inference was drawn that we must look for some other link between those two areas, and which is probably to be found by taking into consideration the oscillations in latitude of the vegetation at different periods, as recently suggested by Dr. Hooker. G. L.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

MEETING AT MANCHESTER, SEPTEMBER, 1861.

(From the Times of September, 11th.)

The following very interesting Address was delivered by Sir Roderick Murchison as President on opening the Geological Section :—

"Although I have had the honour of presiding over the geologists of the British Association at several previous meetings since our first gathering at York, now 30 years ago, I have never been called upon to open the business of this section with an address; this custom having been introduced since I last occupied the geological chair at Glasgow, in 1856.

"The addresses of my immediate predecessors, and the last anniversary discourse of the President of the Geological Society of London, have embraced so much of the recent progress of our science in many branches, that it would be superfluous on my part to go again over many topics which have been already well treated.

"Thus it is needless that I should occupy your time by alluding to the engrossing subjects of the most recent natural operations with which the geologist has to deal, and which connect his labours with those of the ethnologist. On this head I will only say that, having carefully examined the detrital accumulations forming the ancient banks of the river Somme in France, I am as complete a believer in the commixture in that ancient alluvium, of the works of man with the reliquæ of extinct animals, as their meritorious discoverer, M. Boucher de Perthes, or as their expounders, Prestwich, Lyell and others. I may however express my gratification in learning that our own country is now affording proofs of similar intermixture both in Bedfordshire, Lincolnshire, and other counties, and possibly at this meeting we may have to record additional evidences on this highly interesting topic.

"But I pass at once from any consideration of these recent accumulations, and indeed of all Tertiary rocks; and as a brief space of time only is at my disposal, I will now only lay before you a concise retrospect of the progress which has latterly been made in the development of one great branch of our science. I confine myself then, to the consideration of those primeval rocks with which my own researches have for many years been

most connected, with a few allusions only, to metamorphism, certain metalliferous productions, &c.

"There is, indeed, a peculiar fitness in now dwelling more especially on the ancient rocks, inasmuch as Manchester is surrounded by some of them, while, with the exception of certain groups of erratic blocks and drifts, no deposits occur within the reach of short excursions from hence, which are either of secondary or tertiary age.

"Let us then take a retrospective view of the progress which has been made in the classification and delineation of the older rocks since the Association first assembled at York, in 1831. At that time, as every old geologist knows, no attempt had been made to unravel the order or character of the formations which rise from beneath the Old Red Sandstone. In that year Sedgwick was only beginning to make his first inroads into those mountains of North Wales, the intricacies of which he finally so well elaborated, while I only brought to that, our earliest assembly, the first fruits of observations in Herefordshire, Brecon, Radnor and Shropshire, which led me to work out an order that has since been generally adopted.

"At that time the terms of Cambrian, Silurian, Devonian and Permian were not dreamt of, but acting on the true Baconian principle, their founders and their coadjutors have, after years of toil and comparison, set up such plain landmarks on geological horizons, that they have been recognized over many a distant land. Compare the best map of England of the year 1831, or that of Greenough, which had advanced somewhat upon the admirable original classification of our father William Smith, and see the striking difference between the then existing knowledge, and our present acquirements. It is not too much to say that when the British Association first met, all the region on both sides of the Welch border, and extending to the Irish channel on the west, was in a state of dire confusion; while in Devonshire and Cornwall many of these rocks, which from their crystalline nature were classed and mapped as among the most ancient in the kingdom, have since been shown to be of no higher antiquity than the old red sandstone of Herefordshire.

"As to Scotland, where the ancient rocks abound, though their mineral structure, particularly in those of igneous origin, had necessarily been much developed in the country of Hutton, Playfair, Hall, Jameson and M'Culloch, yet the true age of most of

its sedimentary rocks and their relations, were unknown. Still less had Ireland, another region mainly palæozoic, received any striking portion of that illustration which has since appeared in the excellent general map of Griffith, and which is now being carried to perfection through the labours of the Geological Survey under my colleague Jukes. If such was our benighted state as regarded the order and characters of the older formations at our first meeting, great was the advance we had made, when at our twelfth meeting we first assembled at Manchester in 1842. Presiding then, as I do now, over the geological section, I showed in an evening lecture how the palæozoic rocks of Silurian, Devonian and Carboniferous age, as well as those rocks to which I had assigned the name of Permian, were spread over the vast region of Russia in Europe, and the Ural Mountains. What then are some of the main additions which have been made to our acquaintance with the older rocks in the British Isles since we last visited Manchester?

"Commencing with the oldest strata, I may now assume, from the examinations of several associates on whose powers of observation as well as my own I rely, that what I asserted at the Aberdeen meeting in 1859, as the result of several surveys, and what I first put forth at the Glasgow meeting of 1855, is substantially true. The stratified gneiss of the north-west coast of the Highlands, and of the large island of Lewis and the outer Hebrides, is the fundamental rock of the British Isles, and the precise equivalent of the Laurentian system of Canada, as described by Sir W. Logan. The establishment of this order, which is so clearly exhibited in great natural sections on the west coast of Sutherland and Ross, is of great importance in giving to the science we cultivate a lower datum line than we previously possessed, as first propounded by myself before the British Association in 1855.*

* See Report of British Association for 1855 (Glasgow meeting). At that time I was not aware that the same order was developed on a grand scale in Canada, nor do I now know when that order was there first observed by Sir W. Logan. I then (1855) simply put forward the facts as exhibited on the north-west coast of Scotland—viz., the existence of what I termed a lower or "fundamental gneiss," lying far beneath other gneissose and crystalline strata, containing remains which I even then suggested were of Lower Silurian age. Subsequently, in 1859, when accompanied by Professor Ramsay, I adopted, at his sug-

"For hitherto the order of the geological succession even, as seen in the geological map of England and Wales, or Ireland, as approved by Sir Henry de la Beche and his noble coadjutors, Phillips, Ramsay, Jukes and others, admits no older sediment than the Cambrian of North Wales, whether in its slaty condition in Merioneth and Caernarvon, or in its more altered condition in Anglesea.

"The researches in the Highlands have however shown that in our own islands the older palæozoic rocks, properly so called, or those in which the first traces of life have been discovered, do repose, as in the broad regions of the Laurentian Mountains of Canada, upon a grand stratified crystalline foundation, in which both limestones and iron ores occur subordinate to gneiss. In Scotland, therefore, these earliest gneissic accumulations are now to be marked on our maps by the Greek letter *alpha*, as preceding the Roman *a*, which had been previously applied to the lowest known deposits of England, Wales, and Ireland. Though we must not dogmatize and affirm that these fundamental deposits were in their pristine state absolutely unfurnished with any living things (for Logan and Sterry Hunt in Canada, have suggested that there they indicate traces of the former life,) we may conclude that in the highly metamorphosed condition in which they are now presented to us in North-Western Britain, and associated as they are with much granitic and hornblendic matter, they are for all purposes of the practical geologist, 'azoic rocks.' The Cambrian rocks, or second stage in the ascending order, as seen reposing on the fundamental gneiss of the north-west of Scotland, are purple and red sandstones and conglomerates, forming lofty mountains. These resemble to a great extent portions of the rocks of the same age which are so well known in the Longmynd range of Shropshire, and at Harlech in North Wales, and Bray Head in Ireland.

