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ART. XXIV.—*On a New Species of Stickleback* (*Gasterosteus gymnetes*). By J. W. DAWSON, LL.D., &c.

(Read before the Natural History Society.)

I propose in this paper to redeem from unmerited neglect an inhabitant of our brooks, the six-spined stickleback, which, though very well known to the boys of Montreal, and much persecuted by them, has, in so far as I am aware, hitherto escaped the notice of naturalists. It belongs to a group of little fishes, represented by many species in the fresh-waters and on the coasts both of the old and new world, and remarkable for their armature of sharp spines, their active and pugnacious habits, and the provision which they make for the care of their spawn.

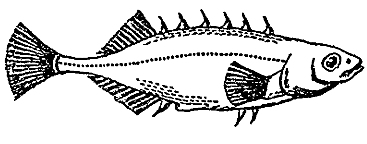


Fig. 1.—*Gasterosteus gymnetes* (male).

The present species makes its appearance in the brooks immediately after the melting of the snows in spring. It is then plump and active, and the females are laden with spawn. The spawn is deposited in the end of March or beginning of April, in a globular nest about the size of a musket-bullet, constructed of green algæ, and placed in a tuft of submerged grass or aquatic weeds. My eldest boy, who first showed me the nest, assures me that one of the parents, probably the male, as in the case of a common British species, remains near the precious deposit, and drives away all intruders. The ova are translucent and colourless, and of the size of a pin-head. They soon exhibit to a close inspection with the naked eye or a magnifying-glass of moderate power, two black specks, the rudiments of the eyes of the future fish; and under the microscope present the appearance represented in figure 2,

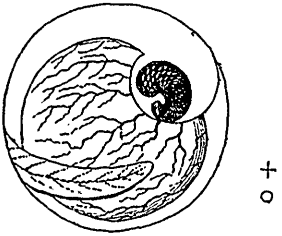


Fig. 2.—*Egg of G. gymnetes* (magnified).

the embryo being coiled up in the usual manner around the yolk-bag, and occasionally moving by convulsive jerks. At this stage I observed that microscopic animalcules had obtained access to the interior of several of the eggs, and evidently occasioned annoyance to the embryo. I have reason to believe that several embryos were destroyed in this way, and perhaps the carefully-built nest may have for one of its objects to guard against such attacks.

In two or three weeks the young extricate themselves from the egg—still only about a tenth of an inch in length, and having the yolk bag attached to the abdomen, as represented in figure 3.

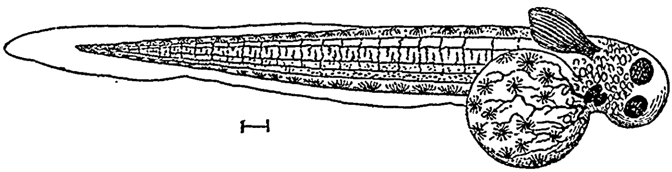


Fig. 3.—*Embryo of G. gymnetes* (magnified).

They swim quickly, and are nearly as dexterous as the adults in avoiding danger and availing themselves of places of concealment. They are now very beautiful objects for microscopic investigation. The head appears a rounded mass of cells. The eyes, however, are well developed, and can be rotated as perfectly as in the adult.

The pulsation of the heart, seen immediately in front of the yolk-bag, and the movement of the blood in the vessels of the yolk-bag, in the aorta and the large veins above and below the spinal column, as well as in the transverse branches passing between the muscular flakes of the sides, can be very distinctly perceived. The spinal column appears as a uniform cartilaginous hyaline cord, and the pectoral fins are fully developed and in constant motion. The posterior part of the body is surrounded by a delicate membranous fin, terminating in a rounded point at the tail.

As the yolk-bag diminishes in size, beautiful stellate pigment cells become developed in the skin, and render it too opaque to permit the interior structures to be well seen; and before the little creature has attained the length of one-sixth of an inch, it has all the appearance of the adult, and may be seen slowly swimming or hovering, with its bright eyes rolling in search of the minute crustaceans, worms, rotifers and animalcules which form its prey, and which it seizes by sudden, quick darts. When alarmed, it hides under stones or algæ, or remains motionless over some part of the bottom resembling its own colour, which, when it is irritated or frightened, deepens almost into black.

The fry remain in the brooks throughout the spring and early summer; but the greater part disappear, descending I suppose into the river, before autumn. Those that remain are now (September) nearly an inch in length, and will probably be full-grown next spring.

The following is the description of the adult in spring:—

Length, two inches; head to body, as 1 to 4; depth of body to length, as 1 to 4. Form, compressed, especially above; back, regularly arched to the end of the dorsal fin, from which it curves upward slightly to the insertion of the caudal fin. Head, regularly conical, obliquely truncated by the lower jaw. Eye, prominent, diameter one-tenth of an inch. Nostril, half-way between eye and pre-maxillary, and on a level with the upper part of the orbit. Body, quite destitute of bony plates; on this last character, the absence of defensive armour, I have given it the specific name *gymnetes*. Pre-operculum, bent nearly at a right angle, rounded at apex. Operculum, rounded below, nearly straight above, rounded at superior posterior angle. Brancheostegal rays, three. Mucous pores, three above each eye, a few very small under the eye; on the occiput a curved row of pores convex backward; at the edge of the operculum two less distinct rows convex upward.

Scapular bones not visible externally. Pectoral fin, broad, separated by a rounded triangular space from the operculum, nearly straight above, rounded below, composed of eleven rays, the two lower soft and simple. Ventrals, consisting each of a stout spine, with the base sheathed in the integument. Pelvic bones, very narrow and pointed backward, thickly covered by integument. Dorsal spines, 5 or 6 (in so far as observed, 5 in the female, 6 in the male); short, stout, and with broad, triangular membranes; anterior spine shortest; spines usually only partially erected, and, when depressed, concealed in the dorsal groove; second dorsal of ten rays, second and third longest; the others rapidly diminishing toward the posterior end of the fin. Anal fin with one detached, curved, stout, membraned spine in front, in form similar to dorsal, and with ten rays. Caudal fin, broad at base, even posteriorly, of fourteen rays. First dorsal spine, above the insertion of the pectoral fin; last, above the beginning of the anal fin. Colour above, dull dark olive, with irregular darker blotches; abdominal region and lower part of gill-covers, pearly gray. Whole body dotted with minute black points. Male darker than female.

This species is found plentifully in most of the small streams near Montreal. Its food appears to consist principally of minute worms and crustacea. Its armature of spines and quickness in hiding enable it to inhabit with safety very shallow and exposed places; but it is easily taken with a dip-net, and great numbers are captured by young anglers for bait. It is easily kept in aquaria, finding its food in the minute inhabitants of the water, if a few tufts of algæ are kept to shelter and feed them. It has however the bad character of attacking and destroying other small fishes with its formidable spines.

I am indebted to Mr. Putnam, assistant to Prof. Agassiz in the Museum of Comparative Anatomy at Cambridge, for comparing this species with specimens in that collection or described in the United States. It is nearly allied to *G. millepunctatus* of Ayres.

I am indebted for the outline in Figure 1, to Mr. R. J. Fowler, who has been so successful in representing our larger Canadian fishes.

ARTICLE XXV.—*On Some of the Glacial Phenomena of Canada and the north-eastern Provinces of the United States during the drift period.* By Professor ANDREW C. RAMSAY, F.R.S., F.G.S., Local Director of the Geological Survey of Great Britain.

(From the Journal of the Geological Society of London.)

Glacialized condition of the Laurentine Mountains; and the drift-deposits of Montreal.—In the Straits of Bellisle, the barren coast of Labrador consists partly of low patches of red sandstones, &c., lying almost horizontally on the Laurentian series—that most ancient system of gneiss and granite which forms the eastern extremity of the great Laurentine chain. These gneissic rocks are rounded and largely mamillated, as if by the action of ice; and all the distant hills, quite bare of trees, possess the same sweeping contours. The gnarled strata of the lofty Bellisle itself, to the very summit, show unequivocal signs of the same abrasion, their well-worn outcrops presenting none of those jagged outlines that all highly-disturbed beds are apt to assume when exclusively weathered by air, rain, and open frost. Similar forms prevail far up the St. Lawrence, on its north shore, easily distinguishable in spite of the forests which, before we reach the Saguenay, rise to the tops of the mountains, leaving here and there unwooded rocky patches. Further up the river, by the Isle aux Coudres (about 50 miles below Quebec), I became more and more impressed by similar appearances. Not a peak is to be seen; and to the top every hill seemed *moutonnée.* Like much of Wales, Ireland, and the Highlands of Scotland, the country appeared *moulded by ice.*

On the south side of the river the country is low, being formed of Silurian strata chiefly covered with drift from the Laurentine chain; and the vast quantity of boulders and smaller stones that cover the land help to impress on it a poor agricultural character.

Approaching Montreal, the gneissic mountains recede to the northwest; and both banks of the river are low, except where an occasional boss of greenstone pierces the Silurian strata. Montreal Mountain, about a mile behind the city, is one of these, rising boldly out of the terraced drift of the plain.

This drift consists of clay, with Laurentian boulders and boulders of greenstone from the mountain, both mixed with subangular gravels of Utica slate and Trenton limestone, which formations rise on its flanks. Many of the boulders and smaller stones are grooved, or more finely scratched, in a manner undistinguishable from the scratched stones of the British and Alpine drift or of Alpine

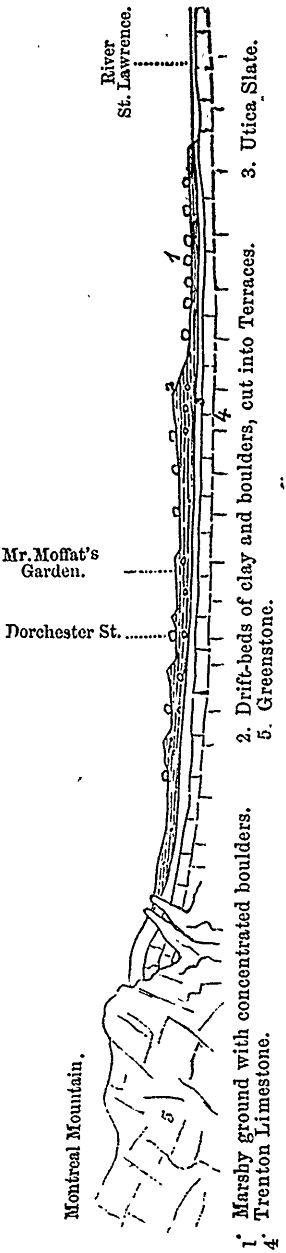


Fig. 1.—*Diagram-section of the Drift Deposits at Montreal*

glaciers. We are indebted to Dr Dawson of Montreal for the three important subdivisions of the superficial deposits,—namely, 1st, at the base, lower boulder-clay and gravel; 2ndly, an unctuous clay, with many marine shells, called by him the "Leda-clay" (*Led-Portlandica*), on which lie, 3rdly, beds of gravel and sand, with shells, one of the most common of which is *Saxicava Rugosa*. These sub-formations occasionnally pass into each other where they join. The Saxicava sand he considers to have been a shallow and sublittoral deposit; the Leda-clay to have been accumulated at depths of from 100 to 300 feet or more; and the true boulder-clay to have been formed at an earlier period of subsidence, during which an ocean spread over the greater part of North America. I shall have occasion to show that at one time this sea was, in places, probably over 3000 feet in depth. The section (fig. 1)* across the drift, which I drew at Montreal, nearly agrees with Dr. Dawson's, with the exception that I show five terraces in the drift, while he gives two. Their number may vary in different localities; but they have certainly been formed during the last emergence of the country, each terrace indicating a pause in elevation; and in a great degree the shells of the upper strata lie in a debris of remodelled drift. The two upper terraces, to the left of

* For the Silurian geology of this diagram, I am indebted to the description of Sir Wm. Logan.

Dorchester Street, correspond to Dr. Dawson's Leda-clay and Saxicava-sand.

Between the lowest terrace and the river there is a broad marsh, including patches of recent freshwater shells. It is part of the old course of the St. Lawrence; and on its surface (the lighter drift having been removed) the boulders that once studded the clay have been concentrated. Similar terraces occur on the banks of the Ottawa. The country is strewn with boulders of gneiss and metamorphic limestone, from the neighbouring Laurentine chain, mixed with more local debris; and here also it seemed, in several cases, as if, by removal of the lighter material, the boulders were more concentrated on the lower than on the highter terraces. Many of the blocks are rounded; in this respect differing markedly from the majority of those on glaciers, in moraines, and probably from those transported by icebergs, which, derived from glaciers that reach the sea-level, obtain their debris by the fall of rocks and stones on their surfaces from inland cliffs. In the American hills which I saw, there are no signs of true glaciers like those of the Alps having existed; and the boulders have been transported by floating ice from old sea-shores, where they had been long exposed to the washing of the waves.

At Hawksbury Mills I crossed the Ottawa with Sir William Logan, and penetrated part of the Laurentine hills lying several miles from the north bank of the river. Waterworn gravel here and there rises nearly to their summits, now rarely more than 500 or 600 feet above the river.

In the range about eight miles north of the Ottawa, there are well-rounded and occasionally grooved surfaces of gneiss greenstone, and quartz-rock,—the striations, where I saw them, running 10° and 20° W. of S.

In many places, among the hills, numerous half-rounded boulders (of the same substances as those that strew the plains of the Ottawa and the St. Lawrence) cover the ground, and appear as if they had been waiting their turn for glacial transportation, ere the country was raised above the sea. These general signs existing in this chain, in latitude 45½° N., gave me more perfect confidence in the universal glacial abrasion of the hills on the coast of Labrador in a latitude nearly 150 miles farther north.

Glacial Drift of the Plains; Striæ and Roches moutonnées.—I need not indulge in repeated descriptions of the drift that covers the plains of Canada and the northern States. It is enough to say that the descriptions given by previous writers are strictly correct. The whole country is literally covered with drift,—to such an extent, indeed, that except in denuded water-courses and deep gorges, like those of the Genesee and Niagara, it is only in rare cases that the rock is exposed. Even railway-cuttings rarely penetrate to the rocks below. It may be compared, in Europe, to the northern plains of Germany. In horizontal extension it is the most widely spread of all deposits; and even in thickness it rises to the dignity of a great formation, having by Logan and Hall been estimated in places at 500 and 800 feet in thickness†. In all cases the Laurentian boulders, which have often travelled hundreds of miles, are mixed with fragments of the rocks that crop out northward towards the Laurentine hills, and with stones from the strata of the immediate neighbourhood,—the number of the component materials of the drift thus generally increasing to the south‡, marking the fact that the lowlands as well as the mountains have been subject to the denuding and transporting agency of ice. At a distance from the mountains, the boulders become comparatively few; and it is this admixture of calcareous and other material, often lightened with sand, that fertilizes the soil in the great plains that surround the lakes.

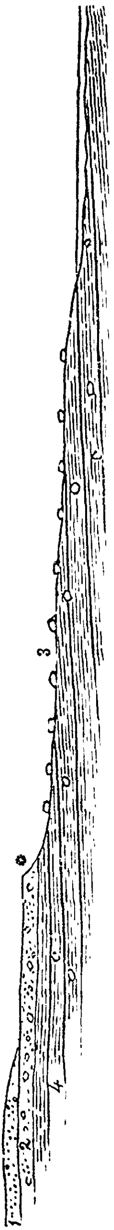
The City of Ottawa stands on Trenton limestone; and the surrounding country is strewn with boulders of Laurentian gneiss and Trenton limestone itself, and of Potsdam sandstone, &c.

Between Ottawa and Prescott on the St. Lawrence, the basement-rock is rarely seen. The country is chiefly covered with gravel containing boulders of gneiss from the hills, and of Silurian rocks from the plains. Here and there are patches of sand containing pebbles and small boulders, generally rounded. In some places it has the appearance of blown sand,—an effect that may have been produced as the land emerged from the sea.

The shores of Lake Ontario, in general, consist of low and shelving slopes of drift; but at Scarborough bold cliffs of sand, gravel, and clay partly white with boulders, rise 320 feet above the lake. The terraces of Toronto have been described by Sir Charles Lyell. They are like those of the St. Lawrence and the Ottawa. The lower part of the city stands on a very stiff boulder-clay, containing large and small boulders, many of them scratched. Somewhat higher there are beds of beauti-

† I had an opportunity of examining the drift in many places between Quebec and London (which lies between Lake Huron and Lake Erie) about 500 miles from N.E. to S.W. in a direct line, and from north to south between Montreal and Ottawa, to Blossburgh and New York.

‡ See Murray's Report, Geological Survey of Canada, 1856.



Lake Ontario.

Sand.

Fig. 2.—*Section of the Drift-terraces at Toronto.*

1. Sand.
2. Sand with boulders.
3. Boulders left after the removal of the sand by denudation.
4. White laminated clay, containing some boulders.

fully laminated brick-clays, similar to the clay of the Hudson Valley, afterwards to be described, and probably its equivalent. In 1857, great railway-cuttings were in progress in the lower clay. The terrace marked * in fig. 2 consists of sand with Laurentian and other boulders resting on white brick-clay, which is beautifully laminated, and in which similar boulders are more sparingly scattered.

The removal of the sand by denudation, to form the terrace, has produced a great concentration of gneissic and other boulders on the surface between the terrace and the lake.

In the great plains between Lake Ontario, Erie, and Huron, the drift of gravel, sand, and clay, with many large and small striated boulders, is frequently of great and unknown thickness. White clay occurs round London; and from this the bricks are made of which the town is built. The geologist may here travel twenty or thirty miles without seeing rocks in place. In the gravels near Hamilton, elephantine remains were found, supposed by Dr. Dawson to have been washed from the table-land of the Niagara escarpment when the lower plain was still covered by sea.

Between Rochester and Scottsville, the undulating surface consists entirely of drift, containing numerous boulders of Potsdam sandstone, labradorite, gneiss, hypersthene-rock, &c., from the Laurentine chain about 100 miles off. Many of them are large, smooth, and well striated. Mr. Hall observed that the drift is here often 120 feet thick, and that the mounds are steepest to the north.

The River Genesee runs through a deep rocky ravine, which near Portage is 350 feet high. The rock on the top is smoothed and scratched, and along the whole course of the river, on either side above the gorge, the rocks are generally obscured by drift. On this river Dr. Bigby observed fragments from Montreal Mountain, which lies 270 miles to the north-east; and Laurentine boulders are common. I observed at Mount-morris, on the river, that in the lower part of the drift the stones are often angular and scratched, while the upper beds are of sand.

Near Portage, on the Genesee, the drift is said by Mr. Hall to be about 500 feet thick, filling up a valley in the rocks, through which an older river ran previous to the drift-period. When the country emerged from the sea, and a new drainage was formed, the river was turned aside by this accumulation finding it easier to form a new channel in the present gorge, 350 feet deep.

At Onondaga the drift is 640 feet thick.

Drift is equally characteristic of Connecticut and Massachusetts. In the New Red Sandstane Valley of Connecticut, the drift seemed mixed, but mostly local.

It is also well known that large far-transported boulders occur on the south bank of the Ohio,—a circumstance less remarkable than at first sight appears, when we consider that it is stated that icebergs have been seen as far south as the Azores.

Wherever the drift is freshly removed, the rocks are found to be smoothed, striated, and often rounded. On the Isle Perrot, near Montreal, Mr. Billings observed striæ running S.W.; and near Ottawa, by the river, in several places they run south-easterly. These instances are both at low levels; and during a late period it is easy to understand how, during a former extension of the Gulf of St. Lawrence, icebergs drifting up the Gulf, as they do now, would produce scratches running S.W. in the strait between the Laurentine hills and the Mountains of Adirondack, while in the open sea south of Ottawa (now a great plain) the drift passed in an opposite direction. About halfway between Ottawa and Prescott, on the St. Lawrence, near Kempville, the striæ runs S. from 5° to 10° E. on a smoothed surface of Calciferous Sandrock; and at Niagara, on the limestone, S. 30° W., with minor striations crossing each other at various angles. Near Avon, at Conesus Outlet, in the Genesee Valley, on the Corniferous Limestone, the chief striæ run S. 10° W., crossed by many minor scratches, having a general southern course. These crossings might be expected, if the striæ were produced by floating ice subject to minor variations of the currents, and to the influence of winds. The rock is overlaid by clay containing scratched subangular stones. At Genesee, under 6 feet of drift-clay full of scratched stones, the striæ run S. 5° W.; and near Portage, on the top of the gorge, 350 feet deep, the striæ run a little west of south.

