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THE

CANADIAN

Naturalist & Geologist,

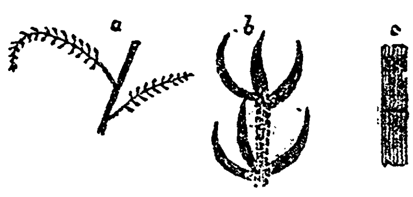
AND PROCEEDINGS OF THE

NATURAL HISTORY SOCIETY

OF MONTREAL.

CONDUCTED BY A COMMITTEE OF THE NATURAL HISTORY SOCIETY.

Vol. VII. APRIL 19, 1862. No. 2.



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(To the Editors of the Canadian Naturalist.)

GENTLEMEN:—I am at present engaged in preparing, with the assistance of Mr. Wm. Saunders, of London, C. W., a list of all those in Canada who study Entomology, or collect Insects,—for publication in *The Naturalist*—in a manner similar to the lists in Stainton's Entomologists' Annuals. I was in hopes that it would have been ready for the present number but as I commenced rather late in the day, and have not yet received answers from some whose consent I desired to obtain before publishing their names, I have concluded to keep the list for your next issue, in order that it may be as complete as possible.

I take this opportunity, therefore, of requesting that any Entomologist who has not yet been applied to will kindly forward his name, address, and the orders of Insects he collects, to Mr. Saunders, or myself, at his earliest convenience.

The advantages to be derived from the publication of such a list are so many and obvious, that it would be superfluous to dilate upon them here. I need only remark that all those from whom I have received replies up to this time, have entered most cordially and cheerfully into the project.

I am, &c.,

C. J. S. B.

Cobourg April 10th., 1862.

The following is my address:—

Rev. Chas. J. S. Bethune, Cobourg, C. W.

THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOL. VII. APRIL, 1862. No. 2.

ARTICLE VI.—*Notes on the Flora of the White Mountains, in its Geographical and Geological relations.* By J. W. DAWSON, LL.D., F.G.S.

(Read before the Montreal History Society.)

The group of the White Mountains is the culminating point of the northern division of the great Appalachian range, extending from Tennessee to Gaspé in a south-west and north-east direction, and constituting the breast-bone of the North American continent. This great ridge or succession of ridges has its highest peaks near its southern extremity, in the Black Mountains; but these are little higher than their northern rivals, which at least hold the undisputed distinction of being the highest hills in north-eastern America. As Guyot * has well remarked, the White Mountains do not occur in the general line of the chain, but rather on its eastern side. The central point of the range, represented by the Green Mountains and their continuation, describes a great curve from Gaspé to the valley of the Hudson, and opposite the middle of the concave side of this curved line towers the almost isolated group of the White Hills. On the other side is the narrow valley of Lake Champlain, and beyond this the great isolated mass of the Adirondack Mountains, nearly approaching in the altitude of their highest peaks, and greatly exceeding in their geological

* Silliman's Journal.

age, the opposite White Mountain group. The Appalachian range is thus in this part of its course, supported on either side by outliers higher than itself.

My present purpose is not to give a general geographical or geological sketch of the White Mountains, but to direct attention to the vegetation which clothes their summits, and its relation to the history of the mountains themselves. For this purpose I may first shortly describe the appearances presented in ascending the highest of them, Mount Washington, and then turn to the special points to which these notes relate.

In approaching Mount Washington by the Grand Trunk Railway, the traveller has ascended from the valley of the St. Lawrence to a height of 802 feet at the Alpine House at Gorham. Thence in a distance of about 8 miles along the bank of the Peabody River, to the Glen House, he ascends to the elevation of 1632 feet above the sea; and it is here or immediately opposite the Glen House, that the actual ascent begins. The distance from the Peabody River, opposite the hotel, to the summit is nine miles, and in this distance we ascend 4656 feet, the total height being 6288 feet above the sea.* Formerly only a bridle path led up this ascent; but last year a regularly graded and admirably finished carriage road was opened, by which visitors can drive comfortably to the top and back without any of the fatigue formerly experienced. This enterprise, almost worthy of comparison with the great roads over the passes of the Alps, was undertaken several years ago by a joint-stock company, and has at length been finished, at a cost, I believe, of $40,000, the interest on which it is hoped will be paid by the tolls levied on travellers, whose annual numbers are estimated at about 5000 for this road. This royal road to the summit is however by far too democratic for the taste of some visitors, who mourn the olden days of ponies, guides, and adventures; and though it gives an excellent view of the geological structure of the mountain, it does not afford a good opportunity for the study of the alpine flora, which is one of the chief attractions of Mount Washington. For this reason, though I availed myself of the new road for gaining a general idea of the features of the group, I determined to ascend by Tuckerman's ravine, a great chasm in the mountain side, named in honour of the indefatigable botanist of the North American

* According to Guyot, but some recent surveys make it a little higher.

lichens.* I was aided in this by the kindness of a gentleman of Boston, well acquainted with these hills, and passionately fond of their scenery. Our party, in addition to this gentleman and myself, consisted of two ladies, two children, and two experienced guides, whose services were of the utmost importance, not only in indicating the path, but in removing windfalls and other obstructions, and in assisting members of the party over difficult and dangerous places.

We followed the carriage road for two miles, and then struck off to the left by a bridle path that seemed not to to have been used for several years—the gentlemen and guides on foot, the ladies and children mounted on the sure-footed ponies used in these ascents. Our path wound around a spur of the mountain, over rocky and uneven ground, much of the rock being mica slate, with beautiful cruciform crystals of andalusite, which seemed larger and finer here than in any other part of the mountain which I visited. At first the vegetation was not materially different from that of the lower grounds, but as we gradually ascended we entered the "evergreen zone," and passed through dense thickets of small spruces and firs, the ground beneath which was carpeted with moss, and studded with an immense profusion of the delicate little mountain wood-sorrel (*Oxalis acetosella*), a characteristic plant of wooded hills on both sides of the Atlantic, and which I had not before seen in such profusion since I had roamed on the hills of Lochaber Lake in Nova Scotia. Other herbaceous plants were rare, except ferns and club-mosses; but we picked up an aster (*A. acuminatus*), a golden rod, (*Solidago thyrsoidea*), and the very pretty tway blade (*Listera cordata*).

In ascending the mountain directly, the spruces of this zone gradually degenerate, until they present the appearance of little gnarled bushes, flat on top and closely matted together, so that except where paths have been cut, it is almost impossible to penetrate among them. Finally they lie flat on the ground, and become so small that, as Lyell remarks, the rein-deer moss may be seen to overtop the spruces. This dwarfing of the spruces and firs is the effect of adverse circumstances, and of their struggle to extend their range toward the summit. Year by year they

* Dr. Bigelow and Prof. Tuckerman have been the chief botanical explorers of the White Mountains; though Pursh was the first to determine some of the more interesting plants, and Peck, Booth, Oakes and others, deserve honourable mention.

stretch forth their roots and branches, bending themselves to the ground, clinging to the bare rocks, and availing themselves of every chasm and fissure that may cover their advance: but the conditions of the case are against them. If their front advances in summer it is driven back in winter, and if in a succession of mild seasons they are able to gain a little ground, less favourable seasons recur, and wither or destroy the holders of their advanced positions. For thousands of years the spruces and firs have striven in this hopeless escalade, but about 4000 feet above the sea seems to be the limit of their advance, and unless the climate shall change, or these trees acquire a new plasticity of constitution, the genus *Abies* can never displace the hardier alpine inhabitants above, and plant its standard on the summit of Mount Washington.

I was struck by the similarity of this dwarfing of the upper edges of the spruce woods, to that which I have often observed on the exposed northern coasts of Cape Breton and Prince Edward Island, where the woods often gradually diminish in height toward the beach or the edge of a cliff, till the external row of plants clings closely to the soil, or rises above it only a few inches. The causes are the same, but the appearance is more marked on the mountain than on the coast.

On the path which we followed, before we reached the upper limit of trees, we arrived at the base of a stupendous cliff, forming the termination of a promontory or spur of the mountain, separating Tuckerman's ravine from another deep depression known as the Great Gulf. From the top of this precipice poured a little cascade that lost itself in spray long before it touched the tops of the trees below. The view at this place was the most impressive that it was my fortune to see in these hills.

Opposite the mouth of the Great Gulf, and I suppose at a height of about 3000 feet, is a little pond known as Hermit Lake. It is nearly circular, and appears to be retained by a ridge of stones and gravel, perhaps an old moraine or sea beach. On its margin piped a solitary sand-piper, a few dragon flies flitted over its surface, and tadpoles in the bottom indicated that some species of frog dwells in its waters. High over head and skirting the edges f the precipices, soared an eagle, intent no doubt on the hares that frequent the thickets of the ravines.

Before we reached Hermit Lake we had been obliged to leave our horses, and now we turned aside to the left and entered

Tuckerman's ravine, where there is no path, but merely the bed of a brook, whose cold clear water tumbles in a succession of cascades over huge polished masses of white gneiss, while on both sides of it the bottom of the ravine is occupied by dense and almost impenetrable thickets of the mountain alder (*Alnus viridis.*)

Tuckerman's ravine has been formed originally either by a subsidence of a portion of the mountain side or by the action of the sea. It is, like most of the ravines and "gulfs" of these hills, a deep cut or depression bounded by precipitous sides, and terminating at the top in a similarly precipitous manner. It must at one period have been in part filled with boulder clay, steep banks of which still remain in places on its sides; and extensive landslips have occurred, by which portions of the limiting cliffs have been thrown toward the centre of the valley, in large piles of angular blocks of gneiss and mica slate, in the spaces between which grow gnarled birches and spruces that must be used as ladders and bridges whereby to scramble from block to block, by every one who would cross or ascend one of these rivers of stones.

At the head of the ravine we paused to rest, to admire the wild prospect presented by the ravine and its precipitous sides, and to collect the numerous plants that flower on the surrounding slopes and precipices. Here on the 19th of August were several large patches of snow, one of them about an hundred yards in length. From the precipice at the head of the ravine, poured hundreds of little rills, and several of them collecting into a brook, had excavated in the largest mass of snow a long tunnel or cavern with an arched and groined roof. Under the front of this we took our mid-day meal, with the hot August sun pouring its rays in front of us, and icy water gurgling among the stones at our feet. Around the margin of the snow the vegetation presented precisely the same appearances which are seen in the low country in March and April, when the snow banks have just disappeared—the old grass bleached and whitened, and many perennial plants sending up blanched shoots which had not yet experienced the influence of the sunlight.

The vegetation at the head of this ravine and on the precipices that overhang it, presents a remarkable mixture of lowland and mountain species. The head of the ravine is not so high as the limit of trees already stated, but its steep sides rise abruptly to a plateau of 5000 feet in height intervening between Mount Washington and Mount Munro, and on which are the dark ponds or tarns known as the Lakes of the Clouds, forming the sources of the Amonoosook river, which flows in the opposite direction. From this plateau many alpine plants stretch downward into the ravine, while lowland plants availing themselves of the shelter and moisture of this cul-de-sac, climb boldly upward almost to the higher plateau. Other species again occur here which are found neither on the exposed alpine summits and ridges nor in the low country. Conspicuous among the hardy climbers are two coarse and poisonous weeds of the river valleys, that look like intruders into the company of the more dwarfish alpine plants;—the cow-parsnip (*Heracleum lanatum*) and the white hellebore (*Veratrum viride*). Both of these plants were seen struggling up through the ground at the margin of the snow, and climbing up moist hollows almost to the top of the precipices. Some specimens of the latter were crowded with the infant caterpilars of a mountain butterfly or moth. Less conspicuous, and better suited to the surrounding vegetation, were the bluets (*Oldenlandia cœrulea*), now in blossom here as they had been months before in the low country, the dwarf cornel (*Cornus Canadensis*), and the twin-flower (*Linnœa borealis*), the latter reaching quite to the plateau of the Lake of the Clouds, and entering into undisputed companionship with the truly alpine plants, though it is also found at Gorham four thousand feet lower.