"At Bray Head they have afforded the Oldhamia, possibly an *alga*, while in the Longmynd in Shropshire, they have yielded to

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gestion, the word "Laurentian" in compliment to my friend Sir Wm. Logan, who had then worked out the order in Canada, and mapped it on a stupendous scale. I stated, however, at the same time, that if a British synonym was to have been taken, I should have proposed the word "Lewisian," from the large island of the Lewis, almost wholly composed of this gneiss.

the researches of Mr. Salter some worm tracks and the trace of an obscure crustacean.

"The Highland rocks of this age, as well as their equivalents, the Huronian rocks of North America, have as yet afforded no trace whatever of former life. And yet, such Cambrian rocks are in parts of the Longmynd, and especially in the lofty mountains of the North-western Highlands, much less metamorphosed than many of the crystalline rocks which lie upon them. Rising in the scale of successive deposits, we find a corresponding rise in the signs of former life on reaching that stage in the earlier slaty and schistose rocks in which animal remains begin clearly to show themselves. Thus, the Primordial Zone of M. Barrande is, according to that eminent man, the oldest fauna of his Silurian basin in Bohemia.*

"In the classification adopted by Sir Henry de la Beche and his associates, the Lingula flags, (the equivalent of the 'zone primordiale' of Barrande), are similarly placed at the base of the Silurian system. This primordial zone is also classed as the lowest Silurian by De Verneuil, in Spain; by James Hall, Dale Owen, and others, in the United States, and by Sir. Wm. Logan, Sterry Hunt, and Billings, in Canada.†

"In the last year M. Barrande has most ably compared the

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* I learn, however, that in Bohemia, Dr. Fritzsch has recently discovered in strata lying beneath the mass of the primordial zone of Barrande, and in rocks hitherto considered azoic, the fossil burrows of annelide animals similar to those of our own Longmynd.

† In completing at his own cost a geological survey of Spain, in which he has been occupied for several years, and in the carrying out of which he has determined the width of the sedimentary rocks of the Peninsula (including the Primordial Silurian Zone, discovered by that zealous explorer, M. Casiano de Prado,) M. De Verneuil has in the last few months chiefly examined the eastern part of the kingdom, where few of the older palæozoic rocks exist. I am, however, informed by him that Upper Silurian rocks with *Cardiola interrupta*, identical with those of France and Bohemia, occur along the southern flanks of the Pyrenees, and also re-occur in the Sierra Morena, in strata that overlie the great mass of Lower Silurian rocks as formerly described by M. Casiano de Prado and himself. The southern face of the Pyrenees, he further informs me, is specially marked by the display of mural masses of Carboniferous strata, which, succeeding the Devonian rocks, are not arranged in basin-shape, but stand out in vertical or highly inclined positions, and are followed by extensive conglomerates and marls of Triassic age, and these by deposits charged with fossils of the Lias.

North American Taconic group of Emmons,* with his own primordial Silurian fauna of Bohemia and other parts of Europe; and, although that sound palæontologist, Mr. James Hall, has not hitherto quite coincided with M. Barrande in some details,† it is evident that the primordial fauna occurs in many parts of North America. And as the true order of succession has been ascertained, we now know that the Taconic group is of the same age as the lower Wisconsin beds described by Dale Owen, with their Paradoxides, Dikellocephalus, &c., as well as of the lower portion of the Quebec rocks, with their Conocephalus, Arionellus, &c., described by Logan and Billings, of the crystalline schists of Massachusetts, containing the noble specimens of Paradoxides described by W. Rogers, and of the Vermont beds with their Oleni. It follows that the primordial Silurian zone of Barrande (the lower Lingula flags of Britain) is largely represented in North America, however it may occupy an inverted position in some cases, and in others be altered into crystalline rocks.

"In determining this question due regard has been had to the great convulsions, inversions, and breaks to which these ancient rocks of North America have been subjected, as described by Professors Henry and W. Rogers.

"In an able review of this subject, Mr. Sterry Hunt thus expresses himself:—'We regard the whole Quebec group, with its underlying primordial shales, as the greatly developed representative of the Potsdam and Calciferous groups (with part of that of Chazy), and the true base of the Silurian system.' 'The Quebec group with its underlying shales,' this author adds (and he expresses the opinion of Sir W. Logan,) 'is no other than the Taconic system of Emmons;' which is thus, by these authors, as well as Mr. James Hall, shown to be the natural base of the Silurian rocks in America, as Barrande and De Verneuil have proved it to be on the continent of Europe.

"In our own country a valuable enlargement of our acquaintance with the relations of the primordial zone to the overlying members of the Silurian rocks has been made through the personal examination of Mr. Salter, aided by the independent

* The Silurian classification was proposed by me in 1835, and in the following year, 1836, Dr. Emmons suggested that his black shale rocks which he called Taconic, were older than any I described.

† Nor are the writings of the Professors W. B. and H. D. Rogers in unison with the opinions of the authors here cited.

discoveries of organic remains by MM. Homfray and Ashe of Tremadoc.

"It has been thus ascertained, that the lower member only of the deposit which has hitherto passed under the name of Lingula flags, can be considered the equivalent of the primordial zone of Bohemia. In North Wales that zone has hitherto been mainly characterized by Lingula and the crustaceans Olenus and Paradoxides. Certain additions having been made to these fossils, Mr. Salter finds that of the whole there are five genera peculiar to the lower zone, and seven which pass upwards from it into the next overlying band, or the Tremadoc slate. But the overlying Tremadoc slate, hitherto also grouped with the Lingula flags, is, through its numerous fossils (many of them of recent discovery), demonstrated to constitute a true lower member of the Llandeilo formation. For among the trilobites, the well-known Llandeilo forms of Asaphus and Ogygia range upwards from the very base of these slates. Again, seven or eight other genera of trilobites, which appear here for the first time, are associated with genera of mollusks and encrinites which have lived through the whole Silurian series. Such, for example, are the genera Calymene, Illænus, among crustaceans; the Lingula, Orthis, Bellerophon, and Conularia, among mollusks; together with encrinites, corals, and that telling Silurian zoophyte, the Graptolite. By this proof of the community of fossil types, as well as by a clear lithological passage of the beds, these Tremadoc slates are thus shown to be indissolubly connected with the Llandeilo and other Silurian formations above them; while, although they also pass down conformably into the *zone primordiale*, the latter is characterized by the linguloid shells (Linguella, Salter) and by the genera Olenus, Paradoxides, and Dikelocephalus, which most characterize it in Britain as in other regions.*

"I take this opportunity, however, of reiterating the opinions I have expressed in my work *Siluria*, that to whatever extent the primordial zone of Barrande be distinguished by peculiar fossils in any given tract, from the prevalent Lower Silurian types, there exists no valid ground for differing from Barrande, De Verneuil, Lo-