The rocks of the St. Lawrence, where it flows from Lake Ontario, deserve more special notice. Above its junction with the Ottawa, the banks of the St. Lawrence are low and shelving, and the rocks are in general obscured by drift; but between Brockville and Lake Ontario, where the river widens and winds amid the intricacies of the Thousand Isles, while the larger islands are partially covered with drift, and well wooded, the lower islets are often only scantily clothed with grass and a few stunted trees and shrubs. Some of them are formed of Laurentian gneiss, and others of Potsdam sandstone. The Potsdam sandstone above the river-bank at Brockville has been ground smooth, and in waving lines passes under the river. The islands formed of Laurentian gneiss or Potsdam sandstone present the same largely mammilated surfaces, rising from the midst of the river, which between Brockville and the lake gradually increases to 9 or 10 miles in width. All of them are *moutonnées*, somewhat like the islands of Loch Lomond; and the surfaces of the little islets often slip under the water quiet smooth and unbroken.

This is one of those cases in which it might be contended that the glaciation of these rocks may be due to the floating ice of the river when it breaks up in spring. But though it may produce slight effects, there are several conclusive reasons why the greater features should not be referred to this cause. The old glaciation has passed up the country quite beyond the reach of the present river, while the tops of most of the islands rise far above the extreme height of the water; and again, some of the islands with well-rounded glaciated surfaces present vertical cliffs in the river, sometimes 20 feet in height, where the rocks have split away at the joints; and on these cliffs I observed no sign of that glaciation which we should expect to find if the river-ice exercised any important influence. Further, it was observed by Sir Wm. Logan, that if the smoothing were produced by river-ice, many of the trees of the islets would be shaved off by the yearly ice,—whereas, when untouched by man, they grow to the water's edge. At the only place I landed (a wooding-station), the rock had been too long exposed to the weather to retain its striations; but as we passed the islands, I could see indications of striæ; and it is to be wished that some one would settle the point by determining their exact bearings, the chief directions of which, without presumption, I venture to predict will be *across* the river, and approximately from north to south.

Drift and Striæ in the Valley of the Hudson, including the Canaan Hills.—On the banks of the Hudson, south of Albany, the rocks frequently show the familiar mammillated surfaces,—the striations, where I observed them, running nearly north and south. The Highlands of the Hudson also, on a smaller scale, recall the well-rounded outlines of the Laurentine Chain; and at the mouth of the river numerous *moutonnées* surfaces strike the eye, while boulders strew its sides and the surface of Staten Island in the harbour of New-York,—all attesting, thus far south, the undiminished energy of glacial action.

Near Boston, gneissic rocks show the same signs; and at Roxbury, on the outskirts of the city, large surfaces of perfectly *moutonnée* Red Sandstone conglomerate were pointed out to me by Dr. Gould, who informed me that, when he first took Agassiz to the same spot, he at once recognized their ice-smoothed character. The water-worn pebbles of quartz have been ground quite flat on their upper surfaces, and stand slightly out from the rock, the softer sandy matrix of which has yielded to the influence of the weather.

The same kinds of indications are strong in all those parts of Massachusetts, New Hampshire, and Vermont, through which I passed. There, as in the other places previously mentioned, the country is much covered with clay, sand, gravel, and boulders, partly rounded and apparently chiefly derived from neighbouring formations. Far transported boulders may be more scarce among these mountains, their height having partly barred the transport of floating material from the Laurentine Chain, whereas the broad plains south of the lakes were more open to the ice drifting from the north. In the above-named States, instances of fresh and of decaying ice-worn and striated rocks are of constant occurence in the low ground; and it is truly marvellous to see the same rounded contours rising in the mountains to the very top,—again reminding the traveller of the ice-moulded surfaces of the south-west of Ireland, of the Highlands of Scotland, and of part of Wales. In none of these American localities are there, however, any signs of pre-existing glaciers, such as are frequent in the mountainous parts of the British Isles.

I am unable to throw any new light on the perplexing question of the glacial phenomena of the Canaan Hills. These have been described by Dr. Hitchcock and Sir Charles Lyell. The range lies on the east side of the Hudson, about twenty miles south-east of Albany, and forms part of the Green Mountains, which are an intermediate part of the long chain that, commencing on the south with the Alleghany Mountains, trends north-easterly to the Mountains of Notre-Dame and Gaspé, on the south shore of the Gulf of St. Lawrence. In the District of Canaan and Richmond, their average strike is nearly north and south, the rocks consisting of that part of the Silurian series which ranges between the

Birdseye and Trenton limestones and the Oneida conglomerate,—highly disturbed, cleaved, and partly metamorphosed and foliated. The contours of the hills indicate the moulding effects of ice. The rounded surfaces, wherever they have not been too long exposed to the weather, are grooved and scratched; and these well-defined indications are found alike on the sides and the summits of the hills. In company with Mr. Hall and Sir Wm. Logan, I ascended the Canaan Hills from the N. W., descended into the opposite valley, crossed the Richmond Hills above the Shakers' Village, and, descending into the Richmond Valley, walked to Pittsfield. It is a remarkable circumstance, recorded by Dr. Hitchcock, and partly confirmed by Sir Charles Lyell, and which I also saw, that on both slopes the observed striations run, more or less, *across* the trend of the hills, which at this point strike about N.N.W. The directions of the striæ are between E. 10° S. and S.E.; a larger proportion approaching the first than the second direction. Why they should run *across* the hills and valleys at all has not yet been explained; for while quite admitting the value of Mr. Darwin's explanation *, it yet does not appear to me to meet a case where the hills are so steep and the valleys so very deep. The difficulty is increased by the fact that the average strike of mountain and valley is from N. to S., which is also the general direction of glacial striations over most of North America; and it is difficult to understand why, if floating ice produced these marks, an exception should have been made in this case, where we might expect the N. and S. run of the submerged valleys would have acted as guides to the icebergs, which would then have floated from north to south as they did in the adjacent valley of the Hudson. The drift is often 40 feet thick and upwards, and is mostly local, many of the boulders being of the Birdseye limestone, which crops out in the valleys. Smaller drift, with these boulders, creeps up the flanks of the hills almost to their summits,—this effect, as stated by Sir Charles Lyell †, having probably been produced in the manner indicated by Mr. Darwin, who, in a similar instance, considers boulders to have been floated up on the ice of successive winters, by little and little during a slow submergence of the country ‡.

* Phil. Mag. August 1855.

† Proceedings of the Royal Institution, vol. ii. p. 95.

‡ If before the submergence of the country the cold were sufficiently intense, it is possible that each minor range forming the sides of valleys

The Catskill Mountains.—On the west side of the Hudson, the Catskill Mountains rise, in their highest peaks, about 3600 feet above the sea, and nearly that height above the river, which is tidal far above Albany. The strike, both of the Silurian and Devonian rocks of the lower hills, is nearly north and south; and after traversing a broken country for ten or twelve miles, the Catskill Range itself rises in a long north and south escarpment, nearly 3000 feet above the hilly ground that lies between it and the river. At the town of Catskill, striations on the smoothed surfaces run nearly north and south, following the trend of the Hudson Valley between the Catskill and Green Mountains; and at other points between the river and the mountains they run about N.N.E. I was anxious to discover if on the Catskill Mountains themselves there were any signs of true *glacier-action*, this range being much higher than any other elevations which I had an opportunity of ascending. The low country is as much or even more glaciated than Anglesea; and the mountains are as high as Snowdon; and—though in latitude 42° N., whereas North Wales is in latitude 52° to 53°—other conditions seemed very much the same. Observations also in this region were of more importance, since I am not aware that evidences of any kind of glaciation on these heights had previously been definitely recorded. The accompanying sketch-map (fig. 3), constructed on the spot, will give an idea of the topography of that part of the range which I examined.

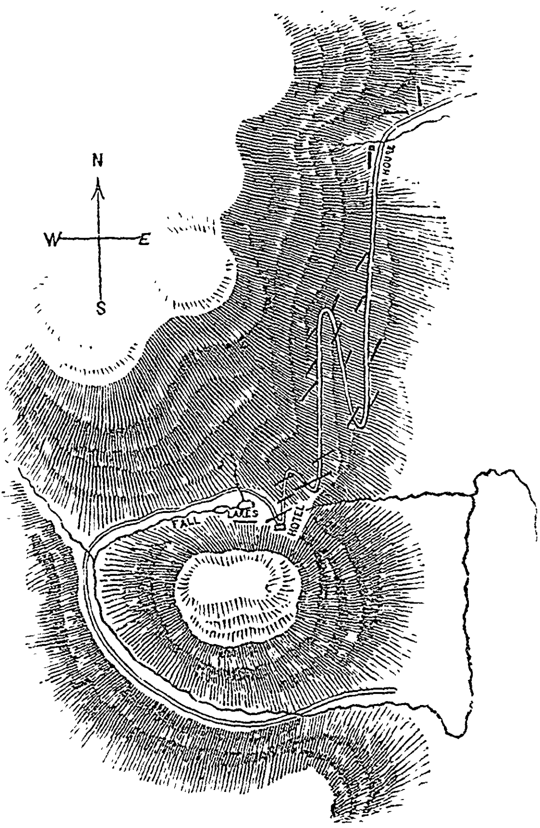
I ascended from the mouth of the valley misnamed "Sleepy Hollow," up the steep and winding road to Mountain House. The mountain is almost everywhere covered by dense wood, so that, except on the roadside, it is comparatively rare to find the

may have been so completely covered with thick snow and ice, that, always pressing downwards from the snow shed, the striations were formed E. and W., or transverse to the trend of the ranges; but in that case both in the valleys and on the sides and summits of the hills, when fairly submerged, we might expect north and south striations formed by the grating of bergs during the deposition of the northern drift. In the case of isolated hills the striæ ought also to radiate from their summits. I observed none of these appearances, but had not sufficient time to search for them in detail. It is clear that the E. and W. striations across the range were not made by a general terrestrial glaciation during, or after, the re-elevation of the country, for then the boulders, &c. transported from low to high levels would all have been swept down again into the hollows.

rocks uncovered. In "Sleepy Hollow" the road runs nearly east and west. Occasionally local drift lies on its steep northern side; and on the smoothed surfaces of rock I observed a few striations from N. to S., and others from E. to W. The former ran up and down the hill towards the brook; and the latter were on the *vertical* faces of the little cliffs, up and down the valley.

Passing the bend where the road crosses the brook, striations became frequent; and I was surprised to find that all of them ran nearly N. and S. along the flanks of the escarpment, and not from W. to E. down the slope of the hill. For a time I thought that as I ascended higher they would cease altogether; but, so far from this being the case, I was alike pleased and astonished

Fig. 3.—*Sketch-map of a portion of the Catskill Mountains, showing the Directions of the striæ near Mountain House.*



to find that they continued equally strong and frequent up to the plateau on which the Hotel stands, 2850 feet above the sea; *and all, but a few of the last, ran not across, but along the face of the escarpment.*

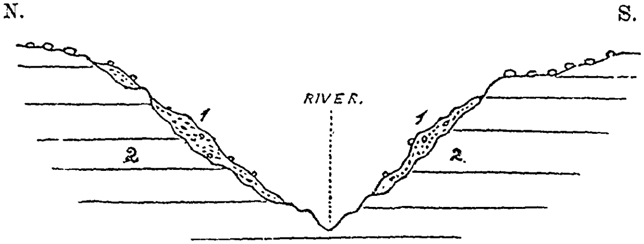
By twenty compass-observations made on clearly defined striations the chief grooves run between S. 22° E. and S. 55° W. Among these, one runs S. 22° E., two S. 10° E., two N. and S., one S. 10° W., six S. 22° W., one S. 30° W., two S. 55° W., and one W. 10° N. The variations seem somewhat connected with bends and other irregularities in the face of the great escarpment, One of the observations (S. 55° W.) was made on the well-scratched plateau on which the Hotel stands, about 120 feet above the lower part of a gorge which here crosses the watershed towards the lakes. in which the stream rises that, further down, forms the Falls of Catskill. The other is at the bend of the road N. E. of the hotel, near the head of the stream. In the lowest part of the gorge, on the summit of the watershed, many square yards of smoothed rock are exposed a little off the road; and in this plateau numerous main grooves are seen, passing *across* the hill, and nearly at right angles to most of those observed during the ascent, seemingly pointing to the fact that the icebergs, which striated the eastern flanks of the mountains in a N. and S. direction, when the whole was nearly submerged, here found a passage or strait, through which they sometimes floated and grated the bottom in a direction quite across that which they were forced to follow when passing along the great escarpment that now faces the Hudson.

Though the principal grooves run in the directions stated, many minor striations, such as might be expected from floating ice, cross them at various angles.

From this point I made two excursions into the higher parts of the range, in the hope of finding similar markings: but so dense is the forest, that it took two hours to walk a mile: and though in several places the rocks were exposed, they were too much weather-worn to afford all the usual indications. Nevertheless the rounded contours of all mountain-tops always impressed me with the idea of glacial abrasion; and if, as I believe, they were contoured and striated by floating ice, then the drift-sea of the Hudson Valley was at least 3000 feet deep,—and probably more, if, as is likely, the higher peaks were also submerged. Judging by the general uniformity that seems to have prevailed over North America in changes of level, it would probably be safe to infer that this submergence also extended to the Laurentine and other mountain-chains in the eastern part of North America.

Allowing that the striations on the eastern flank of the great range were made by floating ice, it still does not follow that in the interior there should be no traces of glaciers in the narrow valleys on the opposite watershed,—such glaciers, if they ever existed, being like some of those in North Wales, of later date than the emergence of the country from the drift sea. I had an opportunity of testing this. In the gorge close to the south shore of the little lakes, the striations still run W. 10° N.; and below that point the valley, descending westward from 5° to 10°, is covered with boulders of Catskill sandstone (see fig. 3). About a mile and a half down, at the Falls of Catskill, the valley suddenly deepens; and about two miles further it curves round to the S. E. and finally the stream escapes from the Catskill Range, and flows towards the Hudson. On either side the valley is bounded by high steep slopes and abrupt cliffs; and the height and form of the ground is such that, under

Fig. 4.—*Section of the Valley below the Falls of Catskill, showing boulder-drift covering its sides.*



1. Drift. 2. Red Sandstone and Conglomerate.

favourable circumstances, it seemed as well adapted for the formation of a glacier as many of the valleys of North Wales, had the conditions for such a result been alike propitious. But the evidence is opposed to any such conclusions. I saw no well-marked *roches moutonnées*, no traces of moraines; and the forest-clad slopes are mostly covered with deep local gravel and boulder-drift, many of the stones in which are scratched. Had a glacier existed there since the drift-period, the drift would have been ploughed out of the valley by the glacier, in the manner that it was removed by the glaciers of the Passes of Lanberis and Nant Francon in North

Wales; whereas nothing has been removed, except a portion of the drift by the torrent that now flows in the bottom* (see fig. 4).

Probable equivalency of the Drift of the Hudson Valley with that of Lake Champlain and of Montreal.—I have now a few remarks to offer on a part of the drift itself. South of Albany the Hudson flows through a broad valley full of minor undulations, between the Catskill and the Green Mountains. On the banks of the river are extensive beds of sandy clay, from which the bricks are made of which Albany is built. The city stands on this clay which extends far down the river towards New York, and northward into the Valley of the Mohawk, and as I shall show, probably also into the valley of Lake Champlain. Beyond the river-bank it stretches E. and W. on the undulating ground towards the mountains, rising, six miles in the direction of the Helderberg, far above the level of the river. At its edge, Mr. Hall pointed out to me that the sands, gravels, and boulder-clay of the ordinary drift pass under it. The superficial deposits of the valley of the Hudson therefore, consists of two subdivisions: first, the older boulder-beds; and, second, the laminated clay, which at Albany is a thick formation, finely and evenly bedded in layers of 1 or 2 inches thick, the argillo-arenaceous laminæ of which graduate into each other in shades of bluish-grey, brown, and brownish-yellow, producing a beautifully ribanded aspect, and giving the impression of a succession of repeated alternations of tranquil depositions in still water. Boulders occur in it rarely; and the top is covered with sand, which may possibly represent the uppermost sandy beds of the St. Lawrence and Ottawa districts. I searched in vain for fossils, both in the paper-like laminæ of clay, and in the abundant concretions, resembling those of the valley of the Ottawa which contain the fossil fish *Mallotus villosus.*

The Hudson runs nearly straight north and south; and forty miles above Albany, at Sandy Hill, the Champlain Canal joins the river to Lake Champlain, which also trends north and south, and, separated by a low watershed, lies in what must be considered a continuation of the valley of the Hudson. The lake is 90 feet above the level of the sea; and on the Vermont shore, 150 feet above the sea, there is a section of six feet and a half of regularly

* I was informed by Professor Agassiz, that in the White Mountains, which rise more than 6000 feet above the sea, there are in the higher regions distinct indications of ancient glaciers; and if this be the case, the same phenomena may be looked for in the mountains of Gaspé.

stratified clay and sand, overlying an older blue clay (the older drift), in which were found, by Prof. Zadoc Thompson, *Sanguinolaria fusca*, *Mya arenaria*, *Saxicava rugosa*, *Mytilus edulis*, and the bottom the bones of a Cetacean associated with *S. Rugosa* and a *Nucula* or, more probably, *Leda*. The Leda clay of Dr. Dawson, at Montreal, is also about 120 feet above the river, or 140 feet above the level of the sea. If the so-called "*Nucula*" of Lake Champlain be *Leda Portlandica*, the Montreal beds contain the same assemblage of fossils (except *Sanguinolaria fusca*).* In the Montreal beds Sir Wm. Logan also found a number of the caudal vertebræ of a Cetacean. The beds at Green's Creek, Ottawa, containing the same assemblage of shells, *Mallotus villosus*, and remains of Seals, are 118 feet above Lake St. Peter, and 140 to 150 feet above the sea. Marine shells (*Saxicava rugosa*, *Mya*, *Mytilus edulis* and *Tellina Grœnlandica*) occur at Kingston, at the entrance to Lake Ontario. Dr. Dawson shows good reason why the above-named fossiliferous deposits on the St. Lawrence and Ottawa should be considered equivalents. In addition, I am of opinion that this conclusion may be extended to the Kingston beds, and that the beds of Lake Champlain leading down to those of the Hudson are of the same date; and if so, then I cannot doubt that the laminated clay that overlies the older boulder-drift of the Hudson Valley is a large development of the same formation, the whole having been deposited at the close of the drift period. In that case, a long marine strait filled the valley of the Hudson, and communicated with the sea that, according to Dr. Dawson, then occupied the whole of Lower Canada south of the Laurentine Chain, and, stretching westward, covered the area of Lake Ontario, and washed the great Niagara escarpment which formed its southern coast.

Probable date of the origin of Niagara Falls.—It has been shown by Mr. Hall and Sir Charles Lyell, that when the Niagara escarpment rose above the water, the Falls of Niagara began by the drainage of the upper lake-area falling into the sea over the edge of the escarpment above Queenstown and Lewistown. It is not improbable that Lake Erie extended at that period much further towards the present falls; and, agreeing in the general conclusions of these observers and of Dawson, it follows that if the sea of the Leda-clay washed the base of the escarpment, *the Falls of Ni-*

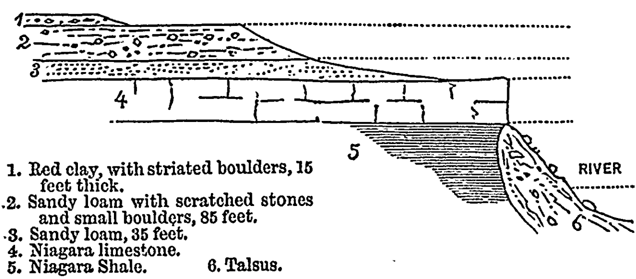
* This is without doubt a Synonym for *Tellina Grœnlandica*, a common shell at Montreal. Ed.

*agara commenced during the deposition of that clay, or a little before the close of the drift-period.** If, with accumulated data, the rate of the past recession of the Falls be actually determinable, we shall then be in a condition approximately to show the actual number of years that have elapsed since the close of the North American drift. It may perhaps appear that the approximate period of 35,000 years, given by Sir Charles Lyell for the erosion of the gorge, is below the reality.

Drift and other Late Tertiary deposits at Niagara.—I have little to add to the account of the late Tertiaries of Niagara given by Sir Charles Lyell and Professor Hall.