Of the plants which seemed to be confined or nearly so to the upper part of the ravine, one of the most interesting was the northern painted cup, (*Castelleia septentrionalis*) a plant which abounds on the coast of Labrador and extends thence through all Arctic North America to the Rocky Mountains, and is perhaps identical with the *C. Sibirica* of Northern Asia and the *C. pallida* of Northern Europe. Large beds of it were covered with their pale yellow blossoms on the precipitous banks overhanging the head of the ravine. With the painted cup and here alone, was another beautiful species of a very different order, the northern green orchis, (*Platanthera hyperborea*) a plant which occurs, though rarely, in Canada, but is more abundant to the northward. Here also occurred, Peck's geum, (*G. radiatum, var.*), *Arnica mollis*, and several other interesting plants.

Of the Alpine plants which descend into the ravine, the most interesting was the Greenland sandwort, (*Arenaria* (*Alsine*) *Groenlandica*) which was blooming abundantly, with its clusters of delicate white flowers, on the very summit of the mountain, and could be found here and there by the side of the brook in the bottom of the ravine.

Clambering by a steep and dangerous path up the right side of the ravine, we reach almost at once the limit beyond which the ordinary flora of New England can extend no longer, and are in the presence of a new group of plants comparable with those of Labrador and Greenland. Here, on the plateau of the Lake of the Clouds, the traveller who has ascended the giddy precipices overhanging Tuckerman's ravine, is glad to pause that he may contemplate the features of the new region which he has reached. We have left the snow behind us, except a small patch which lingers on the shady side of Mount Munro; for it is only in the ravines into which it has drifted an hundred feet deep or more, that it can withstand the summer heat until August. We stand on a dreary waste of hard angular blocks of mica slate and gneiss, that lie in rude ridges as if they had been roughly raked-up by Titans who might have been trying to pile Monro upon Washington; but which seem to be merely the remains of the original outcropping edges of the rocks broken up by the frost, but not disturbed or rounded by water. Behind us is the deep trench-like ravine out of which we have climbed: on the left hand a long row of secondary summits stretching out from Mount Washington to the south-westward, and designated by the names of a series of American statesmen. In front this range descends abruptly in great wooded spurs or buttresses to the valley of the Amonoosook which shines in silvery spots through the trees far below. On our right hand towers the peak of Mount Washington, still more than a thousand feet above us, and covered with angular blocks, as if it were a pile of fragments rather than a solid rock. These stones all around and up to the summit of the mountain, are tinted pale green by the map lichen (*Lecidea Geographica*) which tinges in the same way the alpine summits of European mountains. Between the blocks and on their sheltered sides nestle the alpine flowering plants, of which 20 species or more may be collected on this shoulder of the mountain, and some of which extend themselves to the very summit, where *Alsine Grœnlandica* and the little tufts of deep green leaves of *Diapensia Lapponica* with a few Carices seem to luxuriate. Animal life accompanies these plants to the summit, near which I saw a family of the snow bird (*Plectrophanes nivalis*,) evidently summer residents here, and a number of insects, conspicuous among which was a brown butterfly of the genus *Hipparchia*. Shortly before sundown, when the thermometer at the summit house was fast settling toward the freezing point, a number of swallows were hawking for flies at a great height above the highest peak. To what species they belonged I could not ascertain. Possibly the cliff swallows find breeding places in the sides of the ravines, and rise over the hill top to bask in the sunbeams, after the mountain has thrown its shadows over their homes.

To return to the alpine flora which is peculiar to the peaks of these mountains—are the species comprising it autochthones originating on these hill tops and confined to them, or are they plants occurring elsewhere, and if so where; and how and when did they migrate to their present abodes? These are questions which must occur to every one interested in geology, botany, or physical geography. They have been answered in various ways; but without entering into controversy, I shall merely state a few facts, bearing on and illustrating that view which I myself prefer.

Not one of the alpine plants of Mount Washington is peculiar to the place. Nearly all of them are distinct from the plants of the neighboring lowlands, but they occur on other hills of New England and New York, and on the distant coasts of Labrador and Greenland, and some of them are distributed over the Arctic regions of Europe, Asia and America. In short they are stragglers from that Arctic flora which encompasses the north polar region, and extends in promontories and islands, along the high cold mountain summits far to the southward.

Some of the humble flowerless plants of these hills are of nearly world wide distribution. I have already noticed the pale green map lichen which tints the rocks of the Pyrenees, the Alps, and the Scottish Highlands; and the curious ring lichen (*Parmelia centrifuga*) paints its conspicuous rings and arcs of circles alike on Mount Washington and the Scottish hills. A little club moss (*Lycopodium selago*) is not only widely distributed over the northern hemisphere, but Hooker has recognised it in the Antarctic regions. Not long ago we unrolled in Montreal an Egyptian mummy preserved in the oldest style of embalming, and found that, to preserve the odour of the spices, quantities of a lichen (*Evernia furfuracea*) had been wrapped around the body and had no doubt been imported into Egypt from Lebanon or the hills of Macedonia for such uses. Yet the specimens from this old mummy were at once recognised by Professor Tuckerman as identical with this species, as it occurs on the White Hills and on Katahdin in Maine. These facts are however easily explicable in comparison with those that relate to the flowering plants.

The spores of lichens and mosses float lighter than the lightest down in the air, and may be wafted over land and sea, and dropped everywhere to grow where conditions may be favourable. Had the Egyptian embalmer used some of the first created specimens of *Evernia furfuracea*, it might easily within the three thousand years or so since his work was done, have floated round the world and established itself on the White Hills. But, as we shall see, neither the time nor means would suffice for the flowering plants. The only available present agency for the transmission of these would be in the crops or plumage of the migratory birds; and when we consider how few of these on their migrations from the north could ever alight on these hills, and the rarity of their carrying seeds in a state fit to vegetate, and further that few of these plants produce fruits edible by birds, or seeds likely to attach themselves to their feathers, the chances become infinitely small of their transmission in this way. The most profitable course of investigation in this and most other cases of apparently unaccountable geographical distribution, is to inquire as to the past geological conditions of the region, and how these may have affected the migrations of plants.

The earlier geological history of these mountains far antedates our existing vegetation. It belongs in the first instance to the Lower Devonian period, in which the materials of these mountains were accumulating, as beds of clay and gravel, in the sea bottom. These were buried under great depths of newer deposits, and were baked and metamorphosed into their present crystalline condition. Again heaved above the sea level, they were hewn by the action of the waves to some degree into their present forms, and constituted part of the nucleus of the American continent in the tertiary period. They were again with all the surrounding land depressed under the sea in the newer Pliocene period, and in the Post-pliocene or modern, slowly upheaved again to their present height. These last changes are those that concern their present flora, and their relations to it are well stated by Sir C. Lyell in the following passages from his interesting account of his ascent of Mount Washington in 1846.

"If we attempt to speculate on the manner in which the peculiar species of plants now established on the highest summits of the White Mountains, were enabled to reach those isolated spots, while none of them are met with in the lower lands around, or for a great distance to the north, we shall find ourselves trying to solve a philosophical problem which requires the aid not of botany alone but of geology, or a knowledge of the geographical changes which immediately preceded the present state of the earth's surface. We have to explain how an Arctic flora consisting of plants specifically identical with those which inhabit lands bordering the sea in the extreme north of America, Europe and Asia, could get to the top of Mount Washington. Now geology teaches us that the species living at present on the earth are older than many parts of our existing continents; that is to say they were created before a large portion of the existing mountains, valleys, plains, lakes, rivers, and seas were formed. That such must be the case in regard to Sicily, I announced my conviction in 1833, after first returning from that country, and a similar conclusion is no less obvious to any naturalist who has studied the structure of North America, and observed the wide area occupied by the modern or glacial deposits, in which marine shells of living but northern species are entombed. It is clear that a great portion of Canada, and the country surrounding the great lakes, was submerged beneath the ocean when recent species of mollusca flourished, of which the fossil remains occur about 500 feet above the level of the sea at Montreal. Lake Champlain was a gulf or strait of the sea at that period, large areas in Maine were under water, and the White Mountains must then have constituted an island or group of islands. Yet as this period is so modern in the earth's history as to belong to the epoch of the existing marine fauna, it is fair to infer that the Arctic flora now contemporary with this was then also established on the globe.

"A careful study of the present distribution of animals and plants over the globe, has led nearly all the best naturalists to the opinion that each species had its origin in a single birth-place, and spread gradually from its original centre to all accessible spots fit for its habitation, by means of the powers of migration given to it from the first. If we adopt this view, or the doctrine of specific centres, there is no difficulty in comprehending how the *Cryptogamous* plants of Siberia, Lapland, Greenland, and Labrador, scaled the heights of Mount Washington, because the sporules of the fungi, lichens, and mosses, may be wafted through the air for indefinite distances like smoke; and in fact heavier particles are actually known to have been carried for thousands of miles by the wind. But the cause of the occurrence of Arctic plants of the *Phænogamous* class on the top of the New Hampshire Mountains, specifically identical with those of remote polar regions, is by no means so obvious. They could not in the present condition of the earth affect a passage over the intervening lowlands, because the extreme heat of summer and cold of winter would be fatal to them. We must suppose, therefore, that originally they extended their range in the same way as the plants now inhabiting arctic and antarctic lands disseminate themselves. The innumerable islands in the polar seas are tenanted by the same species of plants, some of which are conveyed as seeds by animals over the ice when the sea is frozen in winter, or by birds; while a still larger number are transported by floating icebergs, on which soil containing the seeds of plants may be carried in a single year for hundreds of miles. A great body of geological evidence has now been brought together to show that this machinery for scattering plants as well as for carrying erratic blocks southward, and polishing and grooving the floor of the ancient ocean, extended in the western hemisphere to lower latitudes than that of the White Mountains. When these last still constituted islands in a sea chilled by the melting of floating ice, we may assume that they were covered entirely by a flora like that now confined to the uppermost or treeless region of the mountains. As the continent grew by the slow upheaval of the land, and the islands gained in height, and the climate around these hills grew milder, the Arctic plants would retreat to higher and higher zones, and finally occupy an elevated area which probably had been at first or in the glacial period, always covered with perpetual snow. Meanwhile the newly formed plains around the base of the mountain, to which northern species of plants could not spread, would be occupied by others migrating from the south, and perhaps by many trees, shrubs, and plants, then first created, and remaining to this day peculiar to North America."

The time to which the above views of Sir C. Lyell would refer the migration of the White Mountain flora, is historically very remote. The changes of level which have submerged the American continent and re-elevated its land, have occupied long periods. Whether with Lyell we measure these periods by the recession of the Falls of Niagara, or by the growth of the alluvial plain of the Mississippi; or with Agassiz, by the extension of the Peninsula of Florida, or endeavour to estimate the time required for the abrasion and deposition of the great mass of clay that fills the valley of the St. Lawrence, we cannot suppose that less than two or three hundred centuries have elapsed since the alpine plants of the White Mountains were cut off from all connection with their Arctic relatives. Their reign upon the mountain tops not only antedates all human dynasties, but reaches far beyond the creation of man himself and many of his contemporaries.

Positive evidence of the existence of some of these plants during a large portion of this lapse of time, has actually been preserved in the Post-pliocene deposits of Canada. At Green's Creek on the Ottawa, in nodules in the clay containing marine shells, and coeval with the Leda clay of Montreal, there are numerous remains of plants that have been embedded in this clay at a time when the Ottawa valley was a bay or estuary, and when the Adirondack Mountains of New York and the mountains of New England were two rocky islands separated from each other, and from the mainland on the north, by wide arms of the sea. The plants found in these nodules all appear to be of modern species. It is of course not easy to recognise the specific characters in these fragments, but I think I have good evidence of *Potentilla Norvegica*, *P. tridentata*, and possibly *P. Canadensis; Populus balsamifera*, *Arctostaphylos uva-ursi*, *Trifolium repens*, *Drosera rotundifolia*, *Potamogeton natans*, and *P. perfoliatum*.* There are also seeds apparently of ranunculaceous plants; grasses and carices, and mosses. Several of these plants are found on the White Mountains, and they are all northern and arctic species. I have no doubt that further examination of these deposits will lead to the discovery of additional examples. This fact, proving as it does the existence of these species at the period in which the theory of Lyell and Forbes requires them to have migrated, is in itself strong corroborative evidence. We can say that some of these species were waiting on the shores of the north, ready to be drifted to the insular spots to the south-west, and that their seeds were actually being washed out to sea by the streams which emptied themselves into the then estuary of the Ottawa.

* These determinations were made from specimens in the collection of the Geological Survey, and from others kindly collected for me by A. Dickson, Esq.