* In the last edition of *Siluria* the distinction was drawn between the lower and upper Lingula flags, but the fauna of the latter is now much enlarged.

gan, James Hall, and others, by separating this rudimentary fauna from that of the great Silurian series of life, of which stratigraphically it constitutes the conformable base. And if in Europe but few genera be found which are common to this lower zone and the Llandeilo formation (though the Agnostus and Orthis are common to it and all the Silurian strata), we may not unreasonably attribute the circumstance to the fact that the primordial zone of no one country contains more than a very limited number of distinct forms. May we not, therefore, infer that in the sequel other fossil links, similar to those which are now known to connect the Lower and Upper Silurian series—which I myself at one time supposed to be sharply separated by their organic remains—will be brought to light, and will then zoologically connect the primordial zone with the overlying strata into which it graduates? Let us recollect that a few years only have elapsed since Mr. De Verneuil was criticized for inserting, in his table of the Palæozoic fauna of North America, a number of species as being common to the Lower and Upper Silurian. But now the view of the eminent French Academician has been completely sustained by the discovery in the strata of Anticosti, as worked out by Mr. Billings under the direction of Sir W. Logan, of a group of fossils intermediate in character between those of the Hudson River and Clinton formations, or in other words between the Lower and Upper Silurian rocks. In like manner, a similar interlacing seems already to have been found in North America, between the Quebec group with its primordial fossils, and the Trenton deposits, which are, as is well known, of the Llandeilo age.

"I have thus spoken out upon the fitness of adhering to the classification decided upon by Sir Henry de la Beche and his associates, long before I had any relation to the geological survey, which places the whole of the Lingula flags of Wales as the natural base of the Silurian rocks. For English geologists should remember that this arrangement is not merely the issue of the view I have long maintained, but is also the matured opinion of those geologists, in foreign countries and in our colonies, who have not only zealously elaborated the necessary details, but who have also had the opportunities of making the widest comparisons.

"On the continent of Europe an interesting addition has been made to our acquaintance with the fauna of one of the older beds of the Lower Silurian rocks, or the Obolus green-sand of St. Pe-

tersburg,* by our eminent associate Ehrenberg. He has described and figured † four genera and ten species of microscopic Pteropods, one of which he names *Panderella Silurica*, the generic name being in honour of the distinguished Russian palæontologist Pander, who collected them. It is well to remark, that as the very grains of the Lower Silurian green sand seem to be in great part to be made up of these minute organisms, so we recognize, in one of the oldest strata in which animal life has been detected, organisms of the same nature as, and not less abundant than those which constitute the deep sea bottoms of the existing Mediterranean and other seas.

"Before I quit the consideration of the older palæozoic rocks I must remind you that it is through the discovery, by Mr. C. Peach of certain fossils of Lower Silurian age in the limestones of Sutherland, combined with the order of the strata observed in the year 1827 by Professor Sedgwick and myself, that the true age of the largest and overlying masses of crystalline rocks of the Highlands have been fixed. The fossils of the Sutherland limestone are not, indeed, strictly those of the Lower Silurian of England and Wales, but are analogous to those of the Calciferous sand-rock of North-America. The Maclurea is indeed known in the Silurian limestone of the south of Scotland; but the Ophileta and other forms are not found until we reach the horizon of North America. Now, these fossils refer the zone of the Highland limestone and associated quartz rocks to that portion of the lower Silurian which forms the natural base of the Trenton series of North America, or the lower part of the Llandeilo formation of Britain. The intermediate formation—the 'Lingula flags' or *zone primordiale* of Bohemia—having no representative in the North-western Highlands, there is necessarily a complete unconformity between the fossil-bearing crystalline limestones and quartz rocks with the Maclurea, Murchisonia. Ophileta, Orthis, Orthoceratites, &c., and those Cambrian rocks on which they rest.

"A great revolution in the ideas of many an old geologist, including myself, has thus been effected. Strengthened and confirmed as my view has been by the concordant testimony of Ramsay, Harkness, Geikie, James and others, I have had no hesitation in considering a very large portion of the crystalline strata of

* See "Russia and the Ural Mountains."

† Monats-Bericht der Konig. der Wiss. Berlin, April 18, 1861.

the Highlands to be of the same age as some of the older fossiliferous Silurian rocks, whether in the form of slates in Wales, of grauwacke-schist in the southern counties of Scotland, or in the conditions of mud and sand at St. Petersburg. The conclusions as respects the correlation of all the older rocks of Scotland have now indeed been summed up by Mr. Geikie and myself in the Geological Sketch-map of Scotland which we have just published, and a copy of which is now exhibited. Not the least interesting part of that production, that which explains the age of all the igneous or trappean rocks of the south of Scotland, as well as all the divisions of the Carboniferous formation, is exclusively the work of my able colleague.

"But if, through the labours of hard-working geologists, we have arrived at a clear idea of the first recognizable traces of life and their sequences, we are yet far from having satisfied our minds as to the *modus operandi* by which whole regions of such deposits have, as in the Highlands, been transmuted into a crystalline state. Let us therefore hope that, ere this meeting closes, we may receive instructions from some one of the band of foreign or British geologists who have by their experimental researches been endeavouring to explain the processes by which such wonderful changes in the former condition of the sedimentary deposits have been brought to light; such as that by which strata once resembling the incoherent Silurian clay which we see in Russia have been hardened into such rocks as the slaty grauwacke of other regions, and how hard schists of the south of Scotland have been metamorphosed into the crystalline rocks of the Highlands. But why are British geologists to see any difficulty in admitting what I have proposed, that vast breadths of these crystalline stratified rocks of the Highlands are of Lower Silurian age? Many years ago I suggested, after examination, that some of the crystalline rocks near Christiana in Norway were but altered extensions of the Silurian deposits of that region; and since then Mr. David Forbes and M. Kjerulf have demonstrated the truth of the suggestion. Again, and on a vastly larger scale, we know that in North America all the noted geologists, however they may differ on certain details, agree in recognising the fact that the vast eastern seaboard range of gneissic and micaceous schists is made up of metamorphosed strata, superior even to the lowest of the Silurian rocks. Logan, Rogers, Hall and Sterry Hunt are decidedly

of this opinion; and the point has been most ably and clearly set before the public by the last mentioned of these geologists,* who, being himself an accomplished chemist, has given us some good illustrations of the probable *modus operandi* in the bringing about of these changes.