Above the falls a terrace of drift with boulders forms the left or Canadian bank of the river. Just before reaching the Horse-shoe Fall, the terraced bank recedes; and a plateau of Niagara limestone lies between it and the edge of the gorge. A road, with a deep cutting in the drift, ascends the slope on the left between Table Rock and Clifton House, at right angles to the river. First there is a gentle slope of 35 feet, then a rapid scarped rise of 85 feet, and behind the railway a second low terrace. The first and second slopes, 120 feet high in all, consist of sandy loam (Nos. 3 and two in fig. 5), scratched stones and small boulders; and the upper terrace (No. 1) is formed of 15 feet of red clay, thinly stratified, also containing angular boulders and scratched stones

Fig. 5.—*Section of the Latter Tertiarg beds near Niagara Falls.*

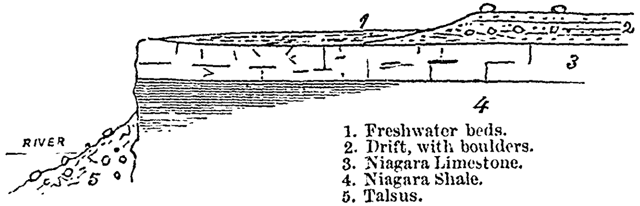


* It is well known that the Niagara escarpment is of older date than the drift. Lake Erie is 329 feet above Lake Ontario; and the older boulder-drift lies indifferently on the lower plain and on the table-land. No one has yet attempted to show at what period this old coast-cliff, about 400 miles in length, was formed. The upper platform, on a grand scale, bears the same physical relation to the rocks of Lake Ontario, that Oolitic escarpment and table-land in England does to the Lias and plains of New Red Marl below.

of Laurentine gneiss, and of Niagara limestones and other Silurian rocks. The top of the upper escarpment of drift forms the highest part of the whole plateau. Being 135 feet above the edge of the fall, its top is 60 feet above Lake Erie, which is only 70 feet above that edge. The edge of the great escarpment above Lewiston is said by Mr. Hall to be 70 feet above the top of the fall; and therefore the escarpment No. 1 of the accompanying diagram (fig. 5) is also 65 feet, and No. 2, 50 feet higher than the top of the escarpment above Lewiston, and 45 feet above Lake Erie. If this drift once extended across the space now occupied by the gorge, as shown by the dotted lines, Lake Erie may originally have extended thus far, and after a time the river gradually cut out a channel in the drift and formed both terraces; or else an original terraced channel existed, formed during the emergence of the country, the terraces being formed by marine denudation.*

The lower terrace has, in part at least, been excavated by the river, which, before the formation of the gorge, here spread into a broad reach, like that above the Falls. It is on a continuation of this platform, about a quarter of a mile below Clifton House, between the drift-terrace and the edge of the gorge, that the strata containing existing river-shells occur (fig. 6).

Fig. 6.—*Section showing the position of the Freshwater beds above the Gorge of the Niagara.*



This drift-terrace Sir Charles Lyell has shown to be as old as the Mastodon-period. The freshwater beds lie in a shallow hollow on the limestone. They consist of remodelled drift, and some of

* It deserves to be stated, that half-way up the cutting, on the surface, I found a *Cyclas;* and another was found by Sir Wm. Logan, with whom I measured the section, on the same terrace, behind Clifton House. Some bits of plate of the "willow-pattern," however, lay near my shell; and that found by Sir Wm. Logan was on ground that had been stirred with the spade; and we came to the conclusion that the evidence they afforded was of very doubtful value.

the stones are scratched; but whether the scratches made in the older drift-period have not been worn away, or whether the stones were scratched by river-ice is uncertain. The floor of Niagara limestone is here deeply furrowed, the striations and minor scratches crossing each other at various angles; but the majority run S. 30° W. They follow the general direction of the other striations of the country, that underlie the drift.

On Goat Island, Sir. Wm. Logan and I observed that the fluviatile strata lie on drift,—a circumstance, I believe, not previously noticed. It consists, at the base, of sand; and above, of clay horizontally and evenly bedded, containing scratched stones and boulders. As shown in Sir Charles Lyell's diagram*, at the eastern end of the island the Niagara limestone rises a few feet above the river, in the still recesses of which are numerous living shell-fish. Between this and the summit of the island overlooking the Falls, there is a gradual fall of 15 feet, showing the slope of the river-bed when Goat Island was covered with water. The drift at this point is 29 feet thick, and the freshwater beds above 10 feet, giving 39 feet for the height of the island above the water at the edge of the Falls. Allowing a dip of 25 feet in a mile for the general dip of the limestone, Goat Island was covered with water when the Falls were probably about one mile and a half further down than at present. With regard to the retrocession of the fall, as might be expected, its rate is fastest when the body of falling water is greatest, this cause of waste being far more powerful than the winter's frost. Towards the base of the edges of the Horse-shoe Fall, and the American Fall, blocks of limestone are accumulated in great heaps, while in the middle of the Horse-shoe Fall the turmoil is so great that it scoops out the shale beneath so deeply that the great fallen blocks are lost in the abyss. Where the body of water is small in the American Fall, the edge has only receded a few yards (where most eroded), during the time that the Canadian Fall has receded from the north corner of Goat Island to the innermost curve of the Horse-shoe Fall.

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* Travels in North America, vol. i. p. 20.

ART. XXVI.—*On Ozone.* By CHARLES SMALLWOOD, M.D., LL.D., Professor of Meteorology in the University of McGill College, Montreal.

[Continued from page 169.]

The method now almost universally adopted for ascertaining the presence of ozone in the atmosphere is from its action on the iodide of potassium and starch. A portion of the iodine is set free by the action of the *oxygen* and combines with the starch, giving rise to the fine blue colour so distinctive of the presence of ozone. The test papers are prepared by boiling one drachm of pure starch in one ounce of distilled water, and when cold, by adding ten grains of the iodide of potassium. This solution is to be carefully and evenly spread upon good *glazed* paper by means of a soft brush, or a sponge may be substituted. I have found that "*glazed*" or "*sized*" paper is preferable to bifulous paper. "*Cream-laid letter-paper*" is that used here—the solution is more evenly spread over the surface. It is then to be quickly dried, cut into pieces of about 4 inches long by 1 inch broad, and kept in a dry place, free from light and air, until required. Schonbein's ozoneometer consists of 750 slips of such paper, which is sufficient for a year. I have found that strips of fine calico, being previously well washed, and then dipped into the solution, answer equally well. I have been in the habit of using them here thus prepared, when long lengths were required, as in the apparatus where time becomes an element of the observation. These strips of paper are exposed to light, free from sun or rain, and are removed at 6 A.M. and 10 P.M., daily. These hours are adopted so as to correspond with the other instrumental observations. The date and hour is inscribed upon them, and the variable amount of ozone indicated is estimated by comparison with a scale of tints. The zero (°) of this scale, or ozoneometer as it is called, is perfectly white, increasing gradually, until a *very deep blue* or *really black* shade is obtained, which is denominated 10; the intermediate shades are easily estimated. The mean of these *two* daily observations forms the daily mean. The deep shades in the ozoneometer, although kept from light and air, are subject to changes by gradually becoming lighter; but a scale of artificial tints may be used, which will be permanent. Dr. Moffatt of England, who has devoted many years to observation on ozone, encloses his slips of paper in a small box without a bottom, so as to keep it shaded from *light* as well as rain. Observations were carried on here for some years, both by Schonbein and Moffatt's method, for the sake of comparison, but the difference was found so small as not to affect the computations and general results; and the observations are now confined to those of Schonbein, and as being the form more generally adopted, more especially on the Continent of Europe. The test papers require to be moistened with water to bring out the colour. The strips of ozonized paper may be laid in a shallow vessel of water for this purpose, and the ratio of shade or colour is easily estimated.

Exposure causes the ozonized paper to become at first of a pale straw colour, which increases to the tint of dried leaves, then deep brown, or dark violet, approaching to black, which becomes blue by wetting,—or should there be a great amount of moisture in the atmosphere, it at once attains its blue colour, which becomes brown as it dries; but the blue colour may again be brought out by moisture, or re-wetting: this may be owing to the formation of a new quantity of the iodide of starch. It will be necessary in pursuing observations, that care should be taken in the preparation of the *ozone* paper, and that the prepared paper should be placed in a situation near the instruments that are used for observing the atmospheric changes; and it would be well, while carrying out these experiments, that slips of paper should also be placed in different situations, from which might be drawn useful inferences and comparisons. Five feet from the surface of the soil have been adopted here as the *standard* altitude, being sufficiently removed from the effects of terrestrial radiation and moisture, and of a convenient height; but observations are also taken at the surface, placed among plants, over drains, in the sick-chamber, and in other localities, and such observations would seem of great interest towards the due investigation of the effects and properties of ozone on the health of individuals and of plants. Observations have been also recorded here, shewing the effects of the different coloured rays of light, and also polarized light, on the amount of ozone, and also the effects of germination on its development.

It would also be well to pay especial attention to the amount before, during, and after thunderstorms, and also after any great display of the Aurora Borealis, to establish if possible any connections it may have with the amount of atmospheric electricity. It should also be particularly observed during the prevalence of any epidemic, and also during any "*blight*" or defective vegetation; and, when convenient, it would be advisable to shew the hourly amount by means of a very simple apparatus, moved by an ordinary clock at the rate of 1 inch per hour. The ozone-test thus constructed consists of strips of calico, about an inch wide, moving over a slit in a closed box, so that the *time* of the greatest amount is thus indicated, and may be compared with advantage with the diurnal changes in the atmosphere, as indicated by the barometer's oscillations, temperature, moisture, and the direction and changes of the wind; and I am led to believe that this method is the only one which will ever give decided results, by thus making *time* an element of the observations.

[To be continued.]

ART. XXVII.—*Fossils of the Calciferous Sandrock, including those of a deposit of white limestone at Mingan, supposed to belong to the formation.* By E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for 1858–1859.)

The following paper contains notices of all the species of organic remains that have been collected in Canada up to the present date from the Calciferous Sandrock, including a deposit of white limestone, supposed to belong to the formation. This white limestone has been observed only at the Mingan Islands, where it overlies the Calciferous Sandrock, and is in its turn overlaid by the Chazy. Twelve species have been collected in this rock, and of these, only three occur in the true Calciferous Sandrock, but none of them have yet been found in the Chazy.

Of the forty-one species noticed in this paper, none have been clearly identified with those of the Chazy or any more recent formation, although several of them, such as *Eunema prisca*, *Pleurotomaria calcifera* and *P. Laurentina* are closely allied to species of the Black River limestone. It is not certain that the siphuncles I have referred to *Orthoceras multicameratum*, belong to that species. Future discoveries may possibly prove to the contrary, but according to our present knowledge, the fauna of the Calciferous Sandrock in Canada is almost entirely distinct specifically from that of the Chazy.

ZOOPHYTA.

PETRAIA MINGANENSIS.

At Romain's Island, one of the Mingan Islands, several fossils have been collected, which appear to be casts of the interior of the cup of a large species of *Petraia.* The specimens are cylindrical, obtusely pointed, and slightly curved at one end. They are deeply striated longitudinally as if by the sharp edges of the radiating lamellæ of a coral of the genus *Petraia.* There are from five to seven striæ in the width of three lines, and therefore, in a specimen one inch and-a-half in diameter, there must have been about one hundred and twenty radiating septa. They appear to be the casts of the interior of a coral, in which the cup extended nearly to the base. In *Petraia profunda,* (Conrad) the characteristic species of the Black River limestone, we have an analagous form in which the depth of the visceral cavity is nearly equal to the total length of the coral. Although it is not yet quite certain that these fossils are the casts of corals, yet, as their form and so much of the structure as is indicated by the markings of the surface render it highly probable that such are their relations, I shall provisionally place them in the genus *Patraia.*

The specimens to which the above description refers are from three to seven inches in length, and about one inch and a half in diameter, but there are fragments that must have belonged to individuals at least two feet long and more than three inches in diiameter.

Locality and Formation.—Mingan Islands in the Gulf of the St. Lawrence, Calciferous Sand-rock.

Collectors.—Sir W. E. Logan and J. Richardson.

STENOPORA FIBROSA* (Goldfuss, sp.)

Small cylindrical stems, several inches in length, and from three to five lines in diameter. They are, I have no doubt, specimens of *Stenopora fibrosa,* although I have not been able, as yet, to detect the cells. They are replaced by chert.

Locality and formation.—Mingnan Islands, Calciferous Sand-rock.

Collectors.—Sir W. E. Logan, J. Richardson.

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*This species has been heretofore called ***Monticulipora dendrosa*** by me. On comparison I do not think we can distinguish it from ***Stenopora fibrosa***, the European form. It is the branched variety of ***Chætetes lycoperdon*** figured in the Palæontology of New York.

CRINODIDEÆ.

Fig. 1—*m*—*n*.

A fragment of a crinoidal column, two lines in diameter, composed of thin joints, of which there are six in two lines. The joints vary slightly in thickness alternately, and the edges of the thicker ones project a little, so that the column is not smooth, but annulated. The central canal is obscurely pentagonal, or nearly circular. See Fig, 1—*m*, *n*.

Locality and formation.—Mingan Island, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

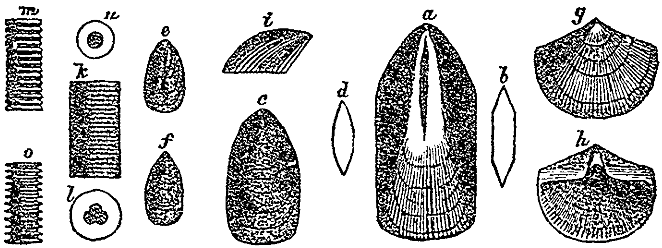

Fig. 1.

a *Lingula Lyelli.*
b Transverse section of *L. Lyelli.*
c Young specimen of *L. Lyelli.*
d Transverse section.
e—*f* *Lingula Mantelli.*
g *Orthis grandæva*, ventral valve.
h Inside of same.
i Side view.
k—*o* Crinoidal columns.

Fig. 1—*o*.

A Column two lines in diameter, composed of large and small joints, the former thin and widely projecting as in that portion of the *Glyptocrinus ramulosus*, which is next to the cup. I think that this is the column of a species of *Glyptocrinus*. See Fig. 1—*o*.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

Fig. 1—*k*, *l*.

A smooth circular column, three lines in diameter, composed of thin equal joints, of which there are ten in three lines. The central canal is trilobed. See Fig. 1—*k*, *l*.

Locality and formation.—Mingan Island, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

These fragments indicate three species of Crinoidea, and they are probably distinct from those that occur in the Chazy or any other overlying formation.

BRACHIPODA.

LINGULA LYELLI. (N. s.)

Fig. 1—*a, b, c, d.*

Description.—Elongate-oval or sub-pentagonal; front margin straight or gently convex; sides nearly straight and parallel in the lower two-thirds of the length, above which they converge and meet at the beak at an angle of about forty-five degrees. Both valves are moderately, but not regularly convex, there being a flat triangular space extending from the beak along the centre to the front, and a similar flat space on each side sloping to the lateral margins, and thus each valve is composed, as it were, of three plane surfaces. In the small specimens these planes are not so distinctly indicated as they are in the large ones. The surface is marked with fine concentric lines, and also with longitudinal radiating striæ, the latter being scarcely visible except when the shell is partly exfoliated. Length of large specimens, thirteen lines, width about half the length.

This species is closely allied to *L. parallela*, (Phillips)* but has not, so far as we can judge from the inspection of a single figure, so obtuse a beak. The size and proportions are the same as those of *L. ovata*, (Mr. Coy)† but in that species the longitudinal radiating striæ curve outwards, so as to cut the lateral margins nearly at right angles, while in this they are straight, and thus, form acute angles with the edges of the shell.

This species is dedicated to the distinguished geologist and philosopher, Sir Charles Lyell.

Locality and formation.—Alumette Island, Calciferous Sandrock.

Collector.—Sir W. E. Logan.

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* Memoirs of the Geological Survey G. B., vol. 2, part 1, page 370, pl. 26, fig. 1.

† Mr. Coy. British Palæozoic Fossils, page 255, pl. 1 L, fig. 6. *L. ovata* appears to be a Lower, and *L. parallela* an Upper Silurian species.

LINGULA MANTELLI. (N. s.)

Fig. 1—*e*, *f*.

Description.—Elongate-oval, sides sub-parallel, gently convex for rather more than half the length, then gradually curving to the beak, front moderately rounded. Surface, when partially exfoliated, covered with longitudinal radiating striæ. Length four or five lines, width rather more than half the length. Both valves are very convex, and do not appear to have the plane surfaces of *L. Lyelli.*

Although the form is somewhat like that of the young specimens of *L. Lyelli*, yet it is clear that this is a distinct species. It occurs in a different locality, and although very abundant, none of the specimens are more than six lines in length, the average size being from four to five lines. It is a smaller, and also proportionally more convex species than *L. Lyelli.*

None of the specimens that I have seen have the shell well preserved, and I am unable, therefore, to say what the character of the surface may be when perfect.

Dedicated to the late Dr. Mantell, author of the Medals of Creation, &c.

Locality and formation.—Near the Village of St. Eustache, Calciferous sandrock.

Collectors.—A Murray, J. Richardson.

ORTHISINA GRANDÆVA. (N. s.)

Fig. 1—*g*, *h*, *i*.

Description.—Ventral valve depressed pyramidal, nearly semicircular, area large, inclined backwards at an angle of about 125°; foramen closed, all except a small space at base, the apex perforated; surface with fine radiating striæ, of which there are four or five in one line at the margin; width of the only specimen seen, at hinge line, seven lines; length, from hinge line to front, three lines and a half; length from beak to front, six lines; height of area, two lines. Dorsal valve unknown.

It is not certain that this species belongs to the genus *Orthisina;* but, as the foramen is nearly closed, it appears more closely allied to that genus than to *Orthis.* A single, but very perfect valve is all that has been collected.

There are, besides the above, in the White Limestone at the Mingan Islands, numerous casts of a species of *Orthis* or *Orthisina*, which have the same form as *O. grandæva*, and appear to me to be the same species. If so, then the dorsal valve is convex, and the species attains a much larger size than that indicated by the single valve in our possesion. The specimens range from six lines to one inch in width, and are very abundant.

Locality and formation.—Mingan Islands,Calciferous Sandrock.

Collector.—Sir W. E. Logan.

LAMELLIBRANCHIATA.

CONOCARDIUM BLUMENBACHII. (N. s.)

Description.—Triangular, ventricose, sub-cordiform, umbones prominent incurved, the posterior or truncated extremity flattish or gently convex with an oval outline, the greatest width being at about one third the length from the beak; the length from the beaks to the posterior ventral margin in the best preserved specimen is sixteen lines, greatest width thirteen lines. On a side view the form is sub-triangular, the posterior angle rather sharp, about 80°; the ventral margin rounded; the posterior edge or ridge which runs from the beak to the posterior ventral angle is nearly straight or but slightly convex in the lower half and thence becomes more and more strongly curved until it reaches the beak. The anterior side is a little longer than the ventral margin and appears to have been nearly straight. Surface with rather strong radiating ridges four or five in the width of two lines at the ventral edge.

The cast of the interior of the right valve indicates six or seven crenulations on the posterior edge of the shell in the length of two lines.

The siphonal tube is not preserved in any of the specimens but there are indications of its existence. There is a small species of this genus in the Black River limestone but this is the first that has been discovered in strata of such great antiquity as the Calciferous sandrock.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

GASTEROPODA.

HOLOPEA TURGIDA, (Hall, Sp.)

PLEUROTOMARIA? TURGIDA, Hall, *Paleont. N. Y., Vol.* 1, *p.* 12, *Plate* 3, *Fig.* 9, 10.

Several specimens have been collected in the Calciferous Sandrock, Mingan Island, which appear to be of this species.

Collectors.—Sir W. E. Logan, J. Richardson.

HOLOPEA OVALIS. (N. s.)

FIG. 2.

Fig. 2.—*Holopea ovalis.*

Description.—Oval, moderately ventricose, four whorls, the body whorl at the aperture occupying two thirds the whole length, the whorls depressed convex, the suture deep,giving the cast a turreted appearance, apical angle about 75°. Length one inch and a half, width fourteen lines.

Locality and formation.—Second Concession of Godmanchester, Calciferous Sandrock.

Collector.—J. Richardson.

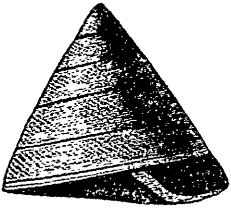

FIG. 3.

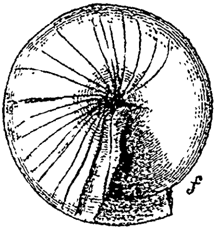

FIG. 4.

Fig. 3.—*Pleurotomaria Ramsayi.*
4.—*P. Ramsayi.* View of base.

PLEUROTOMARIA RAMSAYI, Billings.

Figs. 3, 4.

Description.—Shell trochoid, acutely conical, spire much elevated, whorls five or six perfectly flat, apical angle about 60°. Outer margin of body whorl with a sharply rounded edge; aperture sub-rhomoidal, umbilicus small; surface with fine striæ curving backwards from the upper to the lower edge of the volutions

Base slightly concave. Height of only specimens collected fourteen lines, width of base about the same, width of umbilicus one line.