Another aspect of the inquiry which has perhaps not been regarded with sufficient attention, is that which relates to the reduction of temperature, which might be consequent on the great depression of the land which we know to have existed at the close of the tertiary period, a fact on which I have insisted in former papers on the Post-pliocene deposits of Canada.* A very clever writer on the subject of geographical distribution,† has pictured the case of a subsiding continent with the fauna and flora of its lowlands becoming gradually concentrated on the spots which had previously been alpine summits, but now reduced to low and temperate islands. But he has left out of view the fact, that if land still existed in mass in the arctic regions, and if the subsidence was that of land in temperate regions, then on the principles long ago so well stated by Sir C. Lyell, these islands might have a mean temperature far below that of the former plains, and might in consequence be suitable only to such an alpine flora as that which they had previously borne.

Now this is precisely what occurred in the Post-pliocene period. The arctic land remained in great mass, detaching into the sea annual crops of icebergs, which have strewed all the northern hemisphere with boulders: the temperate regions were submerged except a few insular spots. These are the very conditions required for a low mean temperature both in the sea and on the land, and these geographical conditions correspond precisely with the facts as indicated by the fossil animals and plants of the period.

Further, it would be easy to show that the alpine plants of Mount Washington would thrive under such conditions as those supposed, at the sea level; a low and equable temperature with a moist atmosphere being that which they most desire, and their greatest enemy being the dry parching heat of the plains of the temperate regions. Those of them, such as *Potentilla tridentata*, *Linnæa borealis*, and *Alsine Grœnlandica*, which occur within the limits of the United States, are found under shaded woods, in damp ravines, or on the moist sea coast; and as we follow the coasts northward, we find these plants on these and on neighboring islands, in lower latitudes than those in which they occur inland. When the summer mists roll around the summit of Mount Washington, it is in every respect the precise counterpart of an

* Canadian Naturalist, Vol. IV. † Wollaston.

islet anywhere on the coast of America from Cape Breton to the arctic seas, and when winter wraps everything in a mantle of snow, all these lands are in like manner under the same conditions. So in the Post-pliocene period, though the islets of the White Mountains may have experienced a less degree of winter cold, they must have had very nearly the same summer temperature as now; and as this is the season of growth for our alpine and arctic plants, it is its character that determines the suitableness of the locality to them.

Those stupendous vicissitudes of land and water which have changed the aspect of continents, and swept into destruction races of gigantic quadrupeds, have dealt gently with these alpine plants, which long ages ago looked out upon a waste of ice-laden waters that had engulfed the Pliocene land with all its inhabitants, as securely as they now look down upon the pleasant valleys of New England. It is curious too that the humbler tenants of the sea have shared a similar exemption. In the clay banks of the Saco, on the shores of Lake Champlain, and mixed with the remains of these very plants in the valley of the Ottawa, are shells that now live in the Gulf of St. Lawrence and on the coast of Maine, intermixed with other species that are now found only in a few bays of the Arctic seas. Just as in the Post-pliocene clays of the Ottawa, the remains of arctic plants are found in the same nodule with those of *Leda truncata*, so now similar associations may be taking place on the coasts at the mouth of the Great Fish River. Truly, in nature as in grace, God hath chosen the weak things of the world to confound those that are mighty, and has left in the earth's geological history, monuments of his respect and regard for the humblest of his works.

We look in vain among the alpine plants so long isolated in these mountains, for any evidence of decided change in specific characters. The alpine plants for ages separated from their arctic brethren, are true to their kinds, and shew little tendency to vary, and none to adapt themselves to new forms in the sunny plains below. This is especially noteworthy in Mount Washington and the neighboring peaks, because the soil of these is the same with that of the valleys below. Several of the plants peculiar to these hills, as the black crow-berry (*Empetrum nigrum*), for instance, even when other conditions are favourable, shun rich calcareous soils, and affect these of granitic origin. In many cases the difference in soil is a sufficient reason for the non-occurrence of such plants except on certain hills. At Murray Bay, and on the shores of Lake Superior, the plant above named occurs only on the Laurentian gneiss. In Nova Scotia, its relative, *Corema Conradi*, is confined to the granite barrens of the south coast. Many such plants skirt the whole Laurentian range from Labrador to Lake Superior, but refuse to extend themselves over the calcareous plains of Canada. But in the White Hills the soil of the river alluvium is the same micaceous sand that fills the crevices of the rocks in the mountains, and hence there is no obstruction, in so far as soil is concerned, to the diffusion of plants upward and downward in the hills. In like manner there is every possible condition as to moisture and dryness, sunshine and shade, in both localities. These circumstances are of all others the most favourable to such variation as these plants are capable of undergoing. The case is the same with that which Hugh Miller so strongly puts in relation to the species of algæ that occur at different distances below high water mark on the coast of Scotland, each species there attaining a certain limit, and then instead of changing to suit the new conditions, giving place to another. So it is on Mount Washington; and this whether we regard the lowland plants that climb to a certain height and there stop; the plants that are common to the base and summit, or the plants that are confined to the latter.

I have already referred to the evident struggle of the spruces and firs, and the plants associated with them, to ascend the mountain; and the same remark applies to all the plants that one after another cease to appear at various heights from the lower valleys. One by one they become stunted and depauperated, and then cease, without any semblance of an attempt to vary into new and hardier forms. And this must have been proceeding, be it observed, from all those thousands or myriads of years that have elapsed since the elevation of the mountains out of the glacial seas. It is to be observed also that the new plants that occur in ascending, often belong to different genera and families from those left behind, not to closely allied species; and in the few cases in which this last kind of change occurs, there is no graduation into intermediate forms. For instance *Solidago thyrsoidea* and *S. virga-aurea* occur around the base of the mountain, and for some distance up its sides. At the height of four to five thousand feet, the latter only remains, and this in a dwarfish condition. This corresponds to its distribution elsewhere, for according to Richardson it occurs in lat. 55° to 65° in Arctic America, and according to Hooker it is found in the Rocky Mountains, while it also occurs in the hills of Scotland, and very abundantly in some parts of Norway. In the White Mountains *S. thyrsoidea* prevails toward the base, *S. virga-aurea* toward the summit; and at the top of Tuckerman's ravine I found the former of these golden-rods in blossom, within a few hundred feet of the latter, each preserving its distinctive peculiarities. Much has lately been said of the appearance of specific diversity that results from the breaking up of the continuity of the geographical areas of plants by geological changes; but here we probably have the converse of this. The mountain species is no doubt a part of the older arctic flora, the other belongs to the more modern flora of the plains, and they have met on the sides of the White Hills.

Some hardy species climb from the plains to heights of 5000 feet or more, with scarcely even the usual change of being depauperated, and then suddenly disappear. This is very noteworthy in the case of two woodland plants, the dwarf cornel or pigeon-berry (*Cornus Canadensis*), and the twin-flower (*Linnæa borealis*). The former of these is a plant most widely distributed over northern America, and probably belongs to that newer flora which overspread the continent after its re-elevation. In August this plant in the woods around the base of Mount Washington is loaded with its red berries. At an elevation of four to five thousand feet it may be found in bloom; above this a few plants appear destitute of flowers, dwarfish in aspect, and nipped by cold, and then the species disappears. No doubt the birds that feed on its little drupes have carried it up the mountain, and have sown it a little farther up than the limit of its probable reproductiveness. The beautiful little *Linnæa* is a still more widely distributed plant; for it occurs on the hills of northern Europe, and is found across the whole breadth of the American continent from Nova Scotia to the Columbia River. It is almost beyond question a member of the old arctic flora which colonised the islands of the Post-pliocene sea, and has descended from them on all sides as the land became elevated. This plant also climbs Mount Washington to a height of 5000 feet, and presents precisely the same characters on the top as at the bottom, only losing a little in the length of its stem. Specimens bearing blossoms and quite in the same stage of growth, may be collected at the same time on the highest shoulders of Mount Washington, and on the flats at Gorham. The *Linnæa* in this is true to its designation. For as if it belonged to it to support the reputation of the great systematist after whom it is named, it preserves its specific characters with scarcely a tittle of change throughout all its great range. One cannot see this hardy little survivor of the glacial period, so unchanging yet so gentle, so modest yet so adventurous, so wide in its migrations yet so choice in the selection of the mossy nooks which it adorns with its pendant bells, and renders fragrant with its delicious perfume, without praying that we might in these days of petty distinctions and narrow views, be favoured with more such minds as that of the great Swede, to combine the little details of the knowledge of natural history into grand views of the unity of nature.

Another plant which, being less dependent on shade and shelter than the *Linnæa*, mounts still higher, is the cowberry or foxberry (*Vaccinium vitis-Idæa*). This also is both European and American, and is probably a survivor of the Post-pliocene period. It still occurs in at least one locality in the low country of Massachusetts, and on the coast of Maine. It is found along the granitic coast of Nova Scotia, and extends thence northward to the arctic circle, being found at Great Bear Lake and at Unalaska. This too is a most unchanging species, and the same statement may be made respecting *Rubus Chamæmorus*, the cloud-berry, *Empetrum nigrum*, the black crowberry, *Ledum latifolium*, the Labrador tree, *Potentilla tridentata*, the three toothed cinque-foil, which grows on the coast of Nova Scotia, and is found in the nodules of the Ottawa clay, the same in every detail as on Mount Washington, *Vaccinium uliginosum*, the bog billberry, and *V. cæspitosum*, the dwarf billberry. Several of these too it will be observed, are berry-bearing plants, whose seeds must be deposited in all kinds of localities by birds. Yet they never occur in the warm plains, nor do they show much tendency to vary in the distant and somewhat dissimilar places in which they occur. In the case of most of these species, the most careful, comparison of specimens from Mount Washington with those from Labrador, shows no tittle of difference. When we consider the vast length of time during which such species have existed, and the multiplied vicissitudes through which they have passed, one is tempted to believe that it is the tendency of the "struggle for existence" to confirm and render permanent the characters of species rather than to modify them.

Of the more specially arctic plants which have held their ground unchanged on Mount Washington, the following are some of the principal. *Diapensia Lapponica* in beautiful deep green tufts ascends quite to the summit. It occurs also in the Adirondack Mountains, and on Mount Katahdin in Maine. It is found in Labrador, and according to Hooker, extends north to Whale Island in the Arctic seas; but it is not found west of the Great Fish River. It occurs also on the mountains of Lapland, and is described as the hardiest plant of that bleak region. *Arenaria (Alsine) Grœnlandica,* the Greenland sandwort, adorns with its clusters of white flowers every sandy crevice in the rocks of the very summit of Mount Washington, and is trodden under foot like grass by the hundreds of careless sight-seers that haunt the peak in summer; though I should add that not a few of them carry off little tufts as a memento of the mountains, along with the fragments of mica which appear to form the ordinary keepsakes of unscientific visitors. It is a most frail and delicate plant, seemingly altogether unsuited to the dangerous pre-eminence which it seeks, yet it loves the bare unsheltered mountain peaks, and when it occurs in the more sheltered ravines, has only its stems a little longer and more slender. It occurs on the Adirondack Mountains and on Katahdin, where—if I may judge from specimens kindly sent to me by Mr. Goodale—it attains to smaller dimensions than on Mount Washington, on the Katskills, and at one place on the sea coast of Maine. I have not seen it in Nova Scotia, but it ranges north to Greenland.

Another of the truly arctic plants is the alpine azalea (*Loiseleuria procumbens*), a densely tufted mountain shrub, with hard glossy leaves, that look as if constructed to brave extremest hardships. It is found on the mountains of Norway, at the height of 3550 feet on the Scottish Hills according to Watson, and according to Fuchs at the height of 7000 feet in the milder climate of the Venetian Alps. In America it is found in Newfoundland, in Labrador, and in the barren grounds from lat. 65° to the extreme arctic islands. Gray does not mention its occurrence elsewhere in the United States than the summits of the White Mountains. A member of the same family of the heaths, the yew-leaved phyllodoce (*P. taxifolia*), presents a still more singular distribution. It is found on all the higher mountains of New England and New York, and occurs also on the mountains of Scotland and Scandinavia, but its only known station in northern

America is, according to Hooker, in Labrador. As many as nine or ten of the alpine plants of the White Mountains belong to the order *Ericaceæ*. Another example from this order is *Rhododendron Lapponicum*, a northern European species, as its name indicates, and scattered over all the high mountains of New England and New York, occurring also in Labrador, on the arctic sea coasts, and the northern part of the Rocky Mountains.