"The importance of the inquiries to be made by chemical geologists into this branch of our science was not lost upon the earlier members of the British Association. Even in the year 1833 a committee was appointed to endeavour to illustrate the phenomena of the metamorphism of rocks by experiments carried on in iron furnaces. After a series of trials on various mineral substances, the Rev. W. Vernon Harcourt, to whom we owed so much at our foundation, has as the reporter of that committee, been enabled to present to the Association that lucid report on the actual effect of long-continued heat which is published in our last volume. In referring you to that document, I must, as an old practical field-geologist, express the gratification I feel in seeing that my eminent friend has, in the spirit of true inductive philosophy, arrived, after much experiment and thought, at the same conclusion at which, in common with Sedgwick, Buckland, De la Beche, Phillips, and others in my own country, and with L. Von Buch, Elie de Beaumont, and a host of geologists abroad, I had long ago arrived in the field. I, therefore, re-echo their voices in repeating the words of Mr. W. Harcourt, 'that we are not entitled to presume that the forces which have operated on the earth's crust have always been the same.' Looking to the only rational theory which has ever been propounded to account for the great changes in the crust which have taken place in former periods, the existence of an intense central heat which has been secularly more and more repressed by the accumulation of sediment, until the surface of the planet was brought into its present comparatively quiescent condition, our first General Secretary has indicated the train of causes, chymical and physical, which resolve some of the difficulties of the problem. He has brought before us, in a compendious digest, the history of the progress which has been made in this branch of our science, by the writings of La Place, Fourier, Von Buch, Fournet, and others, as well as by the experimental researches of Mitscherlich, Berthier, Senarmont, Daubrée, Deville, De-

* This Journal for April, and American Journal of Science, May, 1861.

lesse, and Durocher. Illustrating his views by reference to chymical changes in the rocks and minerals of our own country, and fortifying his induction by an appeal to his experiments, he arrives at the conclusion that there existed in former periods a much greater intensity of causation than that which now prevails. His theory is that whereas now, in the formation of beds, the aqueous action predominates, and the igneous is only represented by a few solfataras, in the most ancient times the action was much more igneous, and that in the intermediate times fire and water divided the empire between them. In a word, he concludes with the expression of the opinion which my long continued observation of facts had led me to adopt, 'that the nature, force, and progress of the past condition of the earth cannot be measured by its existing condition.'

"In addition to these observations on metamorphism, let me remind you that, on the recommendation of the British Association, other important researches have been carried on by Mr. William Hopkins, our new General Secretary, and in the furnaces of our President, Mr. Fairbairn, on the conductive powers for heat in various mineral substances. Although these experiments have been retarded by a serious accident which befel Mr. Hopkins, they are still in progress, and I learn from him that, without entering into any general discussion as to the probable thickness of the crust of our planet, we may even now affirm, on experimental evidence, that, assuming the observed terrestrial temperature to be due to central heat, the thickness of this crust must be two or three times as great as that which has been usually considered to be indicated by the observed increase of temperature at accessible depths beneath the earth's surface.

"Of the Devonian rocks or Old Red Sandstone much might be said if I were to advert to the details which have been recently worked out in Scotland by Page, Anderson, Mitchell, Powrie, and others; and in England by the researches of the Rev. W. Symonds and other members of the Woolhope and Malvern clubs. But, confining myself to general observations, it may be stated that a triple subdivision of that group, which I have shown to hold good over the continent of Europe as in our own country, seems now to be generally admitted, while the history of its southern fauna in Devonshire has recently been graphically and ably elaborated by Mr. Pengelley in a paper printed in our last volume.

" In Herefordshire and Shropshire the passage of the upper members of the Silurian rocks into the inferior strata of the Old Red group has been well shown by Mr. Lightbody, and the fossils of its lower members have been vigorously collected, while in Scotland Mr. Geikie and others have shown the upward passage of its superior strata into the base of the Carboniferous rocks, and Dr. Anderson announces the finding of shells with crustacea in the lower or gray beds, south of the Tay. I may here note that the point which I have been for some years endeavouring to establish as to the true position of the Caithness flags with their numerous ichthyolites seems to be admitted by my contemporaries. The lamented Hugh Miller considered these ichthyolites as belonging to the lower member of the group, and had good grounds for his views, since at his native place, Cromarty, these fish beds appear very near the base. But, by following them into Caithness and the Orkneys, I have shown that they occupy a middle position, while the true base of the group is the equivalent of the zone with Cephalaspis, Pteraspis, and Pterygotus.

" And here it is right to state that the Upper Silurian rocks, which are clearly represented in Edinburghshire, and which in Lanarkshire seem to graduate upwards into the Lower Old Red or Cephalaspis sandstone, are wanting in the Highlands, thus accounting for the great break which there occurs between the crystallized rocks of lower Silurian age and the bottom beds of the Old Red Sandstone.

" Of the Old Red Sandstone of Scotland and Herefordshire I may be permitted further to observe that its downward passage into the uppermost Silurian rock and the upward passage of its higher strata into the Carboniferous strata has been well developed; the one near Ludlow, chiefly through the labours of Mr. Lightbody; the other in Scotland, through the researches of the Government geologists Howell and Geikie, as well as by those of Mr. D. Page and other observers. On this head I may however note what my contemporaries seem now to admit, that the removal of the Caithness flags and their numerous included ichthyolites from the bottom of this group, and their translation to the central part of the system, as first proposed by myself, is correct. In truth, the lower member of this system is now unequivocally proved to be the band with Cephalaspis, Pteraspis, &c., as seen in Scotland, England, and Russia. The great break which has been traced in

the south of Scotland by Mr. Geikie between the lower and upper Old Red is thus in perfect harmony with the zoological fact that the central or Caithness fauna is entirely wanting in that region, as in England,—as it is indeed in Ireland, where a similar break occurs.

"It gratifies me to add that many new forms of those fossil fishes which so peculiarly characterize the Old Red Sandstone have been admirably described by Sir Philip de Grey Egerton in the *Memoirs of the Geological Survey*, and I must remark that it is most fortunate that the eminent Agassiz is here so well represented by my distinguished friend, who stands unquestionably at the head of the fossil ichthyologists of our country.

"Very considerable advances have been made in the development of our acquaintance with that system—the Carboniferous—which in the North of England (Yorkshire) has been so well described by Professor Philips, and with which all practical geologists in and around Manchester are necessarily most interested. The close researches of Mr. Binney, who has from time to time thrown new lights on the origin and relations of coal and the component parts of its matrix, established proofs, so long ago as 1840, that a great part of our coal fields was accumulated under marine conditions, the fossils associated with the coal beds being, not as had been too generally supposed, of fluviatile or lacustrine character, but the spoils of marine life. Professor Henry Rogers came to the same conclusion with regard to the Appalachian coal fields in America in 1842. Mr. Binney believes that the plant Sigillaria grew in salt water, and it is to be remarked that even in the so-called 'freshwater limestones' of Ardwick and Le Botwood the Spirorbis and other marine shells are frequent, while many of the shells termed Cypris may prove to be species of Cythere. Again, in the illustrations of the fossils which occur in the bands of iron-ore in the South Welsh coal field, Mr. Salter, entering particularly into this question, has shown that in the so-called 'Unio-beds' there constantly occurs a shell related to the Mya of our coasts, which he terms Anthracomya; while, as he has stated in the *Memoirs of the Geological Survey*, just issued, the very Unios of these beds have a peculiar aspect, differing much from that of true freshwater forms. They have, he says, a strongly wrinkled epidermis, which is a mark of the Myadæ, or such burrowing bivalve shells, and not of true Unionidæ; they also differ in the

interior, as shown by Professor W. King. Seeing that in these cases quietly deposited limestones with marine shells (some of them, indeed, of estuary character) rest upon beds of coal, and that in many other cases purely marine limestones alternate frequently with layers of vegetable matter and coal, may we not be led to modify the theory, founded on the sound observation of Sir W. Logan, by which the formation of coal has been rather too exclusively referred to terrestrial and freshwater conditions? May we not rather revert to that more expansive doctrine, which I have long supported, that different operations of nature have brought about the consolidation and alteration of vegetable matter into coal? In other words, that in one tract the coal has been formed by the subsidence *in situ* of vast breadths of former jungles and forests; in another, by the transport of vegetable materials into marine estuaries; in a third case, as in Russia and Scotland (where purely marine limestones alternate with coal), by a succession of oscillations between jungles and the sea; and lastly, by the extensive growth of large plants in shallow seas?