The spire of this species, owing to the perfect flatness of the whorls, presents at first sight an uniform plane surface, the suture being so fine that it is barely visible. The outer edge of the body whorl shows what may be called a spiral band, which on its upper side is bordered by a fine continuous line, half a line from the edge; the outer angle of the mouth has a moderately deep angular notch as in the other species of this genus; the striæ on the base after leaving the edge curve abruptly forward, and then at the distance of less than a line from the edge rather suddenly change their direction, and with a barely preceptible backward curve proceed to the umbilicus in a nearly straight line; there are several strong wrinkles that follow in the direction of the striæ. The course of the striæ over the edge cannot be distinctly seen but they appear to make a sharp curve backward corresponding to the form of the notch. The upper and outer sides of the aperture are straight, the lower side is also straight for about half the width of the volution, and it then curves up gradually to form the inner lip, a small portion of which is reflected. This species much resembles a *Trochus*, but the notch in the outer angle of the aperture, the direction of the striæ on its surface and the apparent band shew that it is more likely a *Pleurotomaria.*

Dedicated to the eminent geologist Professor A. C. Ramsay, Director of the Geological Survey of Great Britain.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

PLEUROTOMARIA, CALCIFERA, (N. S.)

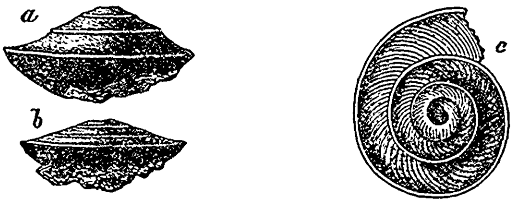

FIG. 5.

a *Pleurotomaria calcifera.*
b A more depressed variety.
c View of the spire shewing the backward curving striæ.

Description.—Lenticular, with a sharp elevated margin; spire much depressed; apical angle varying from 130° to 145°; whorls four or five, rather slender with a thin elevated outer edge which is more or less distinctly visible all the way to the apex; they are also slightly concave on their upper surface, the concavity being deepest near the lower edge; in some specimens there is a gentle convexity in the upper half of each volution and in others the surface is nearly flat. On the under side of the shell the whorls are convex and appear to have a prominent obtuse angle at the edge of the umbilicus; the latter is large, conical, penetrating to the apex and at least half as wide as the whole shell. The surface is covered with fine striæ which turning backward at an acute angle indicate a deep notch in the outer angle of the aperture. The last whorl in some of the specimens on approaching the aperture drops a little below the margin of the second, shewing a tendency to become disengaged. The aperture judging from the form of the volutions must be sub-rhomboidal. The largest specimen seen is one inch and a half wide, and about half an inch in height.

This species is closely allied to *R. aperta* (Salter), but differs therefrom in the following particulars. 1st. The height *R. aperta* is about half the width, in this species about one third. 2nd. In *R. aperta* the edges of the whorls on both sides of the suture sink below the general surface, and there is consequently a rather deep spiral channel running to the apex, but in this species the outer edge of the whorl rises above the general surface and forms an elevated spiral line following the upper side of the suture from the aperture to the apex. 3rd. In *R. aperta* the inner half of the width of the volution is always strongly convex and the outer half as strongly concave but in *R. calcifera* the whole surface of the whorl is concave or only very slightly convex towards the inner side.

As all the specimens that I have seen are embedded in the rock, I have only been able to ascertain the characters of the underside of the shell from fragments. The base seems to be more like *R. aperta* than the spire. The two species are closely allied and should, perhaps, be considered as varieties of each other.

Locality and formation.—Near Beauharnois, Calciferous Sandrock.

Collector.—J. Richardson.

PLEUROTOMARIA ABRUPTA, (N. S.)

Description.—Sub-lenticular, with a broad vertical band beneath the outer edge; whorls four or five, slender, sub-cylindrical, convex above and below. At the upper outer angle of the whorl a rather strong rounded ridge follows all round, and beneath it a flat or slightly concave vertical band, which at the aperture is one line wide in a specimen nine lines in width, below the band, the whorl is regularly convex. The umbilicus is about one third the width of the shell. Surface unknown.

Differs from *R. aperta* and *R. calcifera* in the vertical outer side of the body whorl.

I have seen no perfect specimens of this species but such as we have clearly indicate its distinctions.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

PLEUROTOMARIA MISER, (N. S.)

Description.—This species is closely allied to *R. abrupta* but differs therefrom in having the lower side of the body whorl sharply augulated in the middle and also in the presence of an obtuse carina about the middle of the upper suface of each volution. Judging from the form of the fragments of the whorls the aperture must be sub-pentagonal. It is evidently a smaller species than any of the others; width of largest specimen seen, five lines.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

PLEUROTOMARIA LAURENTINA, (N. S.)

Description.—Lenticular, spire depressed, whorls five or six, on their upper sides slightly convex, but with a shallow concave band just within their outer margin. The lower side of the body whorl is a little concave just beneath the margin, then moderately convex to the umbilicus within which it is rather narrowly rounded. The umbilicus is deep and one fourth the whole width of the shell. The cast of the interior exhibits an acutely rounded margin, which, owing to the concave band above, appears to be turned a little upward, or to have a narrow ridge all round on its upper side. The aperture is sub-rhomboidal, the inner upper side slightly indented by the penultimate whorl. Width of largest specimen two inches and one fourth, height not quite half the width in some of the specimens and more than half in others.

Associated with the larger are others almost an inch wide, with the whorls more convex below, but presenting no other differences so far as I have been able to observe. I think they are of the same species.

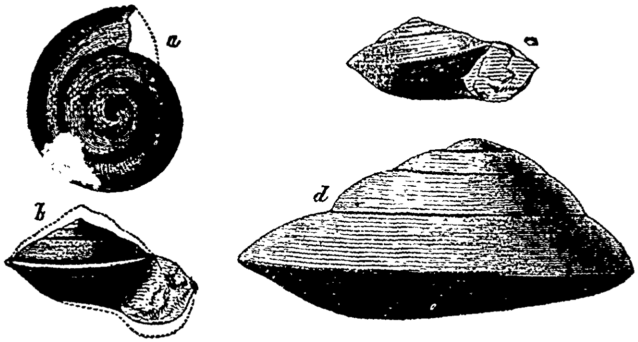

Fig. 6.

a *Pleurotomaria Laurentina.* View of the spire. The specimen is a cast.
b—c Side views of two specimens.
d A large imperfect cast.

This species is allied to *R. lapicida*, Salter, but differs in having the whorls gently convex above, and in the form of the aperture which in that species is acutely oval, while in this it is subrhomboidal. The outer angle of the aperture of *R. lapicida*, measures about 75°, but in this species it is more than 90°.

The two species are most closely related, and it is not improbable that intermediate forms may yet be found to connect them.

Formation and Locality.—Mingan Islands, Calciferous Sandrock and White Limestone.

Collector.—J. Richardson.

Pleurotomaria gregaria. (N. s.)

Fig. 8—*h*, *k*.

Description.—Shell, small; spire conical; apical angle about 45°; whorls, three or four, with a very narrow spiral band, which, on the body whorl, is rather above the middle of the volution, but in the upper whorls is situated on the lower outer side at about one fourth the heighth. In full-grown specimens there is an obscure carina on the body whorl, one fourth of a line above the spiral band, and another close to the suture; the space between these two carinæ is flat or slightly concave; half a line below the band there is a third carina, scarcely visible, and below this the whorl is rounded ventricose. There is a small umbilicus. Length of shell, four lines; greatest width, two lines and a half. Surface minutely striated.

Locality and formation.—St. Anns and near St. Eustache, extremely abundant, Calciferous sandrock.

Collectors. –A Murray, J. Richardson.

TROCHONEMA TRICARINATA. (N. s.)

Description.—Depressed turbinate; whorls, four; with three carinæ, two of which are on the outer edge of the body whorl, and of these one is lost in the suture above. The third carina is on the upper side of the whorl, about the middle, but rather nearer the suture than the outer edge. The spaces between the carinæ, are concave; base depressed convex not carinated.—Width of only specimen collected, nine lines.

At first sight this species appears to be the widely known *T. umbilicata*, (Hall) but differs therefrom by having only three carinæ.

Locality and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

OPHILETA COMPACTA. (Salter).

O. COMPACTA. (Salter). *Canadian Fossils Decade*, 1, p. 16, pl. 3.

This species occurs near Beauharnois, near the Village of St. Eustache, and also at Romain's Island.

HELICOTOMA UNIANGULATA. (Hall.)

EUOMPHALUS UNIANGULATUS. (Hall). *Palaeont., N. Y.*, vol. 1, p. 9, pl. 3, fig. 1, 1 a.

Occurs at Romain's Island.

HELICOTOMA PERSTRIATA. (N. s.)

Description.—One inch and a half wide; whorls, three or four, with a strong carina on the upper side near the suture, another near the outer margin, and, apparently, several smaller ones below on the outside of the outer volution. The spaces between these large carinæ with numerous coarse longitudinal striæ following the whorls to the apex. The lower and outer side of the whorls are regularly convex, and the umbilicus one third of the width of the whole shell.

This species is about the size of *H. uniangulata* and also of *H. planulata*, the spire a little more elevated than that of the latter, while the upper surface, in addition to the two keels, is ornamented with the longitudinal spiral striæ, which occur only on the outer side of *H. planulata*, and not at all on *H. uniangulata*.

Locality and formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MACLUREA MATUTINA. ? (Hall).

MACLUREA MATUTINA, (Hall). *Paleont., N.Y.*, vol. 1, p. 10, pl. 3, fig. 3.

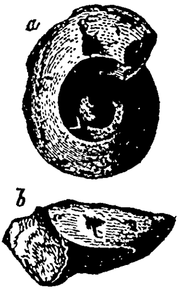

FIG. 7.

a *Maclurea matutina.* Lower side.
b Front view.

The specimen above represented agrees in its proportions very closely with those figured by Professor Hall. On referring to the plate cited, it will be seen that the figure shews two imperfect specimens, a small one with two whorls, and a larger one with nearly three. Ours agrees almost exactly with the smaller and also with the first two whorls of the larger. I think it highly probable that when good specimens can be compared, those of New York will be found identical, and I shall not therefore propose another name for ours.

Locality and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA ANNA. (N. s.)

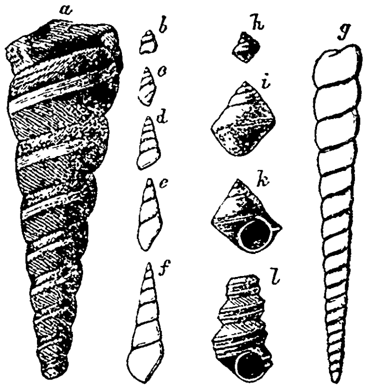

FIG. 8.

a *Murchisonia Anna.*
b—e Small specimens supposed to be of this species.
g *Murchisonia linearis.*
h—k *Pleurotomaria gregaria.*
l *Eunema prisca.*

Fig. 8.—*a, d.*

Description.—Elongate, apical angle about 20°; whorls, ten or twelve, flattened in their upper two-thirds, rounded near to and into the suture. About the middle of the lower half of the whorl there is a narrow flat spiral band, which, on the body whorl of large specimens, is one line or a little more in width, but becomes gradually narrower to correspond with the decreasing dimensions of the upper whorls. The fine striæ are most conspicuous on the upper part of the whorl, their course being from the suture downward, and backward with a sigmoid curve to the band. On some of the specimens there are also numerous undulations in the shell which follow the course of the striæ. Length of full grown specimens, about three inches; but accompanying these there are multitudes of smaller ones of all sizes, from the length of two lines to two inches. Many of these small ones have the whorls nearly regularly convex and may constitute new species; but, at present, I think they are only the young.

This species, especially in the small specimens, somewhat resembles *M. gracilis*, (Hall) but is easily distinguished therefrom by the flatness of the upper part of the whorls. It is more closely allied to *M. multivolvis* (Billings) which occurs in the Hudson River group at Anticosti; but in that species the whorls are still more flattened in the upper part.

Locality and formation.—At St. Ann's, on the Island of Montreal. Lot 12, con. 12 of the Township of Bagot, in the Calciferous sandrock at the Mingan Islands, in the White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA LINEARIS. (N. s.)

Fig. 8.—g.

Description.—Very slender; elongated; apical angle about 10°; whorls twenty or more, convex. Length, two inches or more.

Of this species we have only impressions, but they are sufficient to shew that it differs widely from any other known in the Lower Silurian rocks of this country.

Locality and Formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

MURCHISONIA ARENARIA. (N. s.)

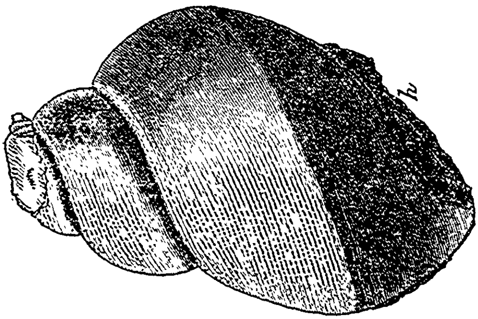

FIG. 9.

Description.—The cast of the interior of this species is conical; apical angle about 50°; whorls four or five, ventricose and obtusely angulated in the middle, where there is evidence of a spiral band. Above and below the band the body whorl is flattened or depressed convex, the upper whorls more evenly convex. Length, apparently, about three inches; width of body whorl, two inches.

The cast of this species somewhat resembles that of some of the varieties of *M. bellicincta.* (Hall) but the spire is shorter and the whorls more angulated in the middle.

Locality and formation.—Lot No. 12, con. 12 Godmanchester, Calciferous sandrock.

Collector.—J. Richardson.

SUBULITES CALCIFERA. (N. s.)

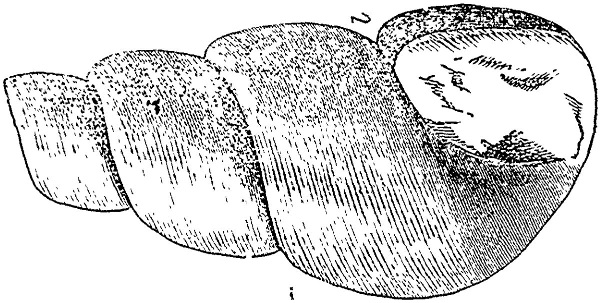

FIG. 10.

Description.—Elongate; apical angle about 20°; whorls five or six; depressed convex, or nearly flat in the middle; length, four or five inches; width of body whorl about fifteen lines. Each whorl is about one-third shorter than the one preceding it.

This species, in its form and in the proportional length of the whorls, very closely resembles a species that occurs in the Trenton.

It appears to be more like a *Loxonema* than a *Subulites.*

Locatity and formation.—Mingan Islands, Calciferous sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

EUNEMA PRISCA. (N. s.)

Fig. 8.—*l.*

Description.—Elongate; slender apical angle about 12°; whorls ten or twelve, each with two sharp keels in the middle, above and below which the surface descends with a gently concave slope to the suture. Length, from one inch and a half to three inches; width of body whorl in a specimen, nearly three inches long five lines; width of spiral band, three-fourths of a line.

This species is only distinguishable from *E. pagoda* (Salter) by having no third keel near the suture.

Locality and formation.—Mingan Islands, Calciferous sandrock, and White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

CEPHALOPODA.

Genus ORTHOCERAS, (Breyn).

The Orthoceratites of the Calciferous Sandrock and Chazy, have the same aspect as a group, and appear to be numerous, but are usually in a very bad state of preservation. Most of them

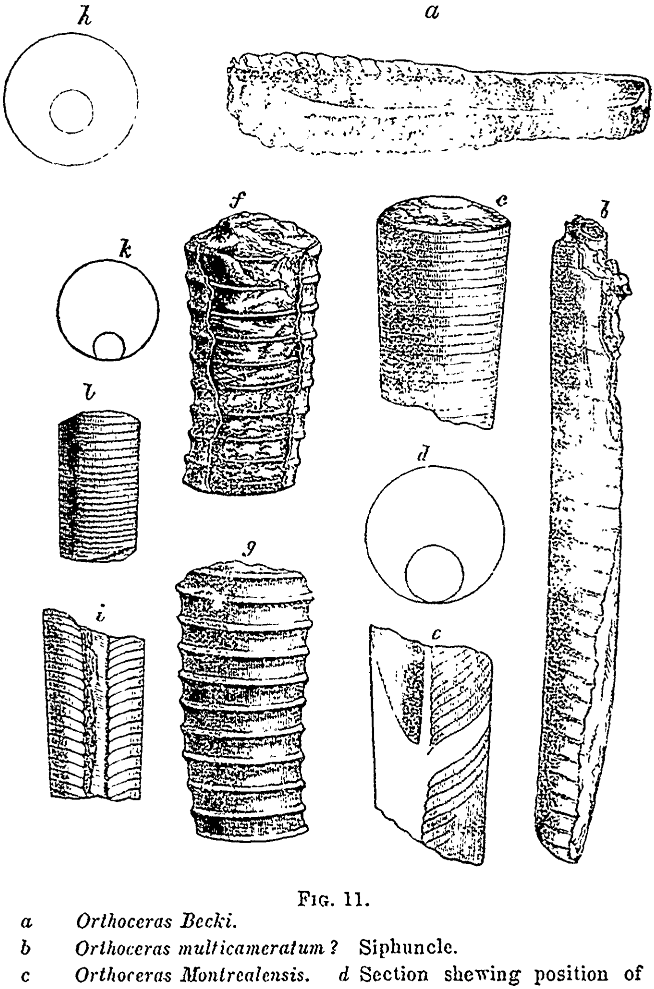

FIG. 11.

a *Orthoceras Becki.*

b *Orthoceras multicameratum?* Siphuncle.

c *Orthoceras Montrealensis.* *d* Section shewing position of siphuncle. *e* Longitudinal section.

f—g *Orthoceras Lamarcki.* *h* Section.

i—k *Orthoceras sordidum.*

Orthoceras deparcum.

are more or less curved and have large siphuncles, and several are remarkable for the close approximation of their septa.

ORTHOCERAS LAMARKI, (N. s.)

Fig. 11.—*f, g, h.*

Description.—Annulated, tapering at the rate of about one line to the inch, section circular, septa gently convex, eight in one inch at a diameter of eight lines, more numerous towards the apex, siphuncle cylindrical a little excentric, its diameter full one third the diameter of the whole shell. The annulations are rather prominent rounded ridges with regularly concave spaces between, distant one line and a half from each other in a specimen eight lines in diameter.

The specimen figured is silicified, and it is impossible to say whether the surface is striated or not. Three specimens have been collected and all are a little curved.

The septa increase rapidly in number towards the smaller extremity of the shell and it would appear also that in some individuals the distance is variable. In one specimen where the diameter is five lines, there are five septa in half an inch, but in the next half inch there are eight.

The position of the siphuncle is also a little variable.

Resembles externally the large curved *O. subarcuatum,* (Hall) of the Chazy limestone, but that species has more distant septa and a siphuncle composed of large oval bead-like segments.

Locality and formation.—Occurs at the Mingan Islands, and also on Lot 12, Con. 12, Township of Godmanchester, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, T. Richardson.

ORTHOCERAS BECKI, (N. s.)

Fig. 11.—*a.*

Description.—Section circular, smooth, slightly curved, tapering at the rate of one line and one fourth to the inch; septa rather convex, nine to the inch at a diameter of seven lines; siphuncle cylindrical nearly marginal one third the whole diameter.

This species is allied to one that occurs in rocks of the same age in Scotland, figured in 3rd Edition of Siluria p. 217.

Locality and formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS MONTREALENSIS, (N. s.)

Fig. 11.—*c, d, e.*

Description.—Section circular, smooth, tapering at the rate of about one line to the inch: septa very convex, eighteen or twenty to the inch at a diameter of eight lines; siphuncle cylindrical marginal seven sixteenths the whole diameter of the shell surface unknown.

Locality and formation.—Near the village of St. Eustache, Calciferous Sandrock.

Collectors.—J. Richardson, A. Murray.

ORTHOCERAS MULTICAMERATUM? (Conrad.)

Fig. 11.—*b.*

Several siphuncles have been collected in the Calciferous Sandrock at the Mingan Islands, which appear to be of this species. Specimens with the shell and septa preserved, occur at the same locality in Chazy limestone immediately overlying the rocks in which these siphuncles were collected.

ORTHOCERAS DEPARCUM, (N. s.)

Fig. 11.—*l.*

Description.—Section circular smooth, tapering about half a line, and with thirty-two septa to the inch at a diameter of five lines. Siphuncle unknown.

This species tapers more gradually than *O. Montrealensis* and has the septa more approximated. *O. primigenium*, Conrad, is an allied species but with about forty septa to the inch according to the figure in the Palæontology of New York.

Locality and formation.—Mingan Islands, White Limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

ORTHOCERAS SORDIDUM, (N. s.)

Fig. 11.—*i, k.*

Description.—Cylindrical, apparently a little curved; septa convex about twenty to the inch at a diameter of half an inch; siphuncle marginal a little less than one third the diameter of the whole shell.

Resembles *O. Montrealensis* but is a more slender species and has the siphuncle smaller.

Locality and formation.—Mingan Islands, White Limestone.
Collectors.—Sir W. E. Logan, J. Richardson.

Genus PILEOCERAS, (Salter.)