It would be tedious to refer in detail to more of these plants, but I must notice two herbaceous species belonging to different families, but resembling each other in size and habit—the alpine epilobium (*E. alpinum* or *alsinefolium*), and the alpine speedwell (*Veronica alpina*). Both are in the United States confined to the highest mountain tops. Both occur as alpine northern plants in Europe, being found on the Alps, on the Scottish Highlands, and in Scandinavia. Both are found in Labrador, and on the Rocky Mountains, and the *Veronica* extends as far as Greenland. The alpine epilobium is one of the few White Mountain plants that have attained the bad eminence of being regarded as doubtful species. Gray notes as the typical form, that with obtuse and nearly entire leaves, and as a variety, that with acute and slightly toothed leaves, which some other botanists seem to regard as distinct specifically. Thus we find that this little plant has been induced to assume a suspicious degree of variability; yet it is strange that both species or varieties are found growing together, as if the little peculiarities in the form of the leaves were matters of indifference, and not induced by any dire necessities in the struggle for life. Facts of this kind are curious, and not easily explained under the supposition either of specific unity or diversity. For why should this plant vary without necessity, and why should two species so much alike be created for the same locality. Perhaps these two species or varieties, wandering from far distant points of origin, have met here fortuitously, while the lines of migration have been cut off by geological changes, and yet the points of difference are too constant to be removed even after the reason for them has disappeared. If this could be proved, it would afford a strong reason for believing the existence of a real specific diversity in these plants.

I have said nothing of the grasses and sedges of these mountains; but one of them deserves a special notice. It is the alpine herd's grass (*Phleum alpinum*), a humble relation of our common herd's grass. This plant not only occurs on the White Mountains, in arctic America, and on the hills of Scotland and Scandinavia, but has been found on the Mexican Cordillera, and at the Straits of Magellan. The seeds of this grass may perhaps be specially suited for transportation by water as well as by land. It is observed in Nova Scotia that when the wide flats of mud deposited by the tides of the Bay of Fundy, are dyked in from the sea, they soon become covered with grasses and carices, the seeds of which are supposed to be washed down by streams and mingled with the marine silt; and fragments of grasses abound in the post-tertiary clays of the Ottawa.

It seems almost ridiculous thus to connect the persistence of the form of a little plant with the subsidence and elevation of whole continents, and the lapse of enormous periods of time. Yet the power which preserves unchanged from generation to generation the humblest animal or plant, is the same with that which causes the permanence of the great laws of physical nature, and the continued revolutions of the earth and all its companion spheres. A little leaf entombed ages on ages ago in the Post-pliocene clays of Canada, preserves in all its minutest features the precise type of that of the same species as it now lives, after all the prodigious geological changes that have intervened. An arctic and alpine plant that has survived all these changes, maintains in its now isolated and far removed stations, all its specific characters unchanged. The flora of a mountain top is precisely what it must have been when it was an island in the glacial seas. These facts relate not to hard crystalline rocks that remain unaltered from age to age, but to little delicate organisms that have many thousands of times died and been renewed in the lapse of time. They show us that what we call a species represents a decision of the unchanging creative will, and that the group of qualities which constitutes our idea of the species, goes on from generation to generation animating new organisms constructed out of different particles of matter. The individual dies but the species lives, and will live until the Power that has decreed its creation shall have decreed its extinction; or until in the slow process of physical change depending on another section of His laws, it shall have been excluded from the possibility of existence anywhere on the surface of the earth.

While the huge ribs of mother earth that project into mountain summits, and the grand and majestic movement of the creative processes by which they have been formed, speak to us of the majesty of Him to whom the sea belongs, and whose hand formed the dry land, the continuance of these little plants preaches the same lessons of humble faith in the divine promises and laws, which our Lord drew from the lilies of the field.

It is suggestive in connection with the antiquity and migrations of these plants, to consider the differences in this respect of some closely allied species of the same genera. Of the blueberries that grow on the White Mountains, one species, *Vaccinium uliginosum*, is found at Behring's Straits and in northern Europe. *V. cæspitosum* has a wide northern range in America, but is not European. *V. Pennsylvanicum* and *V. Canadense* from their geographical distribution do not seem to belong to the arctic flora at all, but to be of more southern origin. The two bearberries (*Arctostaphylos uva-ursi* and *alpina*), occur together on the White Hills, and on the Scottish and Scandinavian mountains, but the former is a plant of much wider and more southern distribution in America than the latter. Two of the dwarf willows of the White Mountains (*Salix repens* and *S. herbacea*), are European as well as American, but *S. uva-ursi* seems to be confined to America. *Rubus triflorus*, the dwarf raspberry, and *R. Chamæmorus*, the cloud-berry, climb about equally high on Mount Washington, but the former is exclusively American and ranges pretty far southward, while the latter extends no farther south than the northern coast of Maine, and is distributed all around the arctic regions of the Old and New Worlds. It is to be observed, however, that the former can thrive on rich and calcareous soils, while the latter loves those that are barren and granitic; but it is nevetheless probable that *R. triflorus* belongs to a later and more local flora. Similar reasons would induce the belief that the American dwarf cornel or pigeon-berry, (*Cornus Canadensis*), whose distribution is solely American and not properly arctic, is of later origin than the *C. Suecica*, which occurs in northern America locally, and is extensively distributed in northern Europe.

I can but glance at such points as these; but they raise great questions which are to be worked out, not merely by the patient collection of facts, but by a style of scientific thought very much above those which on the one hand escape such problems by the supposition of multiplied centres of creation, or on the other, render their solution worthless by confounding races due to external disturbing causes with species originally distinct. Difficulties of various kinds are easily evaded by either of these extreme views; but with the fact before him of specific diversity and its manifestly long continuance on the one hand, and the remarkable migrations of some species on the other, the true naturalist must be content to work out the problems presented to him with the data afforded by the actual observation of nature, following carefully the threads of guidance thus indicated, not rudely breaking them by too hasty generalisations.

ARTICLE VII.—*On the failure of the Apple Tree in the neighbourhood of Montreal.*—A communication to the Committee of the Natural History Society of Montreal. By JOHN ARCHBOLD.

The failure of the apple trees in the neighbourhood of Montreal, and I believe in all the Island, is a sad calamity as regards domestic luxury, as well as in a commercial point of view. I have seen Montreal, in its palmy days of apple-growing, export its thousands of barrels of Pommes Grises, Bourassas, and Fameuses. These were the principal sorts sent to Europe, the refuse of which, as well as the great quantities of wild apples, that is apples from seedlings, always found a ready market at Quebec and the ports below it, at remunerative prices. With these facts clearly before us, it is not to be wondered at that strict enquiry should be made by all who feel the least interest in the culture of the apple, as to the cause of its decay. I have been a resident in Montreal since 1832, and for the last twenty-five years have lived on the south-eastern slope of the Mountain, on the Cote St. Antoine road, and have acted in the capacity of gardener at Mount Pleasant, the then residence of the late Joseph Savage, Esq.; also at Rosemount, the residence of the Hon. John Young, and subsequently at Forden, the residence of Capt. R. T. Raynes, and of the late Charles Bowman, Esq.; one of the most zealous friends and supporters of Horticulture, in his day, that Montreal could boast of. All these places were noted for the production of fine varieties of the apple, the pear, and the plum. The latter place, Forden, in particular, used to yield about fifteen years ago, from 1000 to 1500 lbs. of fruit, but the last three years have made sad havoc with the trees, and unless some reaction in the growth takes place, there will not be one of the old trees living three years hence. I noticed the decline of some sorts of the apple twenty years ago. I had a talk with the late Henry Corse, Esq., about that time, on the failure of the Early Harvest apple, and he was under the impression that it was then extinct about Montreal, but I convinced him that it was not, for in each of the above mentioned places, I had seen trees of the Early Harvest which gave from three to four barrels of good apples, but these few trees are, I have every reason to believe, now gone. There were also the Ribston Pippin, (much on the decline these last ten years,) the Keswick Codlin, Hawthornden, Grant's Major, John Richardson; but these and some others, I always looked upon as being tender, from the softness of their wood, which is not nearly so hard as that of the Bourassa, Pomme Grise, and Fameuse, and therefore do not wonder at their destruction. These latter sorts have, however, for the last ten years, been declining in the vigour of their growth, and the size of their fruit. I was for some time under the impression from what I could learn from some gardeners, and other cultivators of fruit, that the above named three sorts of apples, would not bear fruit in any other locality than in the Island of Montreal, but that impression was completely removed, by visiting the Provincial Exhibition held at Brantford, C. W., some years ago. I saw there as fine specimens of the Bourassa, as Montreal could produce in its best days. At Hamilton I also visited some of the gardens, and there to my surprise, I found the Pomme Grise, Fameuse, and Ribston Pippin, growing side by side, and loaded with fine fruit, with not the slightest appearance of decay. These remarks, however, are by the way; the point of discussion, at present, is the cause of the decay in the apple trees in the vicinity of Montreal. There will no doubt be a great many opinions put forth on the subject, and some light will I hope be thus thrown on both the cause and the cure. Were the decay confined to one place, one kind of soil, or one mode of pruning or culture, there would be less difficulty in discovering both the cause and cure; but when we find the decay, in one fell swoop, taking off the whole of the young orchards that have been planted within these fifteen or twenty years past, and that even the old *savage*, as the Canadians call it, that has stood the severity of the winters for the last fifty years, is suffering the same fate, the difficulty of giving an opinion is all the greater. When also it is observed that apple trees both in the most sheltered nooks and on the bleakest exposures, on the best alluvial soil, and on the gravelly and limestone rock, all alike share the same fate, the necessity of careful consideration is much increased. I noticed in several of the apple trees, after the severity of the winter three years ago, that many of the large limbs became disordered by their cellular tissues not admitting that uniform and free flow of sap to the outer extremities of the branches, which was necessary for healthy growth. The consequence was, that there remained in the trunk an overflow of sap, and some very severe freezing nights coming at the time, the sap froze, and caused the outer bark to burst; the trunk soon after presenting a black and decaying appearance. This is one of the causes to which I attribute the decay.

I have also observed in gardens and orchards, at a season when the trees are in full vigour of flower and foliage, that they have been completely denuded of their leaves by the ravages of the caterpillar. Thus being left bare to the influence of a June sun, their health and vigour were seriously impaired. I have observed that trees which suffered so, for two years in succession, hardly ever recovered from the effects of it; this is one other cause to which I attribute the decay of the apple. To avoid injury to the trees, care should be taken as to the time of pruning. When this is done in the beginning of March, or, as is sometimes the case, before that time, and wounds are left bare, without any cover or protection, the influence of a hot sun by day, and hard frost by night, is such, that these wounds emit a portion of the sap, and cause the parts affected to become black, a sure forerunner of decay. In my humble opinion, that work should be deferred till later in the season. My reason for forming this opinion is, that I have observed in my practice of budding, which commences about the middle of July for stone fruits, and continues all through August for the pear and the apple; that having to cut and prune the stocks to a considerable extent, I always found the wounds, at that season, to heal up very quickly, and leave no trace of black, such as might be seen in early spring pruning. Another cause of decay, seems to me to be some kind of atmospheric agency, for I have frequently noticed a portion of the branches of apple trees becoming black in parts where there were no wounds. Sometimes at the junction of the lateral branches with the main branch, and sometimes near the outer extremity of the branch. Some persons attribute the appearance to lightning, but that appears to me rather doubtful, for although thunder and lightning are common in the summer months, in Canada, I never noticed any parts of apple trees to be blackened to the extent they now are, until these last four years past. There might, indeed, occasionally have been symptoms of decay in some trees, and in certain localities, but the cause in such cases was easily accounted for. This commonly occurred when trees were planted in hard blue sub-soil, saturated with water at all seasons of the year, without the least attention being paid to drainage. On consulting any of the British authors who have written on the culture of the apple, they will all be found to agree that the soil should undergo a thorough preparation, previous to planting, and that it should be trenched at least to the depth of two feet. If such preparation is an essential in such a mild climate as Great Britain, it is much more so in Canada, where we have frequently such a long continuance of drought in the summer, and severe frost in the winter. I have often been struck with the short life of the apple trees about Montreal. There was an impression made on my mind, in early life, that the apple was a long lived tree. I have known apple trees in the west of Ireland, in the neighborhood of the town of Sligo, to attain the age of 150 years, and then to be bearing good crops of apples. I also find that A. J. Downing, one of the most reliable and best American authors, in writing on the age of the apple, says he saw in Rhode Island, two trees 130 years old. He however reckons our fine garden sorts to live only from 50 to 80 years. Now, I question if we could find about Montreal, any of our fine garden sorts half that age, that is 40 years old. He also strongly recommends trenching the soil, and says it adds greatly to the long life of the trees. I must confess that I have not seen that proper attention paid to fruit trees in the neighborhood of Montreal which they require. I have seen, in many cases, trees planted on the green sward, without any other preparation than simply making a hole and putting in the tree; leaving it afterwards to take care of itself. In such cases the result may be easily conjectured. In taking up numbers of both pear and apple trees, the heads of which were dead, I have found that their roots were generally perfectly sound, not showing the least symptom of decay below the surface. The cause of decay does not therefore lie with the root.