"The geological map of Edinburghshire prepared by Messrs. Howell and Geikie, and recently published, with its lucid explanations, affords, indeed, the clearest proofs of the frequent alternations of beds of purely marine limestone charged with Producti and bands of coal, and is in direct analogy with the coal fields of the Donetz, in Southern Russia.*

"In sinking through the extensive coal tracts around Manchester (at Dukinfield), where one of the shafts already exceeds in depth the deepest of the Durham mines, rigorous attention will, I hope, be paid to the discovery of the fossils which characterize each bed passed through, not merely to bring about a correctly matured view of the whole history of these interesting accumulations, formed when the surface of our planet was first furnished with abundant vegetation, but also for the practical advantage of the proprietor and miner, who, in certain limited areas, may thus learn where iron-ores and beds of coal are most likely to be persistent. In carrying out his survey work through the north-western coal tracts of Lancashire, to which the large or six-inch Ordnance map has been applied, one of the secretaries of this section, Mr. Hull, has done good service in accurately defining the tracts

* See "Russia in Europe and the Ural Mountains," Vol. 1.

wherein the elevated coal deposits are covered by drift only, in contradistinction to those which are still surmounted by red rocks of Permian and Triassic age. In seeing that these are eagerly bought by the public, and in recognizing the great use which the six-inch survey has proved in the hands of the geological surveyors in Scotland, our friends in and around Manchester may be led to insist on having that large scale of survey extended to their own important district. By referring to the detailed delineations of the outcrops of all the Carboniferous strata in the counties of Edinburgh, Haddington, Fife, and Linlithgow, as noted by Professor Ramsay and Messrs. Howell and Geikie, the coal proprietors of England will doubtless recognize the great value of such determinations.

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" *Geological Survey and Government School of Mines, Mineral Statistics, and Colonial Surveys.*—As I preside for the first time over this section since I was placed at the head of the Geological Survey of Britain, I may be excused for making an allusion to that national establishment, by stating that the public now take a lively interest in it, as proved by a largely-increased demand for our maps and their illustrations—a demand which will, I doubt not, be much augmented by the translation at an early day of many of our field surveyors from the south-eastern and central parts of England, where they are now chiefly employed, to those northern districts where they will be instrumental in developing the superior mineral wealth of the region.

" The Government School of Mines, an offshoot of the Geological Survey, is primarily intended to furnish miners, metallurgists, and geological surveyors with the scientific training necessary for the successful pursuit and progressive advancement of the callings which they respectively pursue; but at the same time the lectures and the laboratories are open to all those who seek instruction in physical science for its own sake, by reason of its important application to manufactures and the arts. The experience of ten years has led the professors to introduce various modifications into their original programme—with the view of adapting the school as clearly as possible to the wants of those two classes of students; and at present, while a definite curriculum, with special rewards

for excellence, is provided for those who desire to become mining, metallurgical, and geological associates of the school, every student who attends a single course of lectures may by the new rules compete in the final examination for the prizes which attach to it only.

"Throughout the whole period of the existence of the school the professors have given annual courses of evening lectures to working men, which are always fully attended, as a part of their regular duty; and during the past year several of them have delivered voluntarily courses of evening lectures, at a fee so small as to put them within the reach of working men, pupil-teachers, and schoolmasters of primary schools. The professors thus hope to support to the utmost the great impulse towards the diffusion of a knowledge of physical science through all classes of the community which has been given through the Department of Science and Art by the Minute of the Committee of Privy Council of the 2d of June, 1859.

"A body like the British Associa' n for the Advancement of Science should, I conceive, not be unaware of a step of such vast importance, and tending so entirely towards the same goal as that to which its own efforts have been and still are constantly directed.

"Now, inasmuch as I can trace no record of the teachings of the Government School of Mines in the volumes of the British Association, and as I am convinced that the establishment only requires to be more widely known, in order to extend sound physical knowledge not merely to miners and geologists, but also to chemists, metallurgists, and naturalists, I have only to remind my audience that this School of Mines which, owing its origin to Sir Henry De la Beche, has furnished our colonies with some of the most accomplished geological and mining surveyors, and many a manufacturer at home with good chemists and metallurgists, has now for its lecturers men of such eminence that the names of Hoffman, Percy, Warington Smyth, Willis, Ramsay, Huxley, and Tyndall are alone an earnest of our future success.

"In terminating these few allusions to the Geological Survey and its applications, I gladly seize the opportunity of recording that in the days of our founder, Sir Henry de la Beche, our institution was greatly benefited in possessing, for some years, as one of its leading surveyors, such an accomplished naturalist and skilful geologist, as the beloved Assistant General Secretary of the

British Association, Professor Philips, who by his labours threw much new light on the palæontology of Devonshire, who, in the Memoirs of the Survey, has contributed an admirable Monograph on the Silurian and other rocks around the Malvern hills, and who, by his lectures and writings, is now constantly advancing geological science in the oldest of our British Universities.

"There is yet one subject connected with the Geological Survey to which I must also call your attention—viz., the mineral statistics of the United Kingdom, as compiled with great care and ability by Mr. Robert Hunt, the Keeper of the Mining Records, and published annually in the Memoirs of our establishment.

"These returns made a deep impression on the statists of foreign countries who were assembled last year in London at the International Congress. The Government and members of the Legislature are now regularly furnished with reliable information as to our mineral produce, which, until very recently, was not obtainable. By the labours of Mr. Robert Hunt, in sedulously collecting data from all quarters, we now become aware of the fact that we are consuming and exporting about 80,000,000 of tons of coal annually (a prodigious recent increase, and daily augmenting). Of iron ore we raise and smelt upwards of 8,000,000 of tons, producing 3,826,000 tons of pig iron. Of copper ore we raise from our own mines 236,696 tons, which yield 15,968 tons of metallic copper; and from our native metallic minerals we obtain of tin 6,695 tons; of lead, 63,525 tons; and of zinc, 4,357 tons. The total annual value of our minerals and coals is estimated at 26,993,573*l.*, and that of the metals (the produce of the above minerals) and coal at 37,121,318*l.*

"When we turn from the consideration of the home survey to that of the geological surveys in the numerous colonies of Great Britain, I may well reflect with pleasure on the fact that nearly all the leaders of the latter have been connected with, or have gone out from, our home geological survey and the Government School of Mines.