Mr. Salter has informed me that he intends to describe under the above generic name some remarkable fossils that have been found at Durness in Sutherlandshire Scotland, where they occur associated with *Ophileta compacta* and others allied to species of the Calciferous Sandrock and Chazy limestone. A species of the same genus has been collected in this country, but lest any confusion should take place I shall not describe it until I can see Mr. Salter's paper.

Genus LITUITES ?

There are two species apparently of this genus in the Calciferous Sandrock, but the specimens are so imperfect that they cannot be sufficiently characterised.

CRUSTACEA.

Genus BATHYURUS, (New genus.)

Generic Characters.—Trilobites of a medium size, oblong oval; head thorax and pygidium sub-equal; facial suture in front of the eye nearly parallel with the longitudinal axis of the body, reaching the anterior margin and behind the eye dividing the posterior margin; glabella sub-clavate conical or cylindro-conical usually prominent and without lobes, but sometimes with several obscure lateral transverse sulci, divided behind by a neck furrow; hypostoma oblong not forked, somewhat oval, an elevated margin around the posterior two thirds in some of the species, muscular impressions two, transverse or oblique, situated behind the middle; thorax in the species in which it has been observed with nine segments; pleuræ grooved.

The above genus is proposed to include serveral species of Lower Silurian trilobites of which *B. extans* (Asaphus extans, Hall), may be regarded as the type. It should perhaps be considered as a sub-genus of *Asaphus* of equal value with *Megalaspis* (Angelin) from which it differs in the form of the head and pygidium and in the number of tho segments of the thorax. I shall give some further illustrations of the genus hereafter.

I have provisionally referred the following species to *Bathyurus*.

BATHYURUS AMPLIMARGINATUS, (N. S.)

Fig. 12, *a*, *b*.

Description.—The pygidium of this species is nearly semi-circular its length being only a little more than half its width; the axis is elongate conical very prominent and distinctly defined all round, its length about two thirds, and its greatest width one fifth that of the whole pygidium; it is crossed by five distinct transverse furrows but the terminal one third is either smooth or marked by extremely obscure sulci. On each side of the axis there are five ribs; the first of these is only partly preserved in the specimen, the second at about half its length contracts to one half its width and appears to become obsolete before reaching the margin; the third rib is in length equal to the width of the axis at the point where it is attached; the fourth a little shorter, while the fifth is simply a triangular convex space between the fourth furrow and the posterior third of the axis. The most striking character is the broad smooth margin, the width of which is about one fourth that of the whole pygidium.

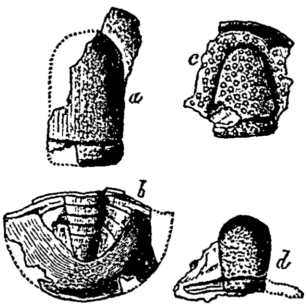

FIG. 12.

a—b *Bathyurus amplimarginatus.*
c *Bathyurus conicus.*
d *Bathyurus Cybele.*

Associated with this pygidium and in the same mass of stone was found the glabella represented by Fig. 12, *a*. It is depressed cylindro conical, length eight lines, width four lines and a half, a strong neck segment one line and a half in width.

Locality and formation.—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan. J. Richardson.

BATHYURUS CYBELE, (N. S.)

Fig. 12, *c.*

Description.—Of this species the glabella only has been found It is slightly clavate being a little wider near the front than it is at the neck furrow; it is convex, with an elevated rounded front; two obscure barely visible lateral sulci not reaching the centre; one of these furrows is at about one third the length from the neck furrow, and the other at two thirds; they slope forward and outward at an angle of about 55°; the neck furrow is deep concave, and with a forward sinus in the middle. The surface is covered with small tubercles. The front of the glabella is slightly produced into an obtuse scarcely visible, rounded lobe one third the whole width. Length nearly five lines, width four lines.

Locality and formation—Mingan Islands, White limestone.

Collectors.—Sir W. E. Logan, J. Richardson.

BATHYURUS CONICUS, (N. S.)

Fig. 12, *d.*

Description.—Glabella conical rather strongly convex, with a deep neck furrow and a deep sulcus all round, covered with small sharp tubercles distant from one fifth to two fifths of a line from each other. In the specimen a small portion of the anterior margin of the cephalic shield in front of the glabella is preserved. It seems to shew that the whole head was surrounded by a deep marginal furrow. Length of glabella including neck segment five lines and a half; width at neck segment four lines. The most striking features are the regularly conical shape of the glabella and the tubercular surface. The margin in front of the glabella is two lines wide.

In the same rock and near the same locality, the cheek piece of a trilobite was found with a tubercular surface, and with the posterior angle produced into a short spine. It probably belongs to this species.

Locality and formation.—Near Beauharnois, Calciferous Sandrock.

Collector.—J. Richardson.

ASAPHUS ——— ?

A single fragment of a large *Asaphus* was collected at the Mingin Islands in the Calciferous Sandrock.

LEPERDITIA ANNA, (Jones).

L. ANNA, (Jones) *Annals of Natural History*, 3rd series, vol. 1, p. 247, plate ix., fig. 18.

———, *Canadian Fossils, Decade* 3, p. 96, plate xi., fig. 13.

This species has been found only at the original locality in a quarry near the Station House of the Grand Trunk Railway, St. Anns.

ARTICLE XXVIII.—*Descriptions of some new species of Trilobites from the Lower and Middle Silurian rocks of Canada.* By E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for 1858-1859.)

ILLAENUS GLOBOSUS. (N. s.)

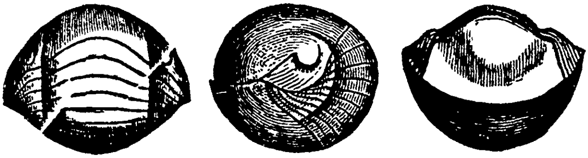

FIG. 1. FIG. 2. FIG. 3.

Fig. 1.—*Illænus globosus.* View of the thorax of a specimen rolled up.
2.—Side view of same specimen.
3.—View of pygidium of the same.

Description. Oblong, oval, distinctly trilobed, the central lobe very broad, full half the whole width. Length two to three inches, width half the length. Head rather more than one third, the thorax about one third and the pygidium rather less than one third the whole length.*

The head is large, very convex, most prominent in the centre and in form about one fifth more than the quarter of a sphere; the dorsal furrows continued on it about one third the length, sub-parallel, a little curved outwards at their anterior extremities, distant from each other half the width of the whole head; cheek

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* All the measurements of the head and pygidium given in this article (unless otherwise stated) were made by placing one point of the dividers at the centre of the anterior, and the other at the centre of the posterior margins. The figures would be different if the length were in all cases taken from the most forward projecting point, and this would be the proper mode, provided we knew how the animel carried its head.

pieces small, the facial suture half way between the dorsal furrow and the genal angle, eye rather small and situated about half its own length from the posterior margin; genal angles broadly rounded.

Thorax with ten segments, axis evenly convex, rather prominent, full half the whole width, about one sixth longer than wide, its sides nearly straight and the width at the first segment slightly greater than at the last; on each side of the axis a very narrow flat space scarcely one sixth the width of the axis, its outer margin forming the line of the fulcra of the pleuræ; the pleuræ are in length equal to about half the width of the axis, at the fulcra they appear to be bent at an angle of about 45°. The segments of the thorax increase in width from behind forwards.

The pygidium is in the extent of its surface about half the size of the head, transversely oval but with its lateral extremities obliquely and largely truncated, the posterior margin broadly and regularly rounded, the front margin trilobed, the central lobe being six eights of the whole width, the axis either not at all or only very obscurely defined.

The surface is smooth with the exception of the front part of the head which is marked by fine undulating concentric fissures about six in one line. The course of the facial suture has not been distinctly observed behind the eye.

Only one specimen with all the parts in place has been collected. It is rolled up and its measurements are as follows. Length of the head following the curvature of the surface one inch, of thorax nine lines and of pygidium nine lines. The proportional lengths of the head thorax and pygidium measured in this way would therefore be $\frac{4}{10}-\frac{3}{10}-\frac{3}{10}$.

But if we measure the parts in a straight line from the middle of the anterior to the middle of the posterior margins, the length of the head is about nine lines, the thorax about eight and the tail a little more than seven.

The width of the head at the eyes in a straight line is one inch nearly; following the curvature one inch and a half; width of axis of thorax about seven lines; length of pleuræ about three lines and a half.

The only described species to which this bears any near resemblance is the well known *I. crassicauda* of Europe but on comparison I find that that species has a larger head, a narrower central lobe to the thorax, the axis of the tail distinctly defined all round and the whole surface covered with strong undulating wrinkles. The two species although allied and occurring in strata which are most probably of nearly the same age are nevertheless decidedly distinct.

Judging from the figures given in the Palaeontology of New-York I think it probable that neither of the species there referred to *I. crassicauda* are identical with the European form.

The specimen represented on Plate 4 Chazy may be a fragment of a large individual of this species but those on Pl. 60, Trenton, I think are not. I have never seen a fragment of the true *I. crassicauda* in the Silurian of Canada.

Associated with the specimen above figured is the head of an individual of this species that must have been a little more than three inches in total length.

I beg to express my obligations to the Geological Society of London for the loan of a specimen of the true *I. crassicauda* with which to compare this species.

Locality and formation. Mingan Islands, and also Island of Montreal, Chazy.

Collectors. Sir W. E. Logan, J. Richardson.

ILLÆNUS BAYFIELDI. (N. S.)

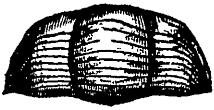

FIG. 4.

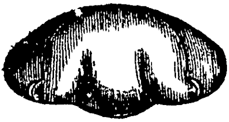

FIG. 5.

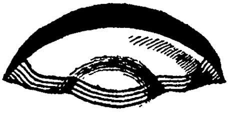

FIG. 6.

Fig. 4.—*Illænus Bayfieldi.* View of the thorax of a rolled up specimen.
5.—View of the head.
6.—View of the pygidium.

Description. Oblong, distinctly trilobed; length two or three inches; width three fourths the length, central lobe rather more than one third the whole width. Proportional length of head, thorax and pygidium about as 9, 8, 6½.

The head is transversely oval in outline, the width twice the length, rather evenly convex, most prominent in the centre, the front margin broadly rounded, the posterior margin trilobed by the dorsal furrows which are extended forward to about the middle of the head but are only distinct for one fourth that distance; they at first incline towards each other and then becoming very obscure curve outwards; on each side of the central lobe the posterior margin is nearly straight as far as the eye when it gradually curves forward and outward for one half the length of the head when turning a broad rounded angle it merges into the front margin. In consequence of this peculiar form of the posterior margin the genal angle in this species is in the front half of the lateral margin of the head. The eye is of moderate size lunate and within one fourth of its length from the margin. The facial suture curves forward so as to cut the front margin considerably within a longitudinal line drawn through the eye; behind the eye its course is remarkable as it turns outwards and runs parallel with the margin which it reaches at about three fourths the length of the pleurae. The lower angle of the eye is distant from the dorsal furrow a little less than half the width of the central lobe of the posterior margin. The width of the cheek piece on a line drawn transversely across the head at one third the distance from the eye to the front is nearly equal to half the distance between the eyes. In a vertical view of the head neither the full width of the cheek piece nor the position of the genal angle can be seen as the outline is fore-shortened, consequently in the figure above given the width appears less than it really is.

Thorax of ten articulations, axis of thorax square, the length and breadth being the same, moderately convex, well defined; the fulcra of the pleuræ are at about one third the width of the axis from the dorsal furrow, the intervening space flat.

Anterior edge of pygidium convex at the axal lobe, obliquely truncated from the fulcrum, the axis either not at all or only very obscurely defined.

Surface smooth with the exception of the front of the head where there are at the margin the usual transverse fissures.

This species was discovered by Admiral Bayfield, R. N., during his survey of the Gulf of the St. Lawrence. A well preserved specimen is in the Cabinet of the Geological Society of London among the fossils presented by Admiral Bayfield. During the present year 1859, Sir W. E. Logan visited the Mingan Islands and procured numerous specimens at Trilobite Bay the original locality.

Dedicated to the discoverer Admiral Bayfield.

Locality and formation. Trilobite Bay Mingan Islands, Chazy.

Collectors. Sir W. E. Logan, J. Richardson.

ILLÆNUS AMERICANUS. (N. s.)

Description.—Oblong, distinctly trilobed, length, two or three inches; width about three-fifths the length; proportional length of head, thorax, and pygidium, as 12, 9, 8.

Head large, transversely oblong or sub-oval, length two-thirds the width, convex most prominent in the centre, behind strongly trilobed by wide and deep dorsal furrows, which, towards their anterior extremities have a sigmoid curve inwards and outwards. Front margin somewhat straight or gently convex; posterior margin straight as far as eye and then gently curved forwards and outwards to the broadly rounded genal angle which is situated in the front half of the lateral border. The eye is not well preserved in our specimens, but enough remains to show that it is not more than two lines in length in a large individual, and situated rather more than half its length from the margin; it appears to be prominent, and is situated at a distance from the dorsal furrow equal to half the width of the axis. The facial suture reaches the front margin a little within the parallel of the eye; behind the eye its course cannot be ascertained from our specimens.

Thorax of ten segments; axis a little more than one third the width of the whole animal, moderately convex, when not distorted about one-fourth longer than wide, about one-ninth wider at the first than at the last segment, sides nearly straight.

On each side of the axis there is a flat space between the dorsal furrow and the bend of the pleuræ; the width of this space is rather more than one-third the width of the axis. The pleuræ are bent at the fulcra at an angle of 45° and at a little more than one-third their length from the side of the axis.

The pygidium is comparatively small, its length being only two-thirds that of the head, it is largely truncated at the ends, the two lateral margins thus formed being straight and in length nearly half the length of the whole pygidium; the width of the pygidium is twice its length. The dorsal furrows are strong at the margin but die out at less than one-third the length, and the axis is therefore not defined all round.

The surface is remarkable. On the head it is thickly covered with short squamose wrinkles, of which there are from six to eight in one line. On the tail these seem to radiate irregularly from the axis as a centre.

This species is related to *I. Bayfieldi*, but differs in its proportions, its head being larger and the axis of the thorax not square, but longer than broad; the eye is more distant and the surface not smooth. *I. crassicauda* has a much larger pygidium, with a conical axis, well defined all round.

Locality and formation.—Trenton Limestone, City of Ottawa. Specimens with all the parts in place rare, as indeed are all the species except *I. Bayfieldi.*

ILLÆNUS CONRADI. (N. s.)

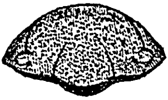

FIG. 7.

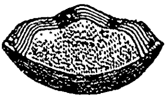

FIG. 8.

FIG. 9.

Fig. 7.—*Illænus Conradi.* View of the head of a rolled up specimen. The width of the cheek pieces cannot be seen in this view on account of the foreshortning.

8.—*Illænus Conradi.* Pygidium of same specimen.

9.—*Illænus Conradi.* Dorsal view, shewing the 8 segments of of the thorax.

Description.—Oblong, distinctly trilobed, central lobe less than one-third the width at the neck segment, the whole width three-fourths the total length. Proportional length of head, thorax, and pygidium, as $5\frac{1}{2}$, $4\frac{1}{2}$, 4.

Head transversely sub-fusiform, the lateral extremities outside and in front of the eye terminating in obtusely rounded points; width measured from point to point a little more than twice the length; front margin convex along the middle with a gentle broad concave sinus in front of each eye; posterior margin strongly tri-lobed by the dorsal furrows, straight from the furrow to the bend of the pleuræ, then curving backwards to a point behind the eye and thence forward and outward to the lateral extremity. The dorsal furrows are deep and broadly concave at the margin, but become obsolete at about one third the length of the head; they curve a little inwards and they are distant from each other one-third the whole width of the head. The eye is small, sub-globular, abruptly elevated all round the lower, outer and upper sides, but on the inner side even with the surface; the distance between its outer side and the dorsal furrow appears to be a little variable, but is always more than half the width of the axis of the thorax at the first segment, or about one-sixth the whole width of the head; it is distant from the posterior margin rather less than its own diameter. The facial suture turns outwards and cuts the posterior margin at a point just behind the outside of the eye; it cuts the front margin on a parallel passing half-way between the eye and the dorsal furrow.

Thorax with eight segments, the axis very convex and well defined by nearly straight sides; it gradually tapers so that the width of the last segment is only about two-thirds that of the first. The space on each side between the axis and the bend of the pleuræ is perfectly flat. The bend of the first pleura takes place at one-third its length or half-way between the axis and the parallel of the outer side of the eye, in the last pleura it is a little more distant.

The pygidium is sub-quadrilateral, the front margin straight with the exception of the convex elevation of the axis in the middle third; the lateral extremities are largely truncated, straight, aud at an angle of about 80° with the straight portion of the anterior border; the posterior margin is gently convex. The axis is very prominent in front but becomes obsolete or scarcely at all defined behind. The width of the pygidium is not quite twice the length.

The surface is strongly punctate.

The fragments such as the heads and tails are not uncommon but perfect specimens extremely rare. The following are the measurements as nearly as they can be made out from a single rolled up specimen which has the lateral extremities of the head broken off, but is in other respects beautifully perfect.

Length of head in straight line............	$5\frac{1}{2}$	lines.
———— following curvature........	7	"
Distance between dorsal furrows...........	4	"
Outside of eye from dorsal furrow..........	$2\frac{1}{2}$	"
Distance of eye from posterior margin......	$\frac{2}{3}$	"
Diameter of eye front to rear..............	$\frac{5}{6}$	"
Length of thorax..........................	$4\frac{1}{2}$	"
Width of axis at first segment..............	$3\frac{1}{2}$	"
———— at last segment..............	$2\frac{1}{3}$	"
Bend of first pleura from axis..............	$1\frac{1}{4}$	"
———— last pleura........................	$1\frac{2}{3}$	"
Length of Pygidium......................	4	"

Width at front margin....................	5¾	lines.
Between posterior angles..................	7	"
Length of the oblique straight lateral margins which are produced by the truncation of the extremities.......................	2½	"
Total length..............................	14	"

The obtusely pointed angles which form the lateral extremities of the head are as already stated broken off but from the detached head of another specimen it would appear that the distance between the angle and the eye is not quite so great as between the eye and the dorsal furrow.

It is difficult to give a clear expression of the form of a rolled up specimen of a small trilobite by wood engraving and the figures above given do not convey so clear an idea of the form as could be desired.

This species is allied to *Illaenus ovatus* (Conrad) but differs therefrom in the following particulars. Conrad says that his species has the eyes "placed on a line with the angle in the middle of the side lobes" meaning a line drawn along the bend of the pleuræ; in ours they are outside of that line; he also says the middle lobe or axis of the pygidium is "convex, rounded and well defined at the extremity" but in this species it is so obscurely defined as to be barely traceable. We have one nearly perfect specimen of *I ovatus* and in its characters it agrees very well with Conrad's description; it has ten articulations in the thorax, the bend is at full one half the length of the pleuræ; the axis of the pygidium is not only distinct but even abruptly elevated behind; the eyes are totally destroyed in the specimen but their position seems to be that mentioned by Conrad.

In the Palaeontology of New-York, Vol. 1, plate 67 two species are figured under the name of *I. ovatus.* One of these has eight segments in the thorax but Professor Hall says "it has a strong thick spine at the posterior angle of the cephalic shield." I do not think therefore that it can be identical with ours. The other specimen figured has nine segments in the thorax, and the eye outside of the line of the bend of the pleurae but conical and strongly projecting; it also differs too much from ours to be regarded as the same.

Dedicated to T. A. Conrad the first Palæontologist of the New York Survey.

Locality and formation. At the falls of La petite Chaudière, Township of Hull, Black River Limestone.

ILLÆNUS MILLERI. (N. S.)

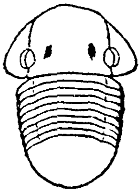

FIG. 10.

Fig. 10.—*Illænus Milleri.* In this figure the head is drawn as if partly flattened out, in order to shew the cheek pieces. The specimen is rolled up. In the natural position the posterior margins of the cheek pieces are in contact with the pleuræ. The head and pygidiam are a little foreshortened.

Description. Oblong oval, indistinctly trilobed, length one or two inches, width variable, about two-thirds the length, proportional length of head thorax and pygidium about as 6, 4½, 5½.

Head transversely semioval, evenly convex somewhat abruptly elevated in the front half and more depressed behind, not trilobed, genal angles rounded, eyes moderately large, lunate, less than half their length from the posterior borders, about their own length from the genal angle, and full six eights the entire width of the head from each other. Cheeks rather small, facial suture cutting the front margin a little within the parallel of the eye and the posterior margin just behind the outside of the eye. The dorsal furrows are represented by two obscure not always visible indentations each about one line in width, situated at about one fourth the length of the head from the posterior margin with a distance between them about equal to half the distance between the eyes. These pits are visible on the cast of the interior of the head and constitute a good character for distinguishing it from other species.