The question often occurs to me, shall we ever see Montreal producing the fine fruits that it did twenty-five years ago? The markets were then filled to overflowing with the finest varieties of the plum and the pear, and a pretty good quantity of the peach and apricot, of open wall culture. Now there is no such thing to be found as a good Bon-chretien pear, or an Autumn Bergamot, or a Burmese Spruce, or yet a luscious Bolman's Washington plum, or a Greengage, or even a coarse Magnum Bonum; and but seldom will you find a good basket of the common wild red plum of the country. I have also noticed a decline in the vigour and growth of several other plants, these last few years past, in comparison with what might have been seen twenty years ago. Then I saw the gardens about Montreal produce enormous crops of melons, with very little care or attention; now it is uncertain if you get a good crop with all the care you can give them. I have also seen good crops of grapes raised in the gardens, and have myself raised at Mount Pleasant, good crops of the Sweet Water and Black Cluster in good condition, in the open ground. Then there was no such thing as the mildew, or the nip, as it is now; nor was that troublesome pest, the curculio, known about Montreal. Yet with all these facts before us, it will not do to be idle lookers on; better to be up and doing. I would suggest that any man possessed of land, whether little or much, should plant trees according to his means, and let what is planted, be planted in the best possible way, and under the best conditions of soil and culture. He may then hope for good results in time to come.

These few remarks, hastily penned, are respectfully submitted to the Montreal Natural History Society.

Forden, 6th January, 1862.

ARTICLE VIII.—*On an Erect Sigillaria and a Carpolite from Nova Scotia.* By J. W. DAWSON, LL.D., F.G.S.

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

The erect trees so frequent in the Joggins coast-section, though often distinctly ribbed, rarely show the minute markings of the leaf-scars in a sufficiently perfect state to enable them to be compared with those of the flattened trunks seen in the shales and ironstones. This, no doubt, arises in part from the circumstance that the bases of the trunks of *Sigillariæ* did not always retain their characteristic markings, and in part from the unfavourable influence of an erect position in coarse and often laminated sediment. The specimen, to which this note relates, and which I obtained in 1859 from a sandstone in Group XIV. of my section of the South Joggins*, affords an exception to the generally

* Quart. Journ. Geol. Soc. vol. x. r. 6.

imperfect condition of these trunks sufficiently remarkable to merit a short notice.

The specimen measures 3 feet in height, and is 10¼ inches in diameter at the base, 9 inches in the middle, and 7½ inches at the top, where it was abruptly broken off. (Fig. 1.) At the base it shows the usual tendency to divide into four main roots; but these have been nipped off or flattened by pressure, not having been filled with sediment. The trunk retains its form on one side, but on the other the bark has been rent from top to bottom, and in part folded inward. This seems to have been caused by the pressure

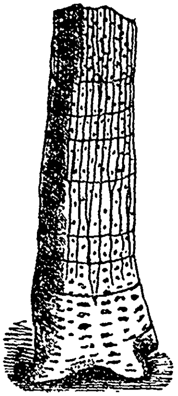


Fig. 1.

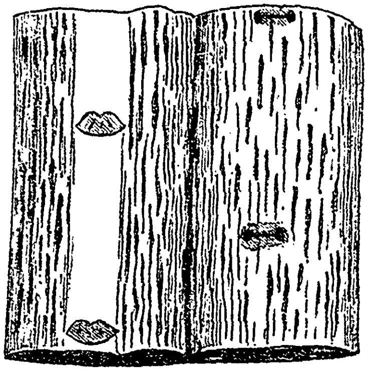


Fig. 2.

of the surrounding sediment, and has probably somewhat diminished the diameter of the stem. The interior of the trunk is filled with grey sandstone, similar to that of the enclosing bed. The outer bark, less than a line in thickness, is in the state of bituminous coal; and an internal cast with a thin coaly envelope represents the pith. This internal cast extends through the greater part of the length, but has fallen to one side. It is only half an inch in diameter. The coaly matter remaining on its surface shows, when prepared with nitric acid, cellular structure; and traces of transverse Sternbergian markings remain in parts of it, so that it must not be regarded as the *woody axis*, which has disappeared, but merely as the *pith-cylinder*.

The leaf-scars and other surface markings are preserved throughout the specimen, but only in a few places in sufficient perfection to show the more minute features of the former. At the upper part the ribs are very prominent, and there are twenty-six in the whole circumference, the breadth of each rib being about nine-tenths of an inch. On the outer or cortical surface each rib is flattened, or even concave, along the middle, and strongly rounded at the sides, descending into deep intercostal furrows; the flat mesial portion being smooth, the lateral portions marked with sharp vertical ridges, and in places with very delicate longitudinal and transverse striæ. The leaf-scars extend across the smooth middle portion of the rib, and are distant from each other one inch vertically. In form they resemble those of *Sigillaria transversalis*, *S. Defrancii*, and *S. Brochantii*, Brongt., being transversely lanceolate, emarginate above, with acute lateral edges. Those best diplayed show two vascular punctures, with a third mark or prominence between and rather below them. On the so-called ligneous surface, or that of the inner bark, the ribs are slightly furrowed or striated lengthwise; and the leaf-scars are represented by two deep punctures of the vascular scars. (Fig. 2.)

In tracing the ribs downward, some of them wedge out and disappear: so that at the middle of the length of the trunk there may be about 22; each with a breadth increased to one inch and four-tenths, and flatter than those at the top, with the intercostal furrow shallower. The leaf-scars are now widened transversely, aud have lost their minute markings on the cortical surface; while on the ligneous surface the vascular punctures are twice as far apart as at the top. About the middle the vertical distance of the scars diminishes somewhat suddenly to seven-tenths of an inch.

In the lower third of the stem the ribs are quite obliterated, and the whole surface is wrinkled with coarse waving striæ or small furrows, due apparently to the expansion of the outer bark. The leaf-scars still remain in regular vertical rows; but these are reduced to about twelve, and apparently at the base to as few as nine. The vertical distance of the scars is still about 0·7 inch; but the transverse distance between the centres of the rows is increased to 2·8 inches or more. In form the leaf-scars are now transverse furrows, an inch or more in length, and the vascular punctures are half an inch or more apart in each scar. *A single row* of these wider scars is shown in (Fig. 3.)

Of the roots I could obtain no specimens; but the markings on the bark at the base of the trunk are precisely similar to those on many Stigmarian roots found attached to less perfectly preserved stems, and a few stigmaroid areoles are perceptible on the lower surface of the stump.

The woody axis has entirely disappeard, nor does any mineral charcoal appear in the base of the cast. It has either been en-

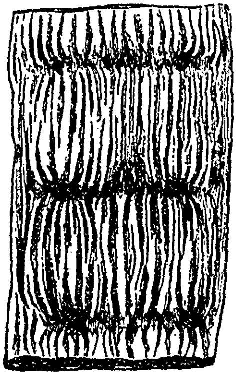


Fig. 3.

tirely removed by decay, or has been washed out by the waves before the hollow bark was filled up.

As this trunk appears to belong to a species not previously described, and we have a better knowledge of its parts and mode of growth than of those of most of the named species, I may propose for it a specific appellation, and would call it *Sigillaria Brownii*, in commemoration of the many interesting discoveries in relation to these plants made by my friend Richard Brown, Esq., of Sydney, Cape Breton.

The following are the most important points relating to *Sigillariæ* in general, illustrated by the specimen above-described :—1. The evidence of the exogenous growth of *Sigillaria*. The growth of the trunk took place, as I have elsewhere maintained,* by the introduction of new woody wedges in the axis and by additions to the surface of the axis and to the inner bark, after the manner of exogenous stems. When the present trunk had nine rows of scars it was only three inches in diameter, perhaps much less, and as it grew in height the base expanded in such a manner as to increase the distances between the scars and the distances between the vascular punctures in the scars, while new rows of leaves were added above until the number amounted to about 26. The same appearances in a species quite distinct from the present

* Quart. Journ. Geol. Soc. vol. x. p. 32.

are illustrated in my paper on the South Joggins section. Specimens which I have observed, however, as well as facts stated by Mr. Brown and by Brongniart, induce me to believe that in some species this mode of growth was so far modified that new ribs were introduced to the very base of the trunk. The expansion of the trunk was accompanied by the flattening out of the ribs, and also by the giving way of the thin outer bark, the inner or middle bark evidently remaining in a growing state to the base of the stem. 2. The decadence of the leaves from the lower part of the trunk in the living state, is proved by the condition of the scars. We may also note the shorter vertical distance of the scars on the lower part of the trunk, showing that, when young, the leaves were much more crowded than subsequently: and the absence of bands of deformed and crowded scars sometimes seen on *Sigillariæ**, probably connected with periods of fructification, and possibly occurring on the upper part of the trunk only. 3. The difficulty of comparing the characters of erect with those of prostrate *Sigillariæ;* the former usually showing only the base of the stem, the latter often only the upper part, and these differing so materially that they may be mistaken for distinct species. 4. The mode of growth illustrated by the specimen may apply only to a portion of the plants usually included in the genus. The species of *Sigillaria* found at the Joggins may amount to about twenty; and with reference merely to the habit of growth, without regard to the resemblances or differences in the leaf-scars, these may be arranged in three groups. The first will include the present species with *S. reniformis, S. alternans, S. organum,* and another (*S. ovalis,* mihi) with oval scars like those of *S. catenulata* but an inch apart vertically. These have broad and well-marked ribs, attain to a large size, and often occur erect. Other species with narrow and less distinct ribs and more or less crowded scars, as *S. elegans, S. Knorrii, S. scutellata, S. Saullii,* &c., do not appear to have attained to so great diameter, and are more rarely seen erect. In some of these species the markings and leaf-scars seem to be more perfectly preserved to the very base of the trunk than in the species before mentioned. A third group consists of species like *S. Defrancii, S. Menardii,* &c., which are destitute of ribs and have the scars arranged spirally. Some of these were of considerable diameter, others quite small; but they are rare, and I have not recognized them in the erect position.

* Ibid. vol. xv. p. 640.

5. In connection with the absence of the usual remains of wood as mineral charcoal from this trunk, it may be stated that the bast-like tissue of the inner bark of *Sigillariæ* is abundant in some of the coal of the Joggins; whilst the discigerous tissue* is prevalent in the great Pictou coal-seam. In the former case the decomposition of the vegetable matter was probably subaërial, or like that of a forest-soil; whilst the conditions of the latter were those of peaty bogs.

CARPOLITE *from the* COAL-FORMATION *of* CAPE BRETON.

ALL the best authorities on coal-plants are disposed to refer the seeds or fruits known by the generic names *Trigonocarpum* and *Rhabdocarpus* to phænogams, and probably to gymnosperms. In this case they may have belonged to *Coniferæ* or *Sigillariæ*, or to both. That they belonged in great part to the latter is, I think, rendered probable by their occurrence very abundantly in the middle part of the coal-measures where *Sigillariæ* abound, by their various forms corresponding rather to the many species of *Sigillariæ* than to the few of Conifers, and by their abundant occurrence in the interior of hollow stumps of *Sigillariæ* and in the surrounding beds. Still these fruits or seeds may have belonged to very different plants; and as an example of the type of structure most frequently associated with *Sigillariæ*, I have prepared a short notice of a species of which very well-preserved specimens exist in my collection, and to which I have assigned the name of

TRIGONOCARPUM HOOKERI.