"Such were the relations to us of Sir William Logan in Canada, of Professor Oldham in India, with several of his assistants; of Selwyn in Victoria, of my young friend Gould in Tasmania, as well as of Wall in Trinidad; while Barret, in Jamaica, is a worthy pupil of Professor Sedgwick. Passing over the many interesting results which have arisen out of the examination of these

distant lands, we cannot but be struck with the fact that, while Hindostan (with the exception of the higher Himalayan mountains), differs so materially in its structure and fossil contents from Europe, Australia (particularly Victoria) presents, in its palæozoic rocks at least, a close analogy to Britain. Thanks to the ability and zeal of Mr. Selwyn, a large portion of this great auriferous colony has been already surveyed and mapped out in the clearest manner. In doing this he has demonstrated that the productive quartzose veinstones, which are the chief matrix of gold, are mainly subordinate to the lower Silurian slaty rocks, charged with trilobites and graptolites, and penetrated by granite, syenite, and volcanic rocks, occupying vast regions. Mr. Selwyn, aided in the palæontology of his large subject by Professor M'Coy, has also shown how these original auriferous rocks have been worn down at successive periods, one of which abrasions is of pliocene age, another of post-pliocene, and a third the result of existing causes. All these distinctions, as well as the demarcation of the carboniferous, oolitic, and other rocks are clearly set forth. Looking with admiration at the execution of these geological maps, it was with exceeding pain I learnt that some members of the Legislature of Victoria had threatened to curtail their cost, if not to stop their production. As such ill-timed economy would occasion serious regret among all men of science, and would, I know, be also deeply lamented by the enlightened Governor, Sir Henry Barkly, and would at the same time be of lasting disservice to the material advancement of knowledge among the mining classes of the State, let us earnestly hope that the young House of Parliament at Melbourne may not be led to enact such a measure.

[Want of space compels us to omit the conclusion of this address, as well as a preceding portion relating to the Permian rocks.]

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF AUGUST, 1861.

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	29.788	29.729	29.720	67.4	89.6	70.1	.584	.855	.586	.87	.62	.80	E. S. E.	E. S. E.	E. S. E.	5.60	2.0	.....	.....	C. C. Str. 4.	Clear.	Clear. Faint Aurora Borealis.
2	723	649	543	70.0	84.7	72.2	.621	.870	.706	.85	.73	.90	S. E.	S. by E.	N. W.	31.40	1.5	Inapp.	.....	Fog.	C. C. Str. 10.	Cirr. Str. 10.
3	709	753	837	71.4	85.1	68.3	.592	.570	.509	.83	.47	.75	W.	W.	W. S. W.	87.00	1.5	.....	.....	Clear.	Clear.	Clear.
4	786	698	514	65.2	85.7	73.5	.516	.768	.712	.84	.63	.83	S. E. by E.	S. S. E.	S. S. W.	58.10	2.0	Inapp.	.....	"	C. C. Str. 8.	Cu. Str. 4. Thunder.
5	545	614	654	68.1	84.1	64.6	.483	.789	.528	.72	.68	.86	W. N. W.	W.	W.	175.00	2.0	0.310	.....	Cu. Str. 10.	Clear.	C. C. Str. 8.
6	710	705	837	60.5	68.3	57.7	.419	.349	.378	.80	.51	.81	W.	W. N. W.	N. by W.	119.80	1.6	.....	.....	Clear.	Str. 4.	Cu. Str. 4.
7	854	819	890	59.7	78.5	64.6	.345	.619	.497	.68	.64	.83	S.	S. W. by S.	S.	56.40	1.5	.....	.....	"	Clear.	Str. 4.
8	869	799	826	61.6	76.6	61.1	.383	.497	.413	.71	.59	.80	E. by N.	N. N. E.	S. S. E.	60.80	1.0	.....	.....	"	"	Clear. Aurora Borealis.
9	784	791	741	60.1	83.0	61.4	.396	.558	.415	.76	.50	.77	E. by N.	S. by E.	S. by E.	11.00	1.0	.....	.....	"	Cirr. 2.	C. C, Str. 4.
10	488	420	548	68.5	83.6	61.0	.577	.711	.360	.85	.62	.68	W. S. W.	S. W.	S. E. by E.	160.40	1.5	0.290	.....	C. C. Str. 4.	Cu. Str. 6.	Clear. Distant Thunder.
11	698	809	816	52.1	78.2	58.5	.334	.704	.387	.86	.73	.79	W. S. W.	S.	W. N. W.	48.70	1.5	.....	.....	Clear.	Clear.	Clear. Aurora Borealis.
12	897	823	860	53.2	73.4	59.4	.305	.476	.380	.79	.59	.76	N. E. by N.	S. S. E.	N. N. E.	78.10	1.5	.....	.....	Cu. Str. 4.	Cu. Str. 4.	Cu. Str. 9.
13	891	913	939	54.6	71.0	59.4	.301	.316	.323	.71	.42	.65	N. N. E.	N. E. by E.	N. E. by E.	229.30	2.0	.....	.....	" 6.	" 6.	" 4. Inapp. faint Hala.
14	990	999	30.060	53.5	71.1	51.0	.295	.386	.252	.73	.53	.68	N. E. by E.	S. S. W.	S. E. W.	224.40	2.0	.....	.....	" 10.	" 4.	Clear. Aurora Borealis.
15	30.091	30.089	026	49.7	80.2	62.4	.315	.452	.429	.89	.44	.77	S. S. W.	S. S. W.	S. S. W.	50.30	1.5	.....	.....	Clear. Heavy dew.	" 4.	"
16	29.995	29.941	29.975	58.0	84.3	66.6	.400	.558	.496	.84	.50	.77	S.	S. S. W.	S. S. W.	45.60	1.5	.....	.....	Clear.	Clear.	Cu. Str. 10.
17	886	846	30.004	64.2	78.8	66.0	.409	.514	.509	.70	.54	.81	S. W.	W. S. W.	S. W.	90.60	1.5	Inapp.	.....	Cu. Str. 4.	C. C. Str. 8.	" 10.
18	894	999	29.951	64.1	79.6	65.0	.373	.465	.513	.62	.47	.86	N.	W.	W. N. W.	57.50	1 5	.....	.....	Cirr. 4.	Cu. Str. 4.	" 10.
19	30.017	999	30.056	58.1	83.1	60.2	.288	.637	.426	.61	.56	.62	N. E. by E.	N. E. by E.	E. by S.	61.10	1.0	.....	.....	Clear.	Clear.	Cu. Str. 4.
20	082	30.190	151	50.0	76.0	56.6	.318	.376	.362	.74	.42	.81	N. N. E.	E. S. E.	E. by N.	155.50	1.0	.....	.....	"	Cirr. 4.	Clear.
21	070	045	29.897	56.0	69.3	65.1	.363	.564	.816	.81	.79	.84	E. by N.	S. E.	S. E.	34.70	3.0	Inapp.	.....	C. C. Str. 10.	Cu. Str. 4.	Cu. Str. 10.
22	29.612	29.612	615	61.6	69.1	51.9	.498	.564	.410	.91	.79	.84	S. W. by S.	S. S. W.	W.	123.90	3.0	0.680	.....	Rain.	" 10.	Clear.
23	853	817	918	53.5	73.6	63.7	.348	.476	.453	.86	.59	.80	W. S. W.	S. W.	W. S. W.	176.61	2.0	.....	.....	Clear.	" 4.	"
24	903	916	30.004	64.1	76.2	63.0	.446	.652	.510	.77	.73	.88	S. S. W.	S. S. W.	W.	81.75	2.5	0.370	.....	"	Clear.	Cu. Str. 6. Distant Thunder.
25	925	982	041	62.0	78.6	63.1	.498	.626	.422	.91	.65	.75	W.	S. S. W.	S. W. by W.	21.20	1.5	.....	.....	"	Cu. Str. 6.	C. C. Str. 8.
26	30.006	30.035	29.951	65.8	83.5	63.7	.576	.657	.471	.92	.56	.81	S.	S. S. E.	S. by E.	20.20	2.0	0.300	.....	C. C. Str. 4.	" 8.	Clear.
27	29.934	29.840	866	65.0	76.1	65.3	.556	.652	.549	.91	.73	.89	S. by W.	S. S. E.	S. by W.	76.00	2.0	Inapp.	.....	Cu. Str. 10.	C. C. Str. 8.	C. C. Str. 4.
28	858	818	821	62.4	81.2	68.0	.466	.585	.619	.85	.56	.92	S. W.	S. S. W.	S.	64.10	1.5	.....	.....	" 10.	Cu. Str. 4.	Cu. Str. 8.
29	865	720	851	63.6	78.6	57.5	.543	.619	.343	.94	.64	.72	S.	W.	S. by W.	88.80	1.0	Inapp.	.....	Rain.	Cirr. 4.	Clear.
30	793	749	898	57.7	77.1	59.1	.407	.436	.387	.87	.49	.79	S. S. W.	S. S. W.	W.	62.40	1.5	Inapp.	.....	Clear.	Cu. Str. 8.	Cu. Str. 10.
31	859	996	932	49.0	68.4	53.2	.303	.411	.328	.89	.60	.83	W.	W. S. W.	W. S. W.	198.40	1.5	.....	.....	"	Clear.	Clear.