Thorax of nine segments; the dorsal furrows represented by two scarcely perceivable longitudinal depressions outside of which the pleuræ bend a little backwards. In well preserved specimens which have not been distorted the line along the bend of the pleuræ is a well defined rounded angular ridge the distance between the two lines being a little less than twice the length of the thorax.

Pygidium a little longer than the thorax, transversely broad oval, depressed convex in the front third, rather abruptly convex and elevated behind. The front margin is nearly straight or only gently convex in the middle third, then straight, but turned backwards to the ends of the pleuræ, where it meets the posterior margin nearly at a right angle.

Surface smooth.

Allied to *I. Trentonensis*, but in that species the dorsal furrows are continued on the head and in the cast of the interior extend nearly to the front margin, where they terminate in two small circular pits.

Dimensions of a small nearly perfect specimen, not the one figured :—

Total length	14½	lines.
Length of head.........................	6	"
Width of head	13½	"
Distance between eyes..................	11	"
Length of thorax	4½	"
Distance between the lines of the bend of the pleuræ	8½	"
Length of pygidium.....................	5½	"
Width	8½	"

Dedicated to the late Hugh Miller, the eminent Scotch geologist.

Locality and formation.—This species occurs in the Trenton limestone at St. Joseph's Island, Lake Huron; at the city of Ottawa; at L'Orignal, and at various other localities in the valley of the Ottawa. Also in the Black River limestone, at the Falls of La Petite Chaudiére, township of Hull.

Illænus Trentonensis. (Emmons.)

This species occurs at La Petite Chaudiére, township of Hull, and at the Mingan Islands in the Black River limestone

Illænus ovatus. (Conrad.)

This species occurs at La Petite Chaudiére, township of Hull, in the Black River limestone.

Of the following species, no perfect specimens have been found, but they are evidently distinct from any of the preceding.

Illænus angusticollis. (N.s.)

Description.—Of this species only the head has been found, and the most remarkable peculiarity it presents is the very narrow neck-like central lobe, and the depth of the dorsal furrows. The eye is depressed conical or sub-globular, and very like that of *I. Conradi;* the space between it and the dorsal furrow tumid and one-third wider than the central lobe. The front margin of the head is somewhat straight, a little convex along the middle, and slightly concave in front of the eye. The lateral extremities of the head are sharp and nearly in a line with the front margin. The posterior margin is strongly tri-lobed by the dorsal furrows, which are at first sub-parallel or gently diverging as far as the level of the eye, when they curve outwards, and become obsolete; in the cast they are distinctly marked nearly to the front margin. From the eye the posterior margin is straight and extends outwards and forward to the lateral angles, which are nearly on a line with the front margin. The head is abruptly elevated in front; the central lobe a little more elevated than the tumid space on each side between the dorsal furrow and the eye, but about the centre of the head it is flattened or very depressed convex, a character which distinguishes this species from *I. conifrons.* The facial suture I have not made out. The eye is distant half its own width from the posterior margin, and from the dorsal furrow a distance equal to once and a hird the width of the middle lobe. In a specimen where the width of the head between the two lateral angles is eight lines, the length is three lines and a half, and the width of the dorsal lobe one line and three-fourths.

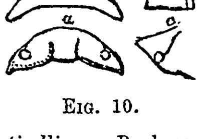

Fig. 10.

Fig. 10.—*Illænus angusticollis.* *a* Back part of the head. *b* Front. *c* Oblique view of one side to shew the pointed front angle. *d* Side view.

The central lobe is finely and closely punctured, the punctures just visible to the naked eye and nearly in contact with each other. The remainder of the head is smooth.

Allied to *I. Conradi*, but in that species the width of the middle lobe is nearly twice the distance between the eye and the dorsal furrow, while in this the distance of the eye is one-third greater than the width of the lobe.

Locality and formation.—Island of St. Joseph, and on the island west of Grant's Islands, Lake Huron; also at the Falls of La Petite Chaudiére, township of Hull. Black River limestone or base of the Trenton.

Collectors.—A. Murray. E. Billings.

ILLÆNUS CONIFRONS. (N.S.)

FIG. 11.

a Upper surface of head. The dorsal furrows are straight instead of curved, as they are in this figure.

b Side view.

Description.—This species is closely allied to *I. angusticollis*, but differs therefrom by having the glabella or central lobe expanded and elevated so as to form a large conical protuberance on the front half of the head. In the best preserved specimen the head is strongly trilobed behind by the deep dorsal furrows which are parallel and distant four and a half lines from each other for four lines forward, when they curve outward to the width of seven lines, then curving inward they unite in front; the furrow in front of the glabella runs along for five lines at a distance of one line from the margin and parallel with it. This is the appearance of the furrow on the cast of the interior of the head, but it is most probable that when the crust is preserved, it is only obscurely indicated in the front half of the head. The central lobe is very convex, and has the elevation and form of one-third of a cylinder so far forward as the dorsal furrows are parallel; it then expands to nearly twice its width and is conically inflated so as to project forward, and overhang the front margin. On a side view the dorsal outline of the head is nearly straight, or gently convex for the length of seven lines, but in the next three lines it makes a short rounded curve which changes the direction about 100° downwards on which course it continues in nearly a straight line to the front margin. (See Fig. 11.) The height of the most elevated point of the head above the front margin is six lines.

The distance of the eye from the dorsal furrow appears to be at least greater than the width of the central lobe, but how much greater cannot be determined by the specimens yet discovered. The facial suture cuts the front margin on a parallel passing nearer the dorsal furrow than the eye.

Judging from the fragments I have seen, this species must attain the length of two inches. I think also that the eye must be small and conical or sub-pedicilated, as it is in *I. ovatus.* It clearly belongs to that group of Illæni for which Mr. Conrad proposed the generic name *Thaleops.*

Locality and formation.—Mingan Islands, Black River limestone; appears to be abundant there in a fragmentary condition.

Collector.—J. Richardson.

ILLÆNUS CLAVIFRONS. (N.S.)

[Perhaps a variety of *I. conifrons.*]

Description.—This species has much the form of *I. conifrons,* but differs from it in having the unexpanded part of the glabella one-fourth shorter and the expanded front portion depressed convex instead of conical. The entire surface is coarsely punctured, the punctures being smaller on the front part of the head than they are on the posterior half.

Locality and formation.—Mingan Islands, in both the Chazy and Black River limestones.

Collectors.—Sir W. E. Logan. J. Richardson.

ILLÆNUS ARCTURUS. (Hall.)

ILLÆNUS ARCTURUS. Hall. *Palæontology of N.Y.,* vol. I., p. 23, plate 4, bis. Fig. 12.

Specimens of detached glabellæ agreeing very nearly with Professor Hall's figures occur in the Chazy and Black River limestones at the Mingan Islands. One of the fragments indicates an individual three or four inches in length.

ILLÆNUS ORBICAUDA. (N.S.)

Description.—The pygidium is sub-orbicular or including the anterior lateral angles, a broad semi-oval, the length one inch, and the greatest width thirteen and a half lines. The front margin is tri-lobed, the middle lobe being convex, and nearly two-thirds the whole width. The side lobes incline backwards at an angle of about 80° with the longitudinal axis; the fulcral angle is at about one line from the dorsal furrow, or one-third the length of the side-lobe. Outside of the fulcral angle the corner of the pygidium is strongly folded down or bevelled as it were to permit of the pleuræ sliding over it in the act of rolling up. The dorsal furrow is broad and shallow and its direction is remarkable; at about half a line from the anterior margin it curves outwards, so that in a distance of five lines the middle of the furrow has approached to within one line of the lateral margin, at which distance it continues all round; the furrow is wide, shallow, broadly concave, and not so distinct at the posterior margin as it is in the anterior half. In consequence of this peculiar course of the dorsal furrow, the axis or central lobe instead of being conical and small as it is in other species is sub-orbicular and occupies nearly the whole superficies of the pygidium. In this respect this species differs widely from any of those above described. The pygidium is rather strongly and evenly convex, and the surface is smooth. The width of the middle lobe of the anterior margin appears to shew that the axis of the thorax is nearly equal to two-thirds the whole width.

Locality and formation.—Gemache Bay, Anticosti, base of the Middle Silurian.

ILLÆNUS GRANDIS. (N.S.)

Description.—Very large, the fragments indicating individuals eight or nine inches in length. The pygidium transversely sub-oval, strongly trilobed in front, the anterior lateral angles largely truncated, and the outline of the posterior two-thirds very nearly a semicircle or rather a depressed cone. The central lobe of the front margin of the pygidium is convex and nearly half the whole width, being in the proportion of 11 to 26. The margin on each side of the central lobe is straight, and nearly at a right angle with the longitudinal axis until it approaches the fulcrum when it makes a short curve and turns back so as to make the fulcral angle about 45.° The distance of the fulcral angle from the dorsal furrow is about half the width of the middle lobe; the length of the side caused by the truncation of the anterior angles rather more than half. The anterior third of the pygidium is flattened or depressed convex, but the margin all round is suddenly curved down. The surface is smooth.

A pygidium 25 lines wide is 18 lines in length. Only a fragment of the thorax of this specimen is preserved, consisting of seven of the pleuræ and the impressions of eight of the segments of the axis, and according to such evidence as can be gleaned from the measurement of these, the thorax nust be thirteen lines in length and the axis eleven lines wide at the last segment.

One of the specimens is a pygidium 3¾ inches wide, and must have belonged to an individual over eight inches in length.

This species closely resembles *I. Davisii*, Salter (British Fossils, Decade 2, Pl. 2.) but in that species the anterior margin of the pygidum is straighter, the lateral angles not so decidedly truncated, the pleuræ more abruptly bent, and the fold under the posterior margin broader. From these differences in the pygidium, it may be inferred that the head when discovered wlll exhibit other grounds for specific distinction.

Locality and formation.—Anticosti, Hudson River Group, and Middle Silurian.

AMPHION CANADENSIS. (N.S.)

a *b*

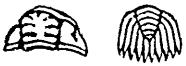

FIG. 12.

a Glabella. *b* Pygidium.

Description.—The glabella in the only fragment of the head that I have seen is sub-quadrate, a little more than two lines in length and the same in width, a little narrower behind than in front, the sides straight or gently concave, the front margin convex, and the posterior margin concave. It is divided into four lobes by three pairs of furrows. The posterior furrow extends entirely across and is arched forward in the middle to correspond with the concavity of the posterior margin. The other four furrows extend rather more than one-third across. The two posterior lobes occupy a little less than half the whole length. The front margin of the anterior lobe has a short furrow in the middle and an oblique one on each side half-way between the middle and the anterior angles. The glabella is moderately convex, and the sides are separated from the cheeks by deep narrow furrows.

Pygidium with six segments in the conical axis and ten ribs in the side lobes, five on each side. The anterior pairs of ribs at first project outwards for about one-third their length or a little less, when they make a short curve and become nearly parallel with the longitudinal axis of the body. The direction of the next pair is the same only that the curve is nearer the axis. The other three pairs are nearly parallel throughout.

The length of the axis of the pygidium is a little greater than the length of the central or terminal pair of ribs, and its last segment is triangular. The ribs are all pointed at their extremities and appear to project a little beyond the true margin of the pygidium.

In addition to the small specimens above figured, we have several other imperfect tails about three-fourths of an inch in length each. In these the ribs are more cylindrical and distinctly separated, and more curved outwards than they are in the small specimens. The axis is convex and obtusely angular along the middle. These differences I think may be the changes induced by the growth of the individuals. The species probably attained the length of one or two inches.

Differs from the Russian species *A. Fischeri* (Eichwald) in having the extremities of the ribs of the pygidium pointed instead of obtuse, and from *A. Lindaueri* (Barrande) in having them more nearly parallel.

It is an interesting fact that associated with this trilobite, the only species of the genus yet found in the Canadas, we find a group of *Cystideæ*, allied to the European *Echinosphærites*, and also a *Bolboporite* closely allied to the *B. mitralis*, which occurs along with *A. Fischeri* in the Lower Silurian rocks of Russia. Our coral has a smooth hemispherical solid base, and a small conical celluliferous upper extremity, often slender and pointed and half the whole length. It appears to me to be a distinct species, and it might be called *B. Americana*.

Locality and formation.—A. Canadensis ocurs in the Chazy Limestone at the Mingan Islands, and also in the same formation near Montreal. In both localities it is associated with *B. Americana.*

Collector.—Sir W. E. Logan.

TRIARTHRUS GLABER. (N.S.)

Description.—This species closely resembles *T. Beckii*, but has not the row of short spines along the middle of the axis. In specimens that are crushed quite flat, the form is elongate oval, and obtuse at both ends. The length is about twice the width, the central lobe as wide as the side lobes, or very nearly so. In the body and pygidium there are altogether nineteen segments, of which it is probable fourteen or fifteen belong to the tail, the precise number not determined. The front margin of the head is very obtuse, being in some specimens straight for more than half the width and in others even a little emarginate in the middle. The tail is either broadly rounded, or slightly emarginate at the extremity. I think that when perfect and not at all flattened by pressure, this species must be rather convex and its width a good deal less than half the length. From the size of several of the fragments, large individuals are probably three inches long, but the more common length is from one to two inches.

Locality and formation.—Lake St. Johns, Utica Slate.

Collector.—T. Richardson.

The three species of *Iriarthrus* known in Canada may be thus distinguished:—

1. TRIARTHRUS BECKII. (Green.)

A row of short spines along the middle of the axis of the thorax.

2. TRIARTHRUS SPINOSUS. (Billings.)

A long slender spine from the middle of the neck segment of the glabella, a similar spine from the eighth segment of the axis of the thorax, and two others from the posterior angles of the head, one on each side probably attached to the cheek pieces.

3. TRIARTHRUS GLABER. (Billings.)

With no spines either on the thorax or the head.

ART. XXIX.—*On the Aurora Borealis of the 28th of August 1859, By* CHARLES SMALLWOOD, M.D., LL.D., *Professor of Meteorology in the University of McGill College, Montreal.*

It is not the intention of the present short notice to endeavour, however faintly, to record the splendid display of the Aurora Borealis of the night of the 28th of August 1859,—to describe its more than earthly grandeur, would far surpass all human efforts; even to pencil its varied beauties, its gorgeous and ever changing tints, its crimson curtains of unusual splendour, suspended as it were from the vast celestial vault, would far excel the powers of human art: our object is to place on record some of the Physical signs by which it was accompanied.

At 8·30 p.m., there was no appearance of Aurora noticed here, the sky was then cloudy, covered by *Cumulus et Cumulo Stratus* clouds to the extent of 8/10th.

At 9 p.m,, which is one of the usual hours for observation at this place, the appearances were thus recorded: "Splendid Aurora Borealis extending nearly over the whole horizon with the exception of a small space in the S. & S. W., sky covered over with patches and streamers of Auroral light,—varying in colour from a pale yellow to deep orange and violet or crimson, giving the appearance of moon-light and nearly as light and bright as when the moon is at its full and giving rise to nearly the same colour." The horizontal and vertical movements were frequent and very rapid and it seemed as though the *Cumulus* and *Cumulo stratus* clouds were lighted up with the Aurora. The *exact moment* of its appearance here was not observed, but it was between 8·30 and 9 p.m., this appearance lasted, with modifications, till nearly sunrise.

There was also a fine display on the following night (Monday) the 29th, but nothing to be compared in brilliancy to the Aurora of the previous evening. The sky was on this occasion cloudless, a few streamers were occasionally seen tinted with a pale violet colour.

The 26th day was mild and pleasant, mean Temperature 69°4, at 8 p.m., distant lightning was observed in the E., but its presence did not affect the Electometers. Volta's Electrometer No. 1 indicated scarcely 2 degrees, positive.

The 27th day was partly clouded. Mean Temperature 64°7, shewing a decrease in Temperature, and a falling Barometer.

The 28th day (Sunday) was for the most part cloudy, the following is an extract from the register,

Day.	Hour.	Barometer.	Temperature.	Tension of Vapour.	Thermometer.	Direction of Wind.	Miles Linear.	Solar radiation.	Terrestrial radiation.	CLOUDS.
28	6 a. m.	29.737	50.7	.290	.82	W.N.W	93.40	91°4	34°8	Cum. Str. 6.
	2 p. m.	689	59.2	.242	.48	W.N.W	40.70			" 4.
	10 p. m.	753	51.7	.302	.82	W.N.W	84.10			" 10 Spl'd A.B.
29	6 a. m.	700	50.6	.301	.71	W	251.30	90°8	37°5	Str. 2.
	2 p. m.	714	66.4	.631	.66	W	51.30			Clear.
	10 p. m.	791	50.1	.258	.71	W	164.10			Clear Aurora Borealis.
30	6 a. m.	730	41.4	.169	.65	W.S.W.	9.60	85°2	25°2	Clear Frost.
	2 p. m.	701	59.7	.235	.46	W.S.W.	14.40			Cum. Str. 6.
	10 p. m.	670	56.0	.385	.84	W.S.W.	6.60			Nim. 10 R'n at 4.45 p.m.

The most remarkable incident, and to which it is more particularly necessary to advert, was the unusual and great amount of Atmospheric Electricity manifested as being present. At 9 p.m. the Electrometers indicated a maximum of 250 degrees in terms of Volta's Electrometer No. 1, of a positive character (but almost constantly varying in intensity) an amount equalled only during the Thunder storms of summer and the heavy Snow storms of winter. The amount during the following day and night indicated a maximum of 10 degrees which is however somewhat above the usual average.

The appearances would lead to the opinion that the *Cumulus* and *Cumulo stratus* clouds which generally do not occupy any great altitude might have been the medium of conducting the Atmospheric Etectricity to the earth, for the indications of the Electrometers were such as is present during the passage of clouds charged with electricity, and this phenomenon seems to have extended to the wires of the Electro-Magnetic Telegraph.

The following day and night indicated a small increase on the usual amount of Electricity, this may be owing to the continued presence of the Aurora, or in some measure may be owing to the decrease in temperature, accompanied by high wind and a great amount of Terrestrial Radiation. The Radiator indicated 25·2 degrees, and frost, which was destructive to vegetables, occurred on the morning of the 30th. The sky was cloudless on the 29th, but rain set in at 4·45 p.m. of the 30th, clouds began to form before noon of this day.

Similar indications of the Electrical state of the Atmosphere during the Aurora Borealis were never observed here, although its effect on the Magnetic Telegraph has been before witnessed, and reference is made to the same effects during the Aurora of the 19th Feby. 1852, which was also visible at this place. It is thus recorded: "From 6·30 to 7 p.m., a curtain or veil of Auroral light completely round the horizon terminating in a point in the Zenith near B *auriga*, of a crimson, green and yellow colour, the sky was cloudless and stars were distinctly visible through it." On the same night there was an immense eruption of Mauna Loa, the great volcano on Hawaii in the Sandwich Islands, a slight shock of an earthquake wae felt here at 5·40 a.m., on the morning of the 11th day (Feby 1852) the wave passing from the W. N. W.

The only display presenting such appearances as that of August last, was seen here in December 1836, and that display was accompanied by a cloudy state of the sky, the Auroral light was then of a deep violet (or blood colour) which gave rise to the popular belief that it predicted the unfortunate outbreak of 1837.

I did not then possess the means of ascertaining the Electrical state of the Atmosphere, and the only Electric Telegraph then in existence I believe on this Continent was in the laboratory of Professor Henry of Princetown N. J., now the respected Secretary of the Smithsonian Institution at Washington, so that the precise effects at that period could not be observed.

In reference to the Aurora Borealis of the beginning of September (which may have been probably a continuation of the same meteor as the 28th of August,) it was visible here on the night of the 2nd day, the 1st and 3rd being cloudy and rainy. The captain of the Barque James W. Paige, at N. York, reports that " from 8 P.M. to 3 A.M. of the 3rd of September the whole horizon was as light as any sunshiny day, the peculiarity of it was that the sky was completely overcast with very black clouds and at times it rained in torrents," but none of these appearances were seen here on the night of the 3rd Sept.

The Aurora Borealis of the 28th of August was seen generally in Europe, in London England, it was first seen at 10·30 p.m., but in more southern Latitudes it made its appearance soon after sunset; it was followed by Earthquakes in England and in Italy.

Mr. E. J. Lowe of the Beetson Observatory first observed it at 8·40 p.m., and his description in reference to appearances and the cloudy state of the sky, coincides with the appearances observed here; and Mr. Burder of Clifton, England, calls attention to some remarkable appearance of Solar Spots. Reports of its appearance in Havanna and many other places on the American Continent South of us, have been received.

Professor Henry of the Smithsonian Institution is investigating phenomena in reference thereto, and which may be looked forward to with great expectations, possessing, as he does, such ample means of collecting facts, and a perfect knowledge of the present state of Electrical Science.

It is much to be desired that the facts about to be collected should establish the origin or source of this Meteor. There are certain points which bear strongly upon the opinion of its electrical origin. Its connection during these extraordinary displays, with Earthquakes and Volcanic Eruptions seems to be almost an established fact.

The appearance of spots on the sun's disc is also another interesting feature in this enquiry, in connection with the Magnetism of the Earth.