Numerous specimens of this species occur in a thin calcareous layer in the coal-measures near Port Hood, Cape Breton. They are not compressed, and are fossilized by calc-spar and iron-pyrites. Their form is ovate,—the length being 0·3 inch, and the breadth 0·2 inch. The external surface is rough and destitute of distinct markings. Internally they present the following structures:—1. An outer coat (*testa*), which is thick, carbonaceous, and apparently of a dense cellular structure. This corresponds to the outer supposed "fleshy coat" of Lindley and Hooker; but in this species I think it must have been firm and hard, like the outer coat of the seeds of pines, which it much resembles in appearance and structure. 2. An inner coat (*tegmen* or *embryo-sac*)

* Ibid. vol. xii. p. 631.

which is thin and marked on its outer surface with interrupted ridges, almost precisely in the manner of the corresponding coat in the seed of *Pinus pinea.* This coat is often pyritised, and in

Figs. 1 to 5.—Trigonocarpum Hookeri, *Dawson; from the Coal-measures of Cape Breton.*

Fig. 1.

Fig. 2.

Fig. 3.

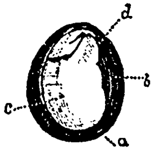


Fig. 5.

Fig. 4.

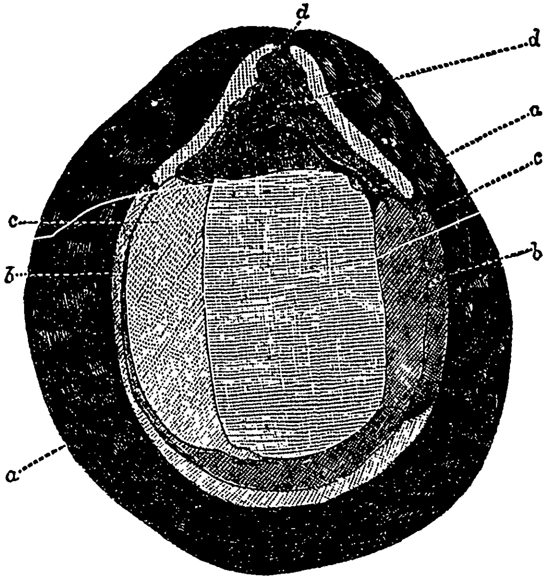


Fig. 1. Perfect specimen, natural size.
Fig. 2. Specimen deprived of its outer coating.
Fig. 3. Broken specimen magnified.
Fig. 4. Section magnified: *a*, the testa; *b*, the tegmen; *c*, the nucleus, and *d*, the embryo.
Fig. 5. Portion of the surface of the inner coat more highly magnified.

some specimens it presents toward the smaller end indications of three ridges. It corresponds, no doubt, to the outer coat of the ordinary *Trigonocarpa.* 3. A nucleus occupying the whole interior of the last-mentioned coat, and exhibiting at the smaller end certain wrinkles and a projecting tubercle, marking the position of the embryo and micropyle. When the seed is sliced longitudinally, the nucleus is seen to present an outer thick layer of calc-spar, stained by vegetable matter, and an inner mass which is colourless. In the smaller end, toward the micropyle, the remains of the embryo and its suspensor are seen replaced by iron-pyrites, in the manner represented in fig. 3. In some specimens the outer coat appears as if divided into two layers, and the nucleus has shrunk inwards from the inner coat, presenting two additional surfaces, which may represent original lines of structure, but are perhaps, results of decay.

A very similar species, which occurs in vast abundance in the interior of an erect *Sigillaria* at the Joggins, has the outer coating very dense and coaly, and with a transverse fibrous structure. In some specimens it shows a projecting ridge on each side, and longitudinal striæ, which might entitle it to be placed in the genus *Rhabdocarpus;* but no coal-fossils are more deceptive than these carpolites, which, when flattened or deprived of their outer coats, present appearances very dissimilar from those of the perfect condition.

I am by no means certain that this note adds much to the knowledge already possessed of the structure of *Trigonocarpum;* but it affords an additional example, and this of a species similar to those most frequently associated with remains of *Sigillariæ.*

ARTICLE IX.—*On the Primitive Formations in Norway and in Canada, and their Mineral Wealth.* By THOMAS MACFARLANE.

(*Continued from page* 20.)

II. THE PRIMITIVE SLATE FORMATION.

A: *The Quartzose Group.*

The district in which the above-named group of rocks is principally developed is that of Tellemarken, in the south of Norway, celebrated by tourists as containing perhaps the most wild and picturesque scenery in the north of Europe. There exist also northward from Trondhjem, some districts, where the same group seems to prevail, but these cannot be compared with that of Tellemarken, either in extent or economic importance; nor have they been studied or described so minutely.* Naumann entitled this district, the Nummedal and Tellemarken Quartz Formation; Keilhau described it as the Goustafjeld Region, from the mountain which is its most distinguished topographical feature; while Dahll somewhat indefinitely calls it the Tellemarken Slate Formation.

The rocks which constitute this group are the following:

1. *Quartzite or quartz slate.* This, the most widely distributed rock of the group, occurs in the most multifarious varieties. Pure quartz, with a granular structure and glassy lustre, of considerable transparency, and of a white or greyish-white colour, is to be found in beds of great thickness. Fine-grained quartz, with a fatty lustre, and rose-red or flesh-red in color, is also observed in equally powerful beds. The most common varieties are however the splintery, grey, and slightly micaceous quartzites, which are known as quartz slates. Amongst the more impure varieties, talcose, feldspathic, and hornblendic quartzites are to be distinguished.

2. *Mica schist,* differing considerably in general character from that which occurs in the Primitive Gneiss Formation. The broad-leaved very micaceous variety, with garnets, which is common in that formation, has not been observed at all in this quartzose series. In the constitution of the mica schist belonging to the latter, quartz greatly preponderates, and the rock differs from quartz slate, only in containing a somewhat larger quantity of silver-white or brownish-black mica.

3. *Gneiss* may be also said to occur in this group, but of a character widely different from what is usually understood by this term. It is finer grained and less slaty than the characteristic primitive gneiss, while the feldspar and quartz, and especially the latter, greatly preponderate in quantity over the mica. This latter mineral, which plays such an important part in the composition of ordinary gneiss, is very little developed, and hornblende is never found replacing it; so that nothing resembling hornblendic gneiss is found in this group.

4. *Hornstone and hornstone porphyry,* passing into jasper, often occur, and seem to consist of the same minerals, and in the same proportions, as the two last named rocks, but so fine grained that the species are no longer recognizable. The mica schist is seen

* According to Keilhau, the district in West Finmark and Quænanger, in which the Alten Copper Mines occur, belongs to this group. It is probable also, that another district to the east of the North Cape is of the same formation.

in some places to pass into a grey, coarse, splintery, quartzose hornstone; while the gneiss gives a red or brown hornstone, with fine splintery, and nearly smooth fractures.

5. *Hornblende slate.*
6. *Talc slate.*
7. *Chlorite slate.*
8. *Clay slate.*
9. *Limestone* has only been remarked at one place in the whole group, where a thin bed of granular yellowish-white limestone, occurs in the quartzose gneïss.
10. *Greenstone and diorite,* composed principally of albite and hornblende, occur in large and important masses.
11. *Granite* does not seem to occur interstratified with the members of this group, but frequently intersects them in the form of veins, and also forms irregular masses.
12. *Conglomerates and breccias* occur in such quantity, and of such peculiar characters, as to constitute a distinguishing feature of the formation. The whole of the rocks already named as forming part of this group, but especially the quartzites, often contain beds or irregular masses, having the aspect of conglomerates; which are made up of fragments of the respectively enclosing rocks, cemented together either by a micaceous or talcose substance. The fragments are more or less rounded, and often of oblong forms; they generally lie parallel with each other, but very often bear little resemblance to boulders.

The rocks just enumerated, form layers, often of enormous thickness,which alternate with each other, forming parallel groups, in which one or the other of them (generally the quartz), predominates. The fine and coarse grained greenstones or diorites of the formation, are most generally in layers running parallel with the other rocks. They sometimes however occur as veins cutting these, and more frequently as irregular masses. The greenstone beds are often of great extent, and pass through gradual transitions into the neighboring rocks. A layer of diorite occurs in the parish of Skafse, having a thickness of 1000 feet. In the middle it is granular, but towards each side, it gradually assumes a slaty texture. It has also been remarked of other greenstone layers in the group, that they assume a slaty structure, as they approach the rocks above or below them. Keilhau has the following remarks with regard to the extent which these greenstone or diorite rocks occupy in the series before us. " We may obtain a good idea of the extent to which this member of the group is developed, from the district west of Bandag Lake. On the road to Mo church, we are surrounded by rugged mountains about 2500 feet high, and these from the bottom of the valley to their summits, consist of the same mass of diorite, which has here a breadth of about two geographical miles."

The conglomerates, of which mention has already been made, have such an important bearing on the question of the origin of the primitive slate formation, that I may be excused for inserting here, at length, a translation of Keilhau's description of them. These conglomerates have been observed: 1. above Hjærdal church; 2. on the road from Fladdal to Manddal; and, 3. on the road from Guldnæs to Berge, in Morgedal. "The first locality in which the conglomerate quartzites occur in repeated alternations with hornblende rock (diorite), has been described by Naumann (Beitrage I, 79). The quartz layers there consist of what often appears to be a very fine-grained micaceous sandstone; in which harder round or oval concretions, sometimes feldspathic, sometimes quartzose, and sometimes of still more varied natures, are imbedded. The softer cementing matter is frequently worn away, so that the harder masses stand out from the rock, like hemispheres. The smaller and more varied in their nature these concretions (which appear formed exactly like boulders) are, the more talcose the enclosing mass becomes; whereby the slaty texture of the quarzite becomes undulating and confused."

The second of the above mentioned localities is on the Mandœla, a short distance before it falls into the Sillegjord. The bluish-grey, very pure and crystalline quartzite which here occurs, is for a considerable distance around, apparently unstratified, and cannot strictly be defined as quartz-slate. It forms powerful masses, in the midst of which large and indistinctly limited portions, are more or less thickly impregnated with small rounded portions of quartz of the most different shades of color, from white to red and dark-grey. Some of these are quartz, others jasper, while others resemble hornstone; but all of them, even those which most closely resemble their quartzose matrix, are sharply defined, and appear like pebbles cemented into it. The fact that these portions are not arranged as separate layers, but spread out as irregular areas, in the massive and crystalline quartz, is to be regarded as unfavorable to the opinion of the mechanical origin of these conglomerates." "At the third of the above mentioned localities, the conglomerate is also enveloped in a large group of quartzite, which contains besides, only a few isolated masses of greenstone. The perfectly boulder-like concretions of the conglomerate bed, which range from the size of a hazelnut, to that of the human head, are here of the same sort of greyish-white splintery quartz, which forms the strata of the whole surrounding group. A few of them only are reddish, and remind one of the jasper-like masses which appear to be generally associated with these conglomerate quartzites. At the Hjærdal locality, already described, Naumann found whole layers of jasper, close to the conglomerate. The cementing material of the conglomerate betwixt Guldnæs and Berge is argillaceous, and small in amount; and is certainly to be regarded as analogous to the small beds of clay slate, which occur as regular layers between the thick quartz strata, at other points in this neighborhood. Although the foliation of the pure quartzite is retained in the conglomerate, which is many fathoms thick, this nevertheless, like that below Manddal, does not appear to occupy any well-defined horizon in the stratification. In place of forming a continuous zone along the strike, it appears rather to be a comparatively short and irregular mass.

Occurrences of this sort, which may be regarded as belonging at once to the quartz and to the mica schist, are found to a considerable extent on the northwest of Sillegjord Lake. Here, on the boundary of the primitive gneiss formation, at several points where the quartzite begins to replace the mica-schist, we find layers in which the quartz occurs in the shape of long cylinders as thick as the finger, and rounded off at both ends, as elongated almond-shaped masses; or in the form of boulders, imbedded in a cement of mica schist.