REPORT FOR THE MONTH OF SEPTEMBER, 1861.

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	30.039	30.017	30.059	49.3	72.2	56.6	.297	.365	.368	.85	.47	.81	W. S. W.	W. S. W.	W. S. W.	32.10	2.0	.....	.....	Clear.	Clear.	Clear. Aurora Borealis.
2	29.959	29.914	29.851	52.2	68.9	61.0	.376	.502	.473	.87	.72	.88	S. E. by E.	S. S. W.	E. by N.	44.90	2.5	0.386	.....	Cu. Str. 8.	Cu Str. 4.	Cu. Str. 10.
3	637	720	889	71.0	81.4	63.0	.651	.585	.453	.88	.56	.80	W. S. W.	S. S. W.	S. S. W.	232.10	2.5	.....	.....	" 4.	" 4.	Clear. Distant Thunder at 6·30
4	882	931	30.021	59.0	65.0	53.7	.358	.307	.315	.73	.51	.77	W.	W.	W. S. W.	230.60	1.5	.....	.....	Clear.	" 4.	" Faint Aurora Borealis.
5	992	980	29.844	48.6	69.6	55.7	.278	.367	.370	.81	.52	.84	S.	S. by E.	S. S. E.	20.30	2.0	.....	.....	" Frost.	C. C. Str. 4.	Cu. Str. 2.
6	699	477	582	50.1	74.6	60.1	.398	.568	.462	.90	.67	.91	S. S. E.	E. S. E.	E. S. E.	173.76	2.0	0.306	.....	Cu. Str. 8.	Cu. Str. 2.	Clear.
7	850	897	902	56.0	72.4	52.0	.370	.550	.289	.84	.69	.76	S. S. W.	S. S. W.	S. S. W.	214.40	1.5	.....	.....	" 4.	Clear.	"
8	30.060	30.110	30.170	46.5	61.0	50.1	.280	.352	.290	.88	.70	.82	W. S. W.	S. W.	S. W.	38.10	1.5	.....	.....	Clear.	Cu. Str. 4.	Cu. Str. 2. faint Aurora Borealis.
9	129	175	150	48.2	68.6	53.0	.285	.349	.303	.85	.51	.77	S.	E. S. E.	S. E.	9.40	1.5	.....	.....	C. C. Str. 10.	" 8.	Clear.
10	198	114	017	51.0	67.7	56.0	.348	.386	.368	.93	.57	.81	E. S. E.	E. S. E.	E.	9.80	2.0	.....	.....	" 8.	Clear.	"
11	29.833	29.700	29.662	53.3	57.1	54.1	.321	.378	.399	.80	.81	.93	N. E. by N.	S. S. E.	N.	79.80	2.5	0.156	.....	Cu. Str. 10.	Rain.	Cu. Str. 4.
12	624	666	736	52.5	68.4	56.1	.361	.509	.391	.93	.75	.87	S. S. W.	S. S. W.	S. S. W.	132.30	2.0	.....	.....	" 10.	Cu. Str. 4.	Clear.
13	802	804	914	56.1	75.6	63.0	.427	.584	.422	.97	.66	.76	S. by E.	S.	S. S. E.	118.70	2.5	.....	.....	Fog.	Clear.	"
14	912	830	808	60.1	75.2	64.2	.432	.735	.563	.85	.86	.94	S. E. by E.	S. E.	S. E.	47.60	2.5	0.066	.....	C. C. Str. 4.	Cu. Str. 10.	Rain.
15	780	862	907	68.2	73.6	54.2	.584	.476	.341	.87	.59	.83	S. W.	W. by S.	N. W.	238.10	2.5	.....	.....	Cirr. 2.	" 4.	Clear. Aurora Borealis.
16	972	30.052	934	41.0	69.6	51.0	.235	.329	.302	.91	.46	.82	S. W. by W.	S. S. E.	S. E. by E.	43.50	1.0	.....	.....	Clear. Frost.	Clear.	Cu. Str. 10.
17	770	29.799	817	47.5	68.0	52.0	.291	.316	.289	.89	.77	.76	E. S. E.	S. S. E.	S. E. by E.	0.70	1.5	.....	.....	C. C. Str. 8.	"	Clear.
18	799	823	871	46.2	79.6	65.1	.269	.606	.523	.88	.60	.86	N. E.	S. E. by E.	S. E.	17.02	1.5	.....	.....	Cu. Str. 4.	Cu. Str. 4.	"
19	714	704	683	61.0	78.4	72.0	.449	.626	.601	.85	.65	.78	S. E. by E.	S. S. E.	E. S. E.	205.10	1.5	.....	.....	Cirr. Str. 2.	Clear.	"
20	842	848	837	57.6	61.7	52.9	.429	.263	.328	.91	.48	.83	W. S. W.	S. by E.	N. E. by E.	42.90	3.0	.....	.....	C. C. Str. 4.	Cu. Str. 10.	Rain.
21	680	660	756	47.0	48.0	45.0	.291	.316	.282	.89	.92	.96	N. E. by E.	N. E. by E.	N. E. by E.	518.30	4.0	2.646	.....	Rain.	" 4.	"
22	763	757	770	46.2	51.0	48.8	.286	.302	.303	.92	.82	.89	N. by W.	S. E. by E.	S. S. W.	184.10	3.0	.....	.....	Cu. Str. 10.	" 10.	C. C. Str. 8.
23	610	650	707	47.0	69.5	54.0	.309	.464	.369	.96	.79	.90	S. S. E.	W. by S.	S. S. W.	44.40	2.5	0.090	.....	Rain.	Clear.	Cu. Str. 10.
24	859	904	931	50.0	69.7	51.3	.290	.592	.321	.82	.83	.86	S. W.	S. W.	S. W. by S.	109.50	1.5	.....	.....	Clear.	"	Clear. Aurora Borealis.
25	924	993	845	48.0	64.1	55.0	.310	.314	.376	.92	.53	.87	S. S. E.	S. by W.	S. S. E.	38.91	1.5	.....	.....	Fog.	Clear.	"
26	770	750	656	50.1	79.1	65.0	.309	.619	.583	.85	.64	.94	S. S. E.	S. S. E.	S. S. E.	91.80	2.0	.....	.....	C. C. Str. 8.	Cu. Str. 4.	Cu. Str. 1.
27	599	515	393	58.5	58 7	57.6	.476	.423	.459	.97	.88	.97	S. E.	S. E.	E.	205.70	3.5	1.066	.....	Rain.	Rain.	Rain.
28	276	549	643	54.3	55.6	51.0	.390	.259	.328	.92	.68	.89	S. W. by S.	W. S. W.	W. S. W.	178.20	3.0	0.100	.....	Cu. Str. 10.	Cu. Str. 4.	C. C. Str. 4.
29	989	30.059	30.196	41.1	59.1	38.6	.212	.309	.201	.82	.85	.86	W. by S.	W. by S.	S. W.	157.40	1.5	Inapp.	.....	" S.	Clear.	Clear.
30	30.270	255	299	40.2	59.0	40.0	.232	.416	.216	.95	.85	.91	S. S. E.	S by E.	S. by E.	8.20	2.0	.....	.....	" 10.	Cu. Str. 4.	"
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