At an early period of Electrical investigations, Priestley enquired, "if the empty space above the clouds might not always be filled with Electricity? and he asks may not Thunders, Earthquakes be owing to the re establishment of an equilibrium?"

It remains for modern investigations to answer these important questions.

ST. MARTIN, ISLE JÉSUS,
1st October, 1859.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, ABERDEEN, SEPTEMBER 14, 1859.*

A large and pleasant Meeting of the Members of the British Association began on Wednesday, at Aberdeen, under the immediate auspices of the Prince Consort, whose speech occupied the evening, and whose presence was rendered still more gracious by an invitation of the Members to an excursion and lunch at Balmoral during the week. The old Scottish loyalty broke out in the counties adjoining Aberdeenshire and Kincardineshire. Two thousand tickets were speedily sold, and by Tuesday morning every available nook in the Music Hall being filled, the sale of Associate tickets had to be stopped. Here was a flush of prosperity! The local arrangements were admirable—reviving dreams of that old Scottish hospitality so amusingly celebrated by Ben Johnson and Taylor, the Water Poet. The Clubs and News-Rooms were generally thrown open to the scientific visitors. Non-resident Members of the Association got admission to the Northern Club, and the Union Club, Market Street, without the forms of introduction. The Committees of the Athenæum News Rooms and of the News Rooms, Corn Exchange, opened their rooms to all Members of the Association on producing their tickets. A crowd of Exhibitions also were open to Members on producing their tickets:—such as the Exhibition of Historical Portraits and Objects of Antiquity, in the Music Hall Building,—the Photographic Exhibition, in the Music Hall Buildings,—Collections illustrating the Geology of the North of Scotland, in the Museum

* Cited from the Athenæum.

of Marischal College,—and the Horticultural Exhibition, King's College. Marischal College, Free Church College, Advocates' Hall, Medico-Chirurgical Society's Library and Hall, and the various prisons, reformatories, and asylums were likewise opened,—as were also most of the great manufactories. The company from a distance was large and brilliant; the papers promised were of scientific importance. Nothing was wanting to make the Meeting at Aberdeen pleasant and memorable.

Before the opening of the doors of the Music Hall the number of tickets issued to the public amounted to more than 2,500.

GENERAL COMMITTEE.

The General Committee held their first meeting in the Library of Marischal College. Professor Owen stated that the number of Associates already admitted amounted to 2,000; and the total number of Members and Associates altogether was nearly as much as the Music Hall could accommodate. He therefore proposed that the Committee should limit the admission of Associates. There was no limit to the admission of Members. The proposal was adopted, as we have already said.

The minutes of the last two Meetings were read and approved of—detailing the proceedings of the Committee as to the choice of Aberdeen for the present Meeting.

Professor Phillips read the Report of the Council, which chiefly pertained to proposals for more extended meteorological and magnetical observations and to the work of the Kew Observatory for the past year.

GENERAL MEETING.

The General Meeting was held, in the evening, at the Music Hall.—Prof. Owen on rising to hand over his Presidency to H. R. H. the Prince Consort, said:—Gentlemen of the British Association,—In rising to perform the brief concluding duty of my office, I may congratulate you on the present sound condition of the Association, and am happy to say that I leave its affairs in a more prosperous state than I found them. Yet this prosperity has for some years been progressive, more especially as regards the direct scientific aims of the Association. It was exemplified last year, by the presence of almost every surviving Founder, with large additions of working scientific Members, at our Meeting at Leeds; it is clearly manifested by the present distinguished assemblage, including many of our most eminent Continental and

American fellow-labourers in science, whom the distance of our present place of meeting has not daunted in their desire to co-operate with us. This prosperous career of the Association, I believe, is, in some measure, due to the element of common sense which mingles with our purely scientific aims. The Founders and Executive of the Association have sought to harmonize its general course of action with the spirit of the social feelings and arrangements and constitution of Great Britain. Accordingly, it has been the custom of the British Association for the Promotion of Science to select, in connexion with its highest office, the names, alternately, of those who are habitually occupied in scientific labours, and of those who combine such pursuits, or an active interest in science, with high social rank and its attendant influence and duties. With pleasure we recall to mind, in the latter category of Presidents, the Earl of Harrowby, the Marquis of Northampton, the Duke of Argyll; and now, our election of this day is ratified by the presence of the highest personage nearest the Sovereign of these realms. We derive from the consent of H. R. H. the Prince Consort to charge himself with the duties of the office the best assurance that the constitution and Acts of our Association have met with the Royal approbation. I need not before this assembly, representing as it does those classes who have always best appreciated it, dwell on the benign influence His Royal Highness's co-operative labours, addresses and example on every movement and organization tending to advance the moral and intellectual condition of the people of Great Britain. Gentlemen, I thank you most respectfully and sincerely for the confidence you have reposed in me during the past year, and, with a grateful sense of the many advantages which I have derived therefrom, permit me to say, that not among the least do I regard my present honourable relation in having, as my final duty, to resign my office and present chair to H. R. H. the Prince Consort.

The Royal President then rose and said:—

The President's Address.

Gentlemen of the British Association,—Your kind invitation to me to undertake the office of your President for the ensuing year could not but startle me on its first announcement. The high position which science occupies, the vast number of distinguished men who labour in her sacred cause, and whose achievements, while spreading innumerable benefits, justly attract the admiration of mankind, contrasted strongly in my mind with the consciousness of my own insignificance in this respect. I, a simple admirer and would-be student of science, to take the place of the chief and spokesman of the scientific men of the day, assembled in furtherance of their important objects!—the thing appeared to me impossible. Yet, on reflection, I came to the conclusion that, if not as a contributor to, or director of your labours, I might still be useful to you, useful to Science, by accepting your offer. Remembering that this Association is a popular Association, not a secret confraternity of men jealously guarding the mysteries of their profession, but inviting the uninitiated, the public at large, to join them, having as one of its objects to break down those imaginary and hurtful barriers which exist between men of science and so-called men of practice—I felt that I could, from the peculiar position Providence has placed me in this country, appear as the representative of that large public, which profits by and admires your exertions, but is unable actively to join in them; that my election was an act of humility on your part, which to reject would have looked like false humility, that is, like pride, on mine. But I reflected further, and saw in mine acceptance the means, of which necessarily so few are offered to Her Majesty, of testifying to you, through the instrumentality of her husband, that your labours are not unappreciated by your Sovereign, and that she wishes her people to know this as well as yourselves. Guided by these reflections, my choice was speedily made, for the path of duty lay straight before me.

If these, however, are the motives which have induced me to accept your flattering offer of the Presidency, a request on my part is hardly necessary that you will receive my efforts to fulfil its duties with kind indulgence.

If it were possible for anything to make me still more aware how much I stand in need of this indulgence, it is the recollection of the person whom I have succeeded as your President—a man of whom this country is justly proud, and whose name stands among the foremost of the Naturalists in Europe for his patience in investigation, conscientiousness in observation, boldness of imagination, and acuteness in reasoning. You have, no doubt, listened with pleasure to his parting address, and I beg to thank him for the flattering manner in which he has alluded to me in it.

LOCAL FEATURES.

The Association meets for the first time to-day in these regions and in this ancient and interesting city. The Poet, in his works of fiction, has to choose, and anxiously to weigh, where to lay his scene, knowing that, like the Painter, he is thus laying in the background of his picture, which will give tone and colour to the whole. The stern and dry reality of life is governed by the same laws, and we are here living, feeling, and thinking under the influence of the local impressions of this northern seaport. The choice appears to be a good one. The travelling philosophers have had to come far, but in approaching the Highlands of Scotland they meet Nature in its wild and primitive form, and Nature is the object of their studies. The geologist will not find many novelties in yonder mountains, because he will stand there on the bare backbone of the globe, but the primary rocks, which stand out in their nakedness, exhibit the grandeur and beauty of their peculiar form, and in the splendid quarries of this neighbourhood are seen to peculiar advantage the closeness and hardness of their mass, and their inexhaustible supply for the use of man, made available by the application of new mechanical powers. On this primitve soil the botanist and zoologist will be attracted only by a limited range of plants and animals, but they are the very species which the extension of agriculture and increase of population are gradually driving out of many parts of the country. On those blue hills the red deer, in vast herds, holds undisturbed dominion over the wide heathery forest, until the sportsman, fatigued and unstrung by the busy life of the bustling town, invades the moor, to regain health and vigor by measuring his strength with that of the antlered monarch of the hill. But, notwithstanding all his efforts to overcome an antagonist possessed of such superiority of power, swiftness, caution, and keenness of all the senses, the sportsman would find himself baffled, had not Science supplied him with the telescope and those terrible weapons which seem daily to progress in the precision with which they carry the deadly bullet, mocking distance, to the mark.

In return for the help which Science has afforded him, the sportsman can supply the naturalist with many facts which he alone has opportunity of observing, and which may assist the solution of some interesting problems suggested by the life of the deer. Man, also, the highest object of our study, is found in vigorous, healthy development, presenting a happy mixture of the Celt, Goth, Saxon, and Dane, acquiring his strength on the hills and the sea. The Aberdeen whaler braves the icy regions of the Polar Sea, to seek and to battle with the great monster of the deep; he has materially assisted in opening these ice-bound regions to the researches of Science; he fearlessly aided in the search after Sir John Franklin and his gallant companions, whom their country sent forth on this mission; but to whom Providence, alas! has denied the reward of their labours, the return to their homes, to the affectionate embrace of their families and friends, and the acknowledgment of a grateful nation. The city of Aberdeen itself is rich in interest for the philosopher. Its two lately-united Universities make it a seat of learning and Science. The collection of antiquities, formed for the present occasion, enables him to dive into olden times, and by contact with the remains of the handiwork of the ancient inhabitants of Scotland, to enter into the spirit of that peculiar and interesting people, which has always attracted the attention and touched the hearts of men accessible to the influence of heroic poetry. The Spalding Club, founded in this city, for the preservation of the historical and literary remains of the north-eastern counties of Scotland, is honourably known by its important publications.

ORIGIN AND OBJECTS OF THE ASSOCIATION.

Gentlemen, this is the twenty-ninth anniversary of the foundation of this Association; and well may we look back with satisfaction to its operations and achievements throughout the time of its existence. When, on the 27th of September, 1831, the Meeting of the Yorkshire Philosophical Society took place at York, in the theatre of the Yorkshire Museum, under the presidency of the late Earl of Fitzwilliam, then Viscount Milton, and the Rev. W. Vernon Harcourt eloquently set forth the plan for the formation of a British Association for the Promotion of Science, which he showed to have become a want for his country, the most ardent supporter of this resolution could not have anticipated that it would start into life full grown, as it were; enter at once upon its career of usefulness, and pursue it without deviation from the original design, triumphing over the oppositions which it had to encounter, in common with everything that is new and claims to be useful. Gentlemen, this proved that the want was a real, and not an imaginary one, and that the mode in which it was intended to supply that want was based upon a just appreciation of unalterable truths. Mr. Vernon Harcourt summed up the desiderata in graphic words, which have almost identically been retained as the exposition of the objects of the Society, printed at the head of the annually-appearing volume of its *Transactions*:—"To give a stronger impulse and more systematic direction to scientific enquiry,—to promote the intercourse of those who cultivate Science in different parts of the empire, with one another and with foreign philosophers,—and to obtain a more general attention to the objects of Science, and a removal of any disadvantages of a pnblic kind which impede its progress."

ORJECT AND DUTY OF SCIENCE.

To *arrange* and *classify* that universe of knowledge becomes therefore the first, and perhaps the most important, object and duty of Science. It is only when brought into a system, by separating the incongruous and combining those elements in which we have been enabled to discover the internal connexion which the Almighty has implanted in them, that we can hope to grapple with the boundlessness of His creation, and with the laws which govern both mind and matter.

The operation of Science then has been, systematically to divide human knowledge, and raise, as it were, the separate groups of subjects for scientific consideration, into different and distinct sciences. The tendency to create new sciences is peculiarly apparent in our present age, and is perhaps inseperable from so rapid a progress as we have seen in our days; for the acquaintance with and mastering of distinct branches of knowledge enables the eye, from the newly gained points of sight, to see the new ramifications into which they divide themselves in strict consecutiveness and with logical necessity. But in thus gaining new centres of light, from which to direct our researches, and new and powerful means of adding to its ever-increasing treasures, Science approaches no nearer to the limits of its range, although travelling further and further from its original point of departure. For God's world is infinite; and the boundlessness of the universe, whose confines appear ever to retreat before our finite minds, strikes us no less with awe when, prying into the starry crowd of heaven, we find new worlds revealed to us by every increase in the power of the telescope, than when the microscope discloses to us in a drop of water or an atom of dust, new worlds of life and animation, or the remains of such as have passed away.

From amongst the political sciences it has been attempted in modern times to detach one which admits of being severed from individual political opinions, and of being reduced to abstract laws derived from well authenticated facts. I mean Political Economy, based on general statistics. A new Association has recently been formed, imitating our perambulating habits, and striving to comprehend in its investigations and discussions even a still more extended range of subjects, in what is called "Social Science." These efforts deserve our warmest approbation and good will. May they succeed in obtaining a purely and strictly scientific character! Our own Association has, since its Meeting at Dublin, recognized the growing claims of Political Economy to scientific brotherhood, and admitted it into its Statistical Section. It could not have done so under abler guidance and happier auspices than the Presidency of the Archbishop of Dublin, Dr. Whately, whose efforts in this direction are so universally appreciated. But even in this Section, and whilst Statistics alone were treated in it, the Association as far back as 1833, made it a rule that, in order to ensure positive results, only those classes of facts should be admitted which were capable of being expressed by numbers, and which promised, when sufficiently multiplied, to indicate general laws.

If, then, the main object of Science—and I beg to be understood henceforth, as speaking only of that Section which the Association has under its special care, viz., Inductive Science—if, I say, the object of Science is the discovery of the laws which govern natural phenomena, the primary condition for its success is—accurate observation and collection of facts in such comprehensiveness and completeness as to furnish the philosopher with the necessary material from which to draw safe conclusions.

SCIENTIFIC MEMOIRS AND REPORTS.

One of the latest undertakings of the Association has been, in conjunction with the Royal Society, to attempt the compilation of a classified catalogue of Scientific Memoirs, which, by combining under one head the titles of all memoirs written on a certain subject, will, when completed, enable the student who wishes to gain information on that subject to do so with the greatest ease. It gives him, as it were, the plan of the house, and the key to the different apartments in which the treasures relating to his subject are stored, saving him at once a painful and laborious search, and affording him at the same time an assurance that what is here offered contains the whole of the treasures yet acquired.

While this has been one of its latest attempts, the Association has from its very beginning kept in view that its main sphere of usefulness lay in that concentrated attention to all scientific operations which a general gives to the movements of his army, watching and regulating the progress of his impetuous soldiers in the different directions to which their ardour may have led them, carefully noting the gaps which may arise from their independent and eccentric action, and attentively observing what impediments may have stopped, or may threaten to stop, the progress of certain columns.

Thus it attempts to fix and record the position and progress of the different labours by its Reports on the state of Sciences published annually in its *Transactions*;—thus it directs the attention of the labourers to those gaps which require to be filled up, if the progress is to be a safe and steady one;—thus it comes forward with a helping hand in striving to remove those impediments which the unaided efforts of the individual labourer have been or may be unable to overcome.

Let us follow the activity of the Association in these three different directions.

The Reports on the state of Science originate in the conviction of the necessity for fixing, at given intervals, with accuracy and completeness, the position at which it has arrived. For this object the General Committee of the Association entrusts to distinguished individuals in the different branches of Science the charge of becoming, as it were, the biographers of the period. There are special points in different Sciences in which it sometimes appears desirable to the different Sections to have special Reports elaborated; in such cases the General Committee, in this capacity of the representative assembly of all the Sciences, reserves to itself the right of judging what may be of sufficient importance to be thus recorded.

The special subjects which the Association points out for investigation, in order to supply the gaps which it may have observed, are—either such as the philosopher alone can successfully investigate, because they require the close attention of a practised observer, and a thorough knowledge of the particular subject; or they are such as require the greatest possible number of facts to be obtained. Here Science often stands in need of the assistance of the general public, and gratefully accepts any contributions offered, provided the facts be accurately observed. In either case the Association points out *what* is to be observed, and *how* it is to be observed.

The first is the result of the same careful sifting process which the Association employs in directing the issue of special Reports. The investigations are entrusted to specially-appointed committees, or selected individuals. They are in most cases not unattended with considerable expense, and the Association, not content with merely suggesting and directing, furnishes by special grants the pecuniary means for defraying the outlay caused by the nature and extent of the enquiry. If we consider that the income of the Association is solely derived from the contributions of its members, the fact that no less a sum than £17,000 has, since its commencement, been thus granted for scientific purposes, is certainly most gratifying.

The question *how* to observe, resolves itself into two—that of the scientific method which is to be employed in approaching a problem or in making an observation, and that of the philosophical instruments used in the observation or experiment. The Association brings to bear the combined knowledge and experience of the scientific men, not only of this but of other countries, on the discovery of that method which, while it economizes time and labour, promises the most accurate results. The method to which, after careful examination, the palm has been awarded, is then placed at the free disposal and use of all scientific investigators. The Association also issued, where practicable, printed forms, merely requiring the different heads to be filled up, which, by their uniformity, become an important means for assisting the subsequent reduction of the observations for the abstraction of the laws which they may indicate.

At the same time most searching tests and inquiries are constantly carried on in the Observatory at Kew, given to the Association by Her Majesty, the object of which is practically to test the relative value of different methods and instruments, and to guide the constantly progressive improvements in the construction of the latter.

The establishment at Kew has undertaken the further important service of verifying and correcting to a fixed standard the instruments of any maker, to enable observations made with them to be reduced to the same numerical expression. I need hardly remind the inhabitants of Aberdeen that the Association, in one of the first years of its existence, undertook the comparative measurement of the Aberdeen standard scale with that of Greenwich,—a research ably carried out by the late Mr. Baily.

We may be justified in hoping, however, that by the gradual diffusion of Science, and its increasing recognition as a principal part of our national education, the public in general, no less than the Legislature and the State, will more and more recognize the claims of Science to their attention; so that it may no longer require the begging box, but speak to the State, like a favoured child to its parent, sure of his parental solicitude for its welfare; that the State will recognize in Science one of its elements of strength and prosperity, to foster which the clearest dictates of self-interest demand.

HUMBOLDT.

If the activity of this Association, such as I have endeavoured to describe it, ever found or could find its personification in one individual—its incarnation, as it were,—this had been found in that distinguished and revered philosopher who has been removed from amongst us in his ninetieth year, within these last few months. Alexander von Humboldt incessantly strove after dominion over that universality of human knowledge which stands in need of thoughtful government and direction to preserve its integrity; he strove to tie up the *fasces* of scientific knowledge to give them strength in units. He treated all scientific men as members of one family, enthusiastically directing, fostering, and encouraging enquiry, where he saw either the want of, or the willingness for it. His protection of the young and ardent student, led many to success in their pursuit. His personal influence with the Courts and Governments of most countries in Europe enabled him to plead the cause of Science in a manner which made it more difficult for them to refuse than to grant what he requested. All lovers of science deeply mourn for the loss of such a man. Gentlemen, it is a singular coincidence, that this very day on which we are here assembled, and are thus giving expression to our admiration of him, should be the anniversary of his birth.

ADVANTAGES OF THE ASSOCIATION.

To return to ourselves, however: one part of the functions of the Association can receive no personal representation, no incarnation: I mean the very fact of meetings like that which we are at present inaugurating. This is not the thoughtful direction of one mind over acquired knowledge, but the production of new thought by the contact of many minds, as the spark is produced by the friction of flint and steel; it is not the action of the monarchy of a paternal Government, but the republican activity of the Roman Forum. These Meetings draw forth the philosopher from the hidden recesses of his study, call in the wanderer over the field of science to meet his brethren, to lay before them the result of his labours, to set forth the deductions at which he has arrived, to ask their examination, to maintain in the combat of debate the truth of his positions and the accuracy of his observations. These Meetings, unlike those of any other Society, throw open the arena to the cultivators of all sciences, to their mutual advantage: the Geologist learns from the Chemist that there are problems for which he had no clue, but which that science can solve for him; the Geographer receives light from the Naturalist, the Astronomer from the Physicist and Engineer, and so on. And all find a field upon which to meet the public at large, invite them to listen to their Reports, and even to take part in their discussions,—show to them that Philosophers are not vain theorists, but essentially men of practice,—not conceited pedants, wrapped up in their own mysterious importance, but humble inquirers after truth, proud only of what they may have achieved or won for the general use of man. Neither are they daring and presumptuous unbelievers—a character which ignorance has sometimes affixed to them—who would, like the Titans, storm heaven by placing mountain upon mountain, till hurled down from the height attained by the terrible thunders of outraged Jove; but rather the pious pilgrims to the Holy Land, who toil on in search of the sacred shrine, in search of truth,—God's truth—God's laws as manifested in His works, in His creation.