Some time since, Naumann directed attention to the fact that the amount of talc contained in the cement is greater, the more the conglomerate is varied in its composition. I have often confirmed this, and have moreover remarked that the talc seems to stand in some intimate connection with these problematical rocks. This may be the reason why they have nowhere been found more frequently than on the road between Berge in Brunkeberg, and Qvale in Höidalsmo; where the quartz beds are associated with other rocks, and especially with those of a talcose nature. The most remarkable conglomerate of this district, as well on account of its composition, as its thickness, is splendidly exposed in a narrow ravine called Ormebrækjuvet, which cuts across the conglomerate, inclined at an angle of 70°. A road and a rivulet here pass through the ravine, and the rocks are seen in profile on both sides. In a coarse mass of quartzose talc-slate, sometimes more or less micaceous or argillaceous, different varieties of quartz are imbedded; which have the form of small boulders, or are elongated in the direction of the stratification. Besides these, there may be remarked in the slate, a multitude of red and very fine-grained feldspathic concretions, which betray here and there a gneissoid nature, caused by dark mica-like streaks. These feldspathic concretions are the more remarkable, since hitherto, no rock far or near, has been discovered bearing the slightest resemblance to them, although their oval form, in some parts, and the fact that they are sometimes bent in the direction of the undulations of the surrounding mass of slate, would favor the view that they are pebbles from an older rock. They become still more remarkable when we observe them repeated at very distant points. Exactly similar gneissoid concretions with those of Tellemarken, of which we here speak, have been remarked in the conglomerate rocks of North Trondhjems Amt. The boulder-like fragments in the rock of Ormebrækjuvet, attain the size of a closed fist, and lie usually so near to each other, that they constitute the greater part of the whole rock. Eastward from Holvig, towards Vaæ, down in Vestfjorddalen, conglomerate talcose rocks also are found. Here, in a talcose slate, a layer was observed including larger and smaller kernels of quartz, sometimes almond-shaped, at other times more irregular; and one part, apparently segregations from the slate itself. The foliated portions of the rock are bent and rolled around these masses. On the weathered surfaces of the rock, these irregular, and, as it were, imbedded portions, have a lighter color than the surrounding mass. There is probably some feldspar present in these, as well as in the gneissoid concretions already mentioned, and their lighter colour may be due to kaolin from its decomposition. Southward from Holvig, a layer of similar rock occurs, which belongs to the clay slate."

"Conglomerates which belong to the chloritic rocks in this district, are found at various places in the upper part of Vestfjorddalen, in the neighborhood of the cataract Rjukanfoss. From Vaæ, over and beyond Maristigen, a hard chloritic slate predominates; which appears often as if it had been torn in pieces, and then joined together again, and which contains other very curious aggregations. There may be observed masses like serpentine, portions of greenstone, &c., combined in the most varied manner with the slate; while many phenomena render this place suitable for a more minute study of these conglomerates."

"Farther on, at several points in the neighbourhood of Aamdal, it may be observed that the mica schist contains concretions having the appearance of imbedded *fragments*, and with an aspect, from which one must believe that it has once been broken up, and its pieces afterwards irregularly joined together. For example, there is exposed between Aamdal Copper-work and Skafse church, a large area of this character. The rock is a fine slaty quartzose mica schist, which, as if by an internal breaking-up, has acquired a well marked brecciated structure. Only a few of the recemented pieces have rounded angles, the most of them being sharp-cornered. The whole rock, but especially the fragments, contain some feldspar. I will mention one other instance, from which it appears that hornblende schist may also sometimes contain fragments of foreign masses. This is the case on Skafseberg, over which the road leads from Mo to Skafse church. Here the concretions are again feldspathic, and even gneissoid, but most of them resemble rather the rudiments of small bent layers or beds, than fragments cemented into the hornblende schist."*

As before remarked, the quartzites or rocks allied to them, such as the quartzose mica schists and gneiss, constitute by far the greatest portion of the group. Next in frequency and extent, the greenstones or diorites may be placed; after these the hornblende, talc, and chlorite schists, and the clay-slates; and lastly, the conglomerates.

Foldings of the strata in the quartzose group, have been observed in various places, but they do not approach, in intricacy, to the contortions of the gneiss formation. The strata are seldom found horizontal, and generally have a dip of more than 45°; although they do not seem, generally, to be so near to the vertical as those of the gneiss formation. The direction of the strike varies much more than in the latter, but parallel groups have been traced upwards of eight geographical miles, on the strike. In some places, an approach to a regular succession of the rocks has been observed, but the particulars related are by no means conclusive.

As before mentioned, the scenery of this district is of the most

* Geæ Norvegica, I. 430.

wild and rugged nature. The Fjelds, consisting of quartz rock, sometimes present massive peaks, rising in the shape of terraces one above the other; which latter form is caused by the outcrops of the highly inclined quartz beds. Goustafjeld itself, is a huge peak, rising to the height of 7000 feet, and presenting from a distance, a peculiar furrowed appearance, the cause of which is thus explained by Keilhau:—"The upper part of Goustafjeld is formed of two varieties of quartzite, one of which is the preponderating, and the other the subordinate constituent. The former belongs to the purer varieties of the quartzite, and resists decomposition. In the latter, which easily disintegrates to a coarse sand, particles of feldspar are more or less abundantly disseminated. From that part of the mountain where these rocks are found *in situ*, which is about 300 feet perpendicularly beneath the sharp ridge forming the summit, going upwards, there is observable only a succession of very regular beds, having a dip of from 20° to 30°. The mountain is here so sharply peaked, that the beds crop out, as well on the side of the direction of the dip, as on the opposite side. If now the relations of the rocks were as usual, the feldspathic quartzite would be found to form more or less isolated layers, between the strata of the preponderating rock; but in place of this, the feldspathic quartzite extends in an entirely opposite direction through the mass of the prevailing rock. It goes right across the strata, and that without in the least (like veins) interrupting the continuity of the several beds, because these otherwise different rocks, at their junction, run into each other, the pure quartz gradually becoming feldspathic. The consequence of this remarkable relation is very striking. On account of the feldspathic quartzite being so easily disintegrated, and the pure variety, on the other hand, resisting so well, there are produced, where the former crops out, cuts on the ridge, and furrows on the sides of the mountain. On account of the height of the mountain (7000 feet), these furrows remain filled with snow throughout the whole year, and are recognisable from a great distance. Thus Goustafjeld preserves the marked features which distinguish this surprisingly furrowed peak, for those who view it from the heights of Hallingdal or Hadeland."

"It is a characteristic trait of this group, as well as of the other sections of the country, analogous with it in geological character, and worthy a mention at the outset, that it is especially well supplied with copper ores."* This great prevalence of cop-

* Geæ Norvegica I, 441.

per ores has given rise, since the beginning of the 16th century, to the establishment of six different copper works or mining establishments; all of which however, with but one exception, that of Aamdal, are abandoned. In describing the various mineral 'deposits, I shall only refer to those of most importance, neglecting altogether the innumerable localities of less value. The mines about to be described are those belonging to the copper works of Guldnæs, Aamdal, Hvideseid, Sauland and Hovindbygden.

The deposit on which the Guldnæs mines occur, is probably the most important of the whole district. It is situated on the southwest side of Sundsbarm Lake, in the parish of Sillegjord, at least 1500 feet above the sea, and inaccessible, unless to the foot traveller. It has the form of a layer, and lies between a bed of quartzite, and one of clay slate. It has a length of about 100 fathoms, and a breadth of about 100 feet, and is composed of a flesh-red and sometimes greenish-white aggregation of quartz, feldspar and talc; in which purple copper and copper pyrites are more or less abundantly disseminated. The ore is found in irregular nests and veins, quartz accompanying it in the latter. These irregular bunches of ore are frequently found in such quantity, as to render the whole mass of the layer worthy of excavation. There is not much of the rock with finely disseminated mineral, and the ore is much more suited for being dressed by means of crushing and jigging, than by stamping and washing. The latter processes were nevertheless those employed when the mines were being worked, and this may partially account for the unsuccessful result. The copper ores occurring here are argentiferous; the metallic copper resulting from their treatment, containing one per cent. of silver.

The mines belonging to the Aamdal copper works are very numerous; the most important of them being Hoffnung mine, Næsmark mine and Mosnap mine. The works themselves, are situated 1300 feet above the sea, on the river called Værkselven, in the parish of Skafse; which is subordinate to that of Mo. Hoffnung mine lies about 150 feet higher, near the junction of a gneissoid granite, of eruptive origin, with the primitive slates. The two lodes containing the ore, occur on both sides of a layer of hornblende schist; which varies from two to six feet in thickness, and has a fall of from 50° to 60° to the W.N.W. They run parallel with the strata, and the lode underlying the hornblende schist is the most important. It has a thickness of from four to thirty inches; the vein-stone is quartz, and is well filled with copper pyrites, generally massive, seldom finely disseminated. In the deeper workings, the lode almost contains as much purple copper as copper pyrites, with no admixture of iron pyrites, or other mineral, except a little feld spar. The ore, on being excavated, was crushed by flat-faced hand hammers, brought up, by jigging, to 30 per cent., and then smelted or sold. Næsmark mine is like Hoffnung, situated in the immediate neighborhood of the work, on a granite vein, two fathoms thick, which intersects primitive slates. In this vein, (from which also side veins shoot out into the adjoining slates,) there occur, running in a direction at right angles with its line of strike, numerous lodes of from two to six inches thick, filled with quartz and copper glance; the latter containing six oz. of silver per cwt. The granite in the neighborhood of these quartz veins is also impregnated with copper glance, to such an extent, as to make it amply worth stamping and washing. This mine is a most promising one; is altogether new, and the granitic vein has been discovered at a distance of three miles from it, at Bergland mine; where it bears copper glance in exactly the same manner as at Næsmark. The ore from the quartz lodes of this mine was brought up by hand-jigging to 70 per cent., and then either smelted or sold. The finely divided ore was worked by stamping and washing. Mosnap mine is about 10 miles distant from the work, and probably lies 2000 feet above the sea. The rocks in the neighborhood are the gneiss, mica schist, and hornblende schist, peculiar to the quartzose group. The mine itself is situated on a granitic vein, which contains irregular quartz layers. Copper pyrites, purple copper, and molybdenite are disseminated through it, but are more especially associated with the quartz. The vein itself has a thickness of several feet, and were it more conveniently situated, would doubtless be considered a very valuable deposit. It is only very lately that the ores from these mines began to be treated by crushing and jigging, and then sent to market. They were previously stamped and washed, at least the poorer sorts, and the products were smelted at the works, along with the richer ores. The smelting, however, even after the discovery of a vein of fluor spar, which was used as flux, was carried on but with indifferent success, on account of the highly quartzose natures of the ores. After the introduction of jigging, the ores were treated as follows, at the smelting works:—The copper glance from Næsmark was calcined in a reverberatory furnace, and the silver extracted according to Ziervogel's method; by treating it with water, and afterwards precipitating the dissolved silver by metallic copper. The lixiviated residue from this process, was then smelted together with the rich copper pyrites and schlichs from the Hoffnung mine, (previously calcined in a reverberatory furnace), in a small shaft furnace. From this operation, there resulted a slag, very rich in ferrous oxide, which was rejected; a regulus with 55 per cent. of copper, and a small quantity of coarse copper. The regulus was roasted and again smelted; coarse copper, and a small quantity of thin regulus being produced. The coarse copper was then refined on the small German gahr hearth.

The two most important mines belonging to Hvideseid copper-works, occur in the parish of Hvides, and are as follows: Haukum mine, situated beneath Brokefjeld, in the neighborhood of a powerful granite vein, wherein orthoclase and oligoclase are observable. This vein intersects primitive slates, and is accompanied by several irregular granitic masses, on the largest of which the mine occurs. The granite mass is more or less impregnated with purple copper, and this is occasionally accompanied by metallic silver in fine threads; which occur in small cavities, with crystals of laumontite and stilbite. The crystals of laumontite form fan-like groups, which are coloured green by the oxyd of copper A very small scale of gold has been found in this mine. The following minerals are also met with: magnetic iron ore, molybdenite, garnet, epidote, and traces of copper pyrites.* Bandag mine is situated on the precipitous south side of Bandag Lake. The surrounding rock bears a strong resemblance to granitic gneiss, but nevertheless differs from it in having a larger quantity of quartz, and, as a consequence, a lighter colour. The ore deposit lies parallel with the stratification of this rock, and consists of a granular mixture of quartz, mica, copper pyrites, purple copper, highly argentiferous galena, zinc blende, and a little feldspar. Metallic silver in threads, has also been remarked in this mine. The ores from these, and other mines, were for a considerable time smelted at the Hvideseid works, and although the smelting was ultimately abandoned, the operation was more successful here than anywhere else in the district, being carried on for a longer time.