REMARKS FOR AUGUST, 1861.

Barometer ..... Highest, the 20th day, 30·190 inches.
Lowest, the 10th day, 29.420 "
Monthly Mean, 29.853 "
" Range, 0.770 "

Thermometer ... Highest, the 1st day, 90°·6.
Lowest, the 20th day, 46°·2.
Monthly Mean, 66°·84.
Monthly Range, 43°·8.

Greatest intensity of the Sun's rays, 108°·4.
Lowest point of Terrestrial radiation,—41°·7.
Amount of evaporation, 3·02 inches.
Mean of Humidity, .736.

Rain fell on 12 days, amounting to 1.950 inches; it was raining 12 hours and 31 minutes, and was accompanied by thunder on 5 days.
Most prevalent wind, the S. S. W.
Least prevalent wind, the N.
Most windy day the 14th day, mean miles per hour, 9.35.
Least winny day the 9th day, mean miles per hour, 0.42.
Aurora Borealis visible on 4 nights.
Solar Haloes visible on 3 days.
The Electrical state of the Atmosphere has indicated rather high intensity.

REMARKS FOR SEPTEMBER, 1861.

Barometer. ..... Highest, the 30th day, 30.229 inches.
Lowest, the 28th day, 29.276 "
Monthly Mean, 29.849 "
Monthly Range, 1.023 "

Thermometer. Highest, the 18th day, 79°·6.
Lowest, the 25th day,—35°·0.
Monthly Mean, 58°·06.
Monthly Range, 44°·6.

Greatest intensity of the Sun's rays, 97°·8.
Lowest point of terrestrial radiation,—32°·0.
Mean of humidity, ·804.
Amount of Evaporation, 1·83 inches.

Rain fell on 9 days, amounting to 4·816 inches, it was raining 66 hours, 50 minutes, and Thunder was heard on 1 day.
Most prevalent wind, S. S. E.
Least prevalent wind, E.
Most windy day, the 21st day; mean miles per hour, 21.60.
Least windy day, the 17th day; mean miles per hour, 0.02.
Aurora Borealis visible on 5 nights. On 2 nights the Magnetic disturbance was considerable during its apparition.
The Electrical state of the Atmosphere has indicated feeble intensity.
First Frost occurred on the 5th day.
Solar Haloes seen on 2 days.

CONTENTS OF NUMBER V.

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Extract from the "Athenæum," Aug. 28, 1858, page 269.

"The adoption by Mr. CHAPPUIS of the principle of the daylight reflector to the stereoscope was noticed by us in the *Athenæum* for Nov. 7th, 1857. We there made some suggestions for further improvements, with a recommendation to Mr. CHAPPUIS to 'try them.' That gentleman has not done so; but Messrs. SMITH & BECK have not only carried out, *they have gone beyond our suggestions,—and from a toy the stereoscope* has progressed to an object belonging to science. A few words will enable our readers to understand the improvements that have been made in this justly popular instrument. 1st. By the introduction of achromatic lenses the optical part is greatly improved, thereby increasing the definition and correcting the colour which single lenses invariably show on the margin of the objects. These errors in the unachromatic stereoscope frequently destroy the delicacy of the image altogether.—2nd. By the application of lenses of such a focal length, and placed at such a distance apart as that all shall see without fatigue, which is not the case with those hitherto contrived. But with these improvements in the optical part of the instrument arose the need of greater delicacy in the mechanical contrivances for observing to the best advantage; this led—3rd. To an arrangement whereby any one having the sight of both eyes could see the effect.—4th. A thoroughly steady and substantial stand adapted for a person seated at a table, and allowing of any alteration of position. 5th. A method for holding the slides so that they can be placed and replaced easily and without danger.—6th. Means have been adopted for varying the illumination at pleasure, causing a great variety of very beautiful effects of light and shade, from the cool tints of moonlight to the ruddy glow of the morning sun. And, lastly, a compact case to keep the whole from dust, injury, or exposure. The result is a perfection beyond which it is hardly possible to carry the stereoscope. This perfection is admirably exhibited in the stereoscopic views of the Moon, taken on glass by Mr. HOWLETT, from the negatives obtained by Mr. WARREN DE LA RUE with his equatoreal reflecting telescope of 13 inches aperture and 19 feet focal length. The stereoscopic effect is obtained by combining two views of the moon, taken at different epochs nearly in the same phase, but when the disc is in two different conditions of libration."

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