REVIEWS AND NOTICES OF BOOKS.

Memoirs of the Life of James Wilson, Esq., of Woodville, F.R.S., M. W. S. By the Revd. JAMES HAMILTON, D.D., F.L.S. New York: R. Carter & Bros. Montreal: B. Dawson & Son. With portrait, pp 399.

Mr. Wilson was brother of the celebrated Professor John Wilson of Edinburgh, and although of very unobtrusive character yet was known among a large circle of most attached friends to be a most accomplished scientific and literary gentleman. Having no profession he resided on a small and beautiful property in the parish of Colenton, about two or three miles from Edinburgh. There he cultivated with great assiduity the zoological department of Natural History. Birds, insects, fishes, and the lower forms of animal life were the objects to which he chiefly devoted his attention. The management and control of the whole Zoological Department of the Encyclopædia Britannica were undertaken by him and most ably executed. His authorship, on this work alone, comprises 900 pages, or equal to *nine* ordinary octavo volumes. He contributed the articles, Angling, Animal Kingdom, Animalculæ, Entomology, Helminthology, Ichthyology, Mammalia Ornithology, Reptiles and Serpents. He also published "Illustrations of Zoology, with historical and descriptive details," folio 1851: "Entomologia Edinensis" 1834; the piscatory part of "The Rod and the Gun" 1840; "Illustrations of Scripture by an animal painter, with notes by a Naturalist" 1842. These besides numerous articles on his favourite studies in Blackwood, the North British Review and other Magazines were the products of his pen. The main features of Mr. Wilson's character were, its meekness of wisdom, warmth of affection, and unostentatious all-comprehending kindness. There was in him a happy harmony of contrasted qualities,—scientific accuracy without pendantry and an unclogged excursive imagination,—fantastic playfulness with strong affection, and steadfast purpose,—freshness of feeling with width of innocent enjoyment, co-existing with great tenderness of conscience and faith unfeigned. He was preëminently a Christian Naturalist. This Memoir is prepared by one of the most genial and happy writers of the present day, and is a beautiful *eloge* of one whose character and labours will long be remembered and admired by the students of Natural History. We cordially commend this book to the Scientific and Christian reader as an interesting and delightful record of a beautiful, vigorous and useful life.

A. F. K.

The Use and Abuse of Tobacco. By John Lizars, M. D., late Professor of Surgery to the Royal College of Surgeons, Edinburgh. Philadelphia: Lindsay & Blakston. Montreal: B. Dawson & Son. Eighth edition, pp. 138.

The object of the author in the publication of this little, but most pregnant book, is, if possible, to correct the progress of Tobacco smoking, and other forms of its use. He finds it difficult to estimate the pernicious consequences produced by habitual smoking, on the number of victims, both old and young. The consumption of Tobacco in Britain alone, in the year 1853, amounted to the enormous quantity of 29,737,561 pounds or more than a pound to every man, woman and child of the population. When we consider that in every hundred pounds of this drug there is one pound of the most deadly poison known to chemistry, it is obvious that much injury must be done to the human constitution by its so extensive use. The first chapter of this book treats of the general characteristics of tobacco—its history, botany, chemistry and physiological effects; chapter second contains practical observations on its use and abuse; and chapter third communications from distinguished physicians, and extracts from medical writings. There can be no doubt that Dr. Lizars has made out an Indictment, against Tobacco, of the most alarming character. It is the fruitful cause of some of the most painful and horrible diseases to which the human frame is subject. Among others he enumerates ulcerations of the mouth, cancer, dyspepsia, diarrhœa, disease of the liver, congestion of the brain, apoplexy, palsy, mania, loss of memory, nervousness, emasculation, cowardice, &c. The cases and authorities which he adduces in support of his own large experience are numerous and conclusive. Let no one suppose that this is a quack book. It is written by one of the most skilful and judicious of surgeons—one whose reputation is world-wide. We are persuaded that a perusal of this book will convince the most skeptical that tobacco is a most deliterious drug, whether used in the form of smoke, snuff, or *quid*, producing effects on society which neither the public nor the medical profession seem yet to have fairly estimated. In page 103 of this book an experienced surgeon says "that the germs of premature decay which the abuse of tobacco is spreading through the country, will ultimately, in my opinion, prove more overwhelming than even the serious abuse of intoxicating liquors." Another says: "After fifty years of most extensive and varied practice in my profession, I have come to the decision that smoking is the main cause of ruining our young men, pauperizing the working-men, and rendering comparatively useless the best efforts of ministers of religion." As a scientific journal we deem it right to warn our youth against the use, in any form whatever, of this disgusting "weed." The Virginian *Nicotiana tabacum*, as well as the Canadian *Nicotiana rustica* should be regarded by every lover of himself and his kind, as a thing to be absolutely proscribed as both destructive to health and morals. We most cordially recommend this little seasonable treatise. A. F. K.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF AUGUST, 1859.

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.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow 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.			6 a. m.	2 p. m.	10 p. m.
1	29.719	29.780	29.784	66.1	72.3	69.0	.536	.631	.642	.84	.81	.92	S. E.	S. E.	S.	0.05	4.81	1.30	Inapp.	....	Cum. Str. 8.	Cu. Str. 10.	Str. 2. Distant Lightning.
2	866	795	824	68.8	86.2	66.3	.548	.564	.536	.79	.46	.84	S. S. W.	S. S. W.	S. S. W.	4.47	4.42	1.93	....	....	Clear.	Clear.	Clear.
3	827	779	752	68.8	90.6	75.1	.550	.616	.686	.82	.43	.83	S.	S. E. by E.	S. E. by E.	0.11	0.05	0.01	....	....	"	" [der.	Cu. Str. 10.
4	543	481	601	68.9	70.6	70.3	.648	.688	.688	95	92	92	S. E. by S.	W. N. W.	S. S. W.	0.26	5.13	1.11	4.223	....	Rain.	Cu. Str. 8. Thun-	Clear.
5	656	569	656	69.1	78.6	59.7	.606	.550	.439	88	58	88	W. S. W.	W. S. W.	W. S. W.	3.51	6.97	6.26	0.180	....	Light Cirri 2.	C. C. Str. 9.	Cu. Str. 8.
6	771	700	791	59.0	70 4	67.2	.358	.323	.496	73	44	77	W. N. W.	W. S. W.	S. W.	8.82	9.80	7.35	....	....	Clear.	Cirri 4.	" 9.
7	506	535	684	68.3	67.0	58.2	.516	.310	.423	77	48	88	S. W.	W.	W. N. W.	14.42	12.12	12.56	0.070	....	Cu. Str. 8.	C. C. Str. 8.	" 6.
8	775	784	798	60.1	74.7	61.0	.403	.463	.419	79	56	86	S. W. by W.	S. W. by W.	S.	1.26	0.60	0.83	....	....	Clear.	Clear.	Clear.
9	980	945	30.011	63.2	84.6	66.8	.510	.590	.529	88	51	82	S. W. by S.	S. W. by S.	S.	0.15	1.08	0.01	....	....	"	"	"
10	900	887	29.892	62.0	90.5	72.3	.523	.671	.631	94	48	81	S. S. E.	S. S. W.	S. E.	0.18	0.18	0.00	....	....	"	"	"
11	866	748	778	64.9	88.4	71.6	.563	.650	.572	93	47	76	S. E.	S. by E.	S. by E.	0.22	0.97	1.72	....	....	"	"	"
12	728	814	871	70.0	81.4	70.4	.665	.664	.695	92	62	95	S. by E.	S. S. W.	S. W.	1.08	1.75	0.73	Inapp.	....	C. C. Str. 10.	Cu. Str. 10	C. Str. 10. Thunder.
13	741	530	720	68.7	86.2	69.0	.648	.719	.599	95	85	85	W. S. W.	S. S. W.	S. W. by W.	0.36	1.01	3.80	0.186	....	" 10.	" 4.	Clear.
14	707	680	800	70.0	87.7	69.1	.523	.623	.571	72	48	82	E. by S.	E. S. E.	S. E. by E.	0.20	1.91	0.21	....	....	Clear.	Clear.	Cirri 4.
15	817	896	905	63.0	85.1	69.0	.510	.570	.599	88	47	85	N. E. by E.	E. by N.	E.	4.00	6.18	5.21	....	....	"	"	Clear.
16	910	977	929	63.2	82.9	65.9	.510	.721	.509	88	53	81	N. E. by E.	N. E. by E.	N. E. by E.	6.54	4.02	4.05	....	....	"	"	"
17	959	916	845	65.0	89.7	65.8	.483	.637	.509	78	47	81	N. E. by E.	S. E. by E.	S. E.	0.20	1.65	0.06	....	....	"	"	"
18	864	653	628	60.1	87.6	67.0	.456	.664	.529	88	52	82	S. E. by E.	S. S. W.	S. W. by W.	0.00	0.65	0.80	....	....	"	"	"
19	632	645	763	56.2	72.0	60.5	.420	.462	.338	94	60	65	N. N. E.	N. N. E.	N.	9.53	6.36	4.02	0.590	....	Rain.	Cumulus 4.	Clear. Faint Aurora Borealis.
20	845	851	877	62.0	79.4	60.3	.376	.465	.433	69	47	85	W. S. W.	W.	S. W.	2.15	0.67	0.66	....	....	Clear.	Clear.	Clear.
21	882	846	910	64.4	85.0	68.0	.464	.691	.542	77	77	87	W. S. W.	W. S. W.	W. S. W.	1.07	5.33	3.01	....	....	"	"	Str. 2. Distant Lightning.
22	904	835	899	68.6	84.5	68.2	.549	.590	.612	89	51	90	N. E.	N. E. by E.	N. E. by E.	2.00	1.50	3.36	....	....	C. C. Str. 8.	Cum. Cir. 8.	Clear.
23	932	844	884	63.8	84.3	67.0	.416	.545	.502	72	47	78	N. E. by E.	S. E. by E.	S. E.	4.97	5.50	2.41	....	....	Clear.	C. C. Str. 6.	Clear. Faint Aurora Borealis.
24	806	731	706	69.0	65.5	63.1	.606	.549	.543	88	89	94	S. E. by E.	S. E. by E.	S. W. by S.	2.03	8.78	0.70	1.100	....	C. C. Str. 8.	Rain.	Cu. Str. 4.
25	643	604	689	64.7	77.9	68.4	.536	.671	.577	92	71	85	S. S. W.	S. W.	S. S. W.	0.05	0.02	3.11	....	....	Cu. Str. 10.	Cu. Str. 6.	4.
26	716	650	688	64.2	78.1	66.1	.471	.588	.570	81	62	89	S. W.	S. W.	W. S. W.	1.32	5.70	2.33	....	....	" 10.	Cirr. Str. 4.	Cu. Str. 4. Distant Lightning.
27	614	600	738	63.0	71.1	57.0	.485	.429	.329	86	55	72	W. S. W.	W. by N.	W. N. W.	0.00	6.26	12.80	....	....	Clear.	Cirri Cum. 4.	Cu. Str. 6.
28	737	689	753	50.7	59.2	51.7	.290	.242	.302	82	48	82	W. N. W.	W. N. W.	W. N. W.	11.63	5.06	10.51	....	....	Cu. Str. 6.	" 4.	Cu. Str. 10. Splendid Aur. Bor.
29	700	714	791	50.6	66.4	50.1	.301	.431	.258	71	66	71	W.	W.	W.	25.11	6.30	20.26	....	....	Str. 2. Frost.	Clear.	Clear. Aurora Borealis.
30	730	701	670	41.4	59.7	56.0	.169	.235	.385	65	46	84	W. S. W.	W. S. W.	S. by W.	1.20	1.80	0.82	0.076	....	Clear.	C. Str. 6.	Rain.
31	540	517	586	57.0	59.9	54.0	.400	.354	.355	84	68	89	S. by W.	N. W.	W. by S.	12.13	5.90	0.87	0.231	....	Cu. Str. 10.	" 4.	Cu. Str. 2.

REPORT FOR THE MONTH OF SEPTEMBER, 1859.

	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.			6 a. m.	2. p. m.	10 p. m.
1	29.660	29.698	29.493	49.8	65.9	55.1	.265	.319	.376	.75	.47	.87	W. S. W.	W. S. W.	S. by E.	5.83	4.46	2.30	....	....	Clear.	Cu. Str. 4.	Rain.
2	347	484	680	50.1	59.6	52.3	.335	.342	.323	.93	.78	.85	W. S. W.	W. N. W.	W. S. W.	14.01	15.13	14.95	0.136	....	Rain.	" 6.	Clear. Aurora Borealis.
3	738	667	623	50.0	57.0	52.9	.309	.350	.361	.85	.75	.93	S. W.	S. by W.	S. E.	5.41	1.96	3.64	0.301	....	C. Cum. 4.	Rain.	Rain.
4	658	713	876	50.4	60 9	51.2	.309	.325	.296	85	61	79	W. S. W.	W. by S.	W. S. W.	8.01	12.21	10.05	0.800	....	Cu. Str. 8.	C. C. Str. 6.	Cu. Str. 3.
5	837	968	987	50.6	61.0	53.0	.328	.310	.348	89	60	86	S. W.	W.	W. S. W.	3.63	2.08	4.17	Inapp.	....	C. C. Str. 4.	Cu. Str. 9.	Clear.
6	30.050	30.064	30.113	50.8	58.2	49.1	.265	.255	.297	75	53	85	N. W.	N. W.	S. W. by S.	0.61	6.26	4.53	....	....	Clear.	C. C. Str. 6.	"
7	054	000	077	45.7	65.0	54.6	.211	.296	.335	72	44	80	S. S. W.	W. S. W.	S. W. by W.	0.21	4.00	1.77	....	....	C. C. Str. 4.	Cu. Str. 4.	Cir. Cum. 4.
8	072	067	092	47.2	69.4	54.0	.291	.529	.335	89	75	80	W. S. W.	S. S. W.	S. S. W.	0.00	1.31	2.15	....	....	Cirri 4.	Clear.	Clear.
9	124	006	001	58.9	76.4	68.2	.275	.498	.571	56	55	85	S. W.	S. W.	S.	5.07	2.90	1.51	....	....	C. C. Str. 4.	"	Clear.
10	29.922	29.821	29.754	52.9	61.5	61.2	.354	.498	.530	90	91	97	S. E.	S. S. E.	S.	0.27	0.51	2.85	0.330	....	C. Str. 8.	Rain.	Rain.
11	546	243	359	64.8	64.6	61.3	.590	.529	.478	97	89	88	N.	N. E.	S. W.	1.27	8.57	3.98	3.890	....	Rain, thunder.	"	Clear.
12	314	138	167	60.3	74.1	63.3	.489	.568	.453	90	67	80	S. W.	S. W.	S. W.	3.30	2.80	7.55	....	....	Cu. Str. 9.	C. C. Str. 6.	Cu. Str. 9.
13	214	262	319	60.8	59.0	46.1	.396	.289	.262	76	57	84	W.	W.	W.	10.27	10.16	19.26	....	....	" 10.	Cu. Str. 10.	" 4.
14	267	594	850	39.5	47.8	38.1	.180	.150	.186	77	45	81	W.	W. N. W.	W.	11.98	19.13	17.01	0.773	....	Snow, with hail.	" 4.	Clear. Aurora Borealis.
15	30.083	30.107	30.154	37.2	50.0	38.4	.178	.139	.165	81	39	72	W. N. W.	W. by N.	S. W.	24.86	14.15	3.70	....	....	Clear frost.	Clear.	Cirri 4.
16	120	044	29.998	34.2	61.3	44.6	.144	.249	.241	75	47	84	S. E.	E. S. E.	E. S. E.	0.01	0.78	0.66	....	....	C. C. Str. 8.	"	Clear.
17	29.856	29.789	834	42.0	58.2	52.2	.228	.387	.361	87	80	93	E.	E. by N.	N. E. by E.	0.40	1.30	4.38	....	....	Cu. Str. 10.	Cu. Str. 10.	Cu. Str. 10.
18	840	862	848	48.0	75.7	50.4	.303	.574	.290	89	70	82	W.	S.	S. by W.	1.92	0.07	0.01	....	....	" 10.	Clear.	Clear. Faint Aurora Borealis.
19	640	629	610	45.2	77.0	61.7	.211	.534	.442	72	59	83	E.	S. by E.	S. E. by E.	0.00	0.17	0.15	....	....	Clear.	"	Cu. Str. 9.
20	632	814	973	55.5	62.4	46.3	.405	.429	.238	94	77	77	N.	N. E.	E. N. E.	3.92	7.61	11.66	0.930	....	Rain.	Cu. Str. 10.	Clear. Aurora Borealis.
21	30.008	943	986	43.0	47.0	48.0	.215	.291	.316	79	89	96	E. N. E.	N. E. by E.	N. E. by E.	17.87	2.26	17.18	0.771	....	C. Str. 8.	Rain.	Slight rain.
22	29.940	880	887	45.2	54.3	53.6	.294	.396	.397	99	96	95	N. E. by E.	N. E. by E.	N. E. by E.	15.76	7.65	9.18	1.409	....	Rain.	"	C. Str. 10.
23	840	844	887	50.0	55.2	52.6	.341	.383	.361	96	90	93	N. E. by E.	N. E. by E.	N. E. by E.	15.17	11.13	4.92	1.970	....	"	"	" 10.
24	834	800	791	50.9	63.2	55.2	.348	.429	.383	92	77	90	N.	N. E. by E.	N. E. by E.	0.25	0.43	1.26	Inapp.	....	Cu. Str. 9.	Cu. Str. 6.	Cu. Str. 10.
25	870	864	869	53.0	62.3	59.6	.354	.436	.462	90	80	90	E. S. E.	E. S. E.	S. S. W.	0.36	3.16	0.01	....	....	" 10.	" 9.	" 10.
26	780	840	792	56.0	71.1	61.5	.413	.544	.498	90	73	91	S. S. W.	S. W.	S. W.	0.70	0.50	0.09	....	....	" 4.	" 4.	" 8.
27	761	749	765	57.8	68.2	62.3	.436	.543	.534	90	79	92	S. S. W.	S. W.	S. W.	0.35	2.43	1.83	Inapp.	....	C. C. Str. 6.	" 8.	" 10.
28	874	972	30.024	56.7	56.2	50.8	.336	.357	.283	75	78	78	N. E. by E.	N. N. E.	N. by W.	8.80	6.12	4.04	Inapp.	....	Cu. Str. 8.	" 9.	" 10.
29	30.179	30.169	201	42.7	62.0	43.2	.239	.311	.248	89	56	88	N. E. by E.	E.	E. S. E.	1.95	4.67	0.09	....	....	Clear.	Cirr. 2.	Clear. Faint Aurora Borealis.
30	179	003	29.961	40.3	70.6	53.2	.225	.423	.348	91	59	86	E. by N.	S. E.	S. S. E.	0.57	1.67	2.60	....	....	Cu. Str. 4.	Clear.	Clear.

REMARKS FOR AUGUST, 1859.

Barometer .... Highest, the 9th day, 30·011 inches.
Lowest, " 4th " 29·481 "
Monthly Mean, 29·760 inches.
Monthly Range, 0·530 "

Thermometer ... Highest the 3rd day, 90°9.
Lowest, the 30th day, 36°2.
Monthly Mean, 68°72.
Monthly Range, 54°7.

Greatest intensity of the Sun's rays, 110°8.
Lowest point of terrestrial radiation, 25°2.

Rain fell on 10 days, amounting to 6.666 inches; it was raining 42 hours 55 minutes, and was accompanied by thunder and lightning on 2 days.
Most prevalent wind, the S. W.
Least prevalent wind, N.
Most windy day, the 29th day; mean miles per hour, 17.22.
Least windy day, the 10th day; mean miles per hour, 0'12.
Frost occurred on the 30th day.
Aurora Borealis visible on 4 nights.
The Electrical state of the atmosphere has indicated high intensity.

REMARKS FOR SEPTEMBER, 1859.

Barometer. ...... Highest, the 29th day, 30·201 inches.
Lowest, " 12th " 29·138 "
Monthly Mean, 29.771 inches.
Monthly Range, 1.063 "

Thermometer. Highest, the 9th day, 78°4.
Lowest, " 16th " 29°2.
Monthly Mean, 54°31.
Monthly Range, 49°2.

Greatest intensity of the Sun's rays, 101°6.
Lowest point of terrestrial radiation, 18°2.
Mean of humidity, .799.
Amount of evaporation in inches, 1.42.

Rain fell on 14 days, amounting to 11.310 inches; it was raining 112 hours 17 minutes, and was accompanied by thunder on 1 day.
Most prevalent wind, N. E. by E.
Least prevalent wind, N.
Most windy day, the 14th day; mean miles per hour, 16.04.
Least windy day, the 19th day; mean miles per hour, 0'10.
Aurora Borealis visible on 5 nights.
The Electrical state of the atmosphere has indicated rather feeble intensity.
Ozone was present in rather large quantity.