The Sauland smelting works were built for the copper ores occurring at Guli, in the parish of Sauland, which is subordi-

* Dahll, Om Telemarken's Geologie, p. 27.

nate to Hjærdal. The lode, which occurs in a coarse grained diorite, is sometimes of considerable thickness, and consists of quartz well charged with purple copper. Here, too, the smelting was unsuccessful, even more so than elsewhere in the district.

The ore deposits near Horindbygden in the parish of Tin, are described by Keilhau,* and are the following: I. That of Rödsöe consists of a layer of quartz, containing partly massive and partly disseminated copper glance. The thickness is about three feet, the strike north and south, and the dip vertical. It is traceable over a length of 200 feet. II. That of Daarudberge contains also some copper glance in a quartz bed, two feet thick, but appears less rich than that of Rödsöe. III. That of Vashoed is a quartz layer of six inches thick, with a strike north and south, and contains some purple copper. The adjacent rock is full of magnetic iron ore, disseminated, and crystallized in very small octohedrons.

A deposit of iron ore has been described by Dahll,† as occurring in Nissedal, between the farms Aarhuus and Söfdestad. It appears to be a vein, and runs from north to south over the hill called Grubeaasen. It dips 30° to 50° towards east, and has a thickness of nine feet on an average. It is exposed for a distance of 210 fathoms, between two small valleys. In the deepest portion, it consists of magnetic iron ore, but on ascending the hill from both sides, the magnetic ore becomes mixed with iron glance, (specular iron ore); the quantity of which gradually increases, until, at the highest part, iron glance alone is present. The surrounding slates are mica schist, containing a little hornblende, hornblende schist and feldspar, and containing portions having a granular structure. The vein is more distinctly separated from the side rock, where it consists of magnetic ore, than when the iron glance is present. The latter penetrates into the side rock, where it replaces the feldspar. It is thus possible to find hand specimens consisting only of iron glance and hornblende. Quartz and desmine are present in the vein. It is impossible to determine with certainty the age of this deposit, but it is intersected by granite veins.

In concluding this description of the quartzose division of the primitive slate formation, and of its economic minerals, as developed in Norway, I think that the following features may be mentioned as characteristic of the group. I. The preponderance of quartzose rocks; II. The presence of conglomerates of a pecu-

* Geæ Norvegica, p. 442.

† Om Telemarken's Geologie, p. 31.

liar character ; III. The prevalence of copper ores, of a high percentage, unmixed with iron pyrites; the veinstone accompanying them being quartzose, and therefore difficultly fusible; IV. The presence of iron glance in the few deposits of iron ore occurring in the group.

The equivalent of these rocks in Canada appears to be the Huronian formation. In support of this view I shall avail myself of the minute descriptions of the latter to be found in the Reports of the Geological Survey, and particularly in Sir W. E. Logan's Report on the north shore of Lake Huron. The rocks of the Huronian formation are, by these authorities, described as follows:

"The quartzites have sometimes the aspect of sandstones, but at other times lose their granular texture, and become a vitreous quartz. Not unfrequently the quartzite is thin bedded, and even schistose in its structure, and it sometimes holds a little mica, passing into a variety of mica schist.

"These quartzites often become conglomerate, enclosing pebbles of quartz and various coloured jaspers. These pebbles are sometimes arranged in thin layers among fine grained beds. At other times, the conglomerates form thicker beds, which swell into mountain masses; including great portions which contain blood-red jaspers in a white matrix, constituting a very beautiful rock.

"In addition to these, there are conglomerates of a distinctly different character, belonging to this formation. They are composed chiefly of syenitic pebbles, held in a grey argillo-arenaceous cement, which is more frequently of a greenish color, from the presence of chlorite. The pebbles, which are of reddish and grey colors, vary greatly in size, being sometimes no larger than swan shot, and at others, boulders rather than pebbles, measuring upwards of a foot in diameter.

"The quantities in which they are aggregated vary much. They sometimes constitute nearly the whole mass of the rock, leaving but few interstices for a matrix, and sometimes on the contrary, they are so sparingly disseminated through considerable portions, as to leave spaces of several feet between neighboring pebbles; which are still, in such cases, often several inches in diameter. With the syenitic pebbles, are occasionally associated some of different colored jaspers. The matrix appears often to pass on the one hand, into the grey quartz rock, by an increased proportion of the arenaceous particles; and on the other, into a thin bedded greenish fine grained slate, which is sometimes very chloritic. In a third form, the matrix is scarcely distinguishable from a fine grained greenstone In the slate, the stratification is often marked by slight differences of color, in the direction of which, it is occasionally cleavable. The bands in other instances, are firmly soldered together, but in both cases, joints usually prevail, dividing the rock into rhomboidal forms, which are sometimes very regular."

These slates sometimes approach to argillites, but often, through the chloritic varieties, appear to pass into greenstone or diorite, which, in its typical form, consists of a greenish white feldspar, with dark green or black hornblende. The feldspar is sometimes however, more or less tinged with red, and the rock then occasionally appears to pass into a kind of syenite, by the addition of a very sparing amount of quartz. These two forms of the rock are generally highly crystalline, and not very fine grained. The greenstone, however, sometimes displays a fine texture; and in such cases it frequently holds much disseminated chlorite, giving it a very decided green colour. Portions are found, containing so great a proportion of the mineral, as to yield with facility to the knife.

Associated with these, are three bands of impure limestone, often silicious and sometimes dolomitic, the uppermost one of which, is interstratified with a large amount of hornstone, in very regular beds. The total thickness of the formation on Lake Huron, is estimated about 18,000 feet; of which more than 10,000 feet are quartzites, including the jasper conglomerates. 900 feet of the remainder are limestone and hornstone bands, and the remainder the slate conglomerates, with chloritic and epidotic slates the whole being interstratified with diorites.

While the great mass of these greenstones or diorites, are supposed to be altered sedimentary beds, there are other greenstones, which, as well as certain granites in the formation, are evidently intrusive.

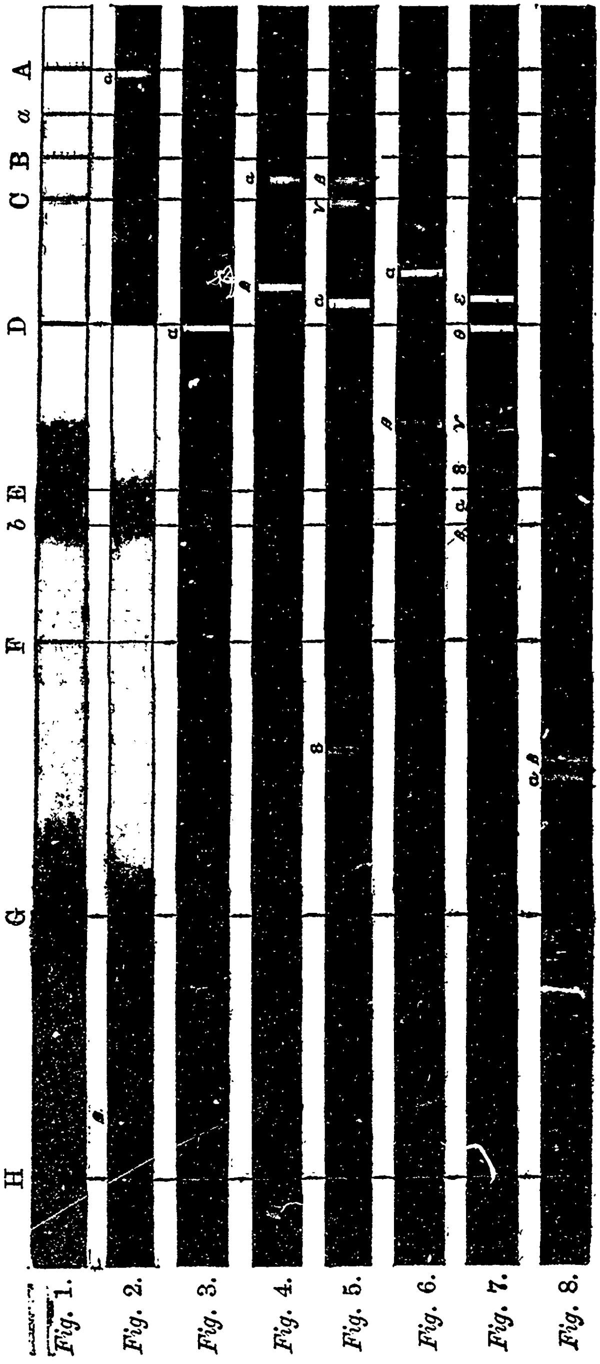
The most important mineral deposits of the Huronian series are the copper lodes at the Bruce, Wellington, and Huron Bay mines. The ores are here yellow and purple sulphuret, in veins, of quartz, which cut the diorites of the region. According to Sir W. E. Logan's careful examination of the Bruce Mines, made in 1848, about 3000 square fathoms of the lodes were computed to contain, on an average, 6½ per cent. of copper. Since then, about 9000 tons of 18 per cent. ore have been raised from the mine, which has been opened to a depth of 50 fathoms. Attempts were made to smelt the ores, in a furnace erected on the spot, but they are now shipped to Great Britain or to the United States. The adjacent mines appears to be yielding even larger quantities of ore than the Bruce. Copper mining has been attempted also at Root River, at Echo Lake, and in many other localities in this formation; which, like its Norwegian equivalent, appears to be eminently cupriferous. At the Wallace mine on Lake Huron, copper pyrites occurs, with an arsenical sulphuret of nickel, but the deposit has not been much examined. In the same vicinity, Mr. Murray has described a bed of specular iron or red hematitic ore, and he has shown that the immense deposits of this ore now so extensively wrought at Marquette, in Northern Michigan, belong to the Huronian formation.

From this sketch of the Huronian formation I think it will appear evident that the same particulars characterize it as the corresponding group in Norway, viz: I. The preponderance of quartzose rocks. II. The presence of conglomerates of peculiar character. III. The occurrence of great masses of interstratified diorites or greenstones. IV. The beds of hornstone or chert. V. The presence of copper ores of a high percentage, unmixed with iron pyrites; the veinstone accompanying them being of quartzose. VI. The presence of iron glance (specular iron ore) in the few deposits of iron ore occurring in the group.

In the absence of organic remains, it seems to me that the only means left of identifying the same group in remote localities, is to compare minutely their petrographical and other physical characters. If this view be correct, there can be little doubt but that the quartzose division of the primitive slate formation in Norway, and the Huronian formation of Canada, are identical.

In conclusion, I have to remark with regard to the development of the mineral resources of both formations, that more appears to have been accomplished in this respect in Canada, than in Norway; seeing that the copper mines on the north shore of Lake Huron have had more permanency than those of Tellemarken. Greater progress is probably attributable only to the greater amount of capital which has been invested in the former mines. The obtacles met with have been substantially the same in both countries: the remoteness and inaccessibility of the region from the ordinary markets, and the difficulties in the treatment of the ores. These however have been overcome in this country, and the principal mines on Lake Huron are now well established, and profitably wrought.

PLATE TO ILLUSTRATE THE SPECTRUM DISCOVERIES.



ARTICLE X.—*The New Spectrum discoveries.**

We give in this number a series of illustrations† of the spectra of flames, in which salts of Potassium, Sodium, Lithium, Strontium, Calcium, Barium, and Cæsium are volatilized, with the solar spectrum for the sake of comparison.

Fig. 1 represents the solar spectrum, with the most remarkable of Fraunhofer's lines indicated by transverse bars.

Fig. 2 is the potassium spectrum, nearly continuous between Fraunhofer's lines G and D, but showing beyond these limits, two characteristic lines, one named Kα, correspondent to the dark line A, at the red extremity of the solar spectrum, and one Kβ, near the remote extremity of the spectrum, and coincident with another of Fraunhofer's lines. A third line, less distinct, and therefore less valuable for purposes of analysis, coincides with the solar line B.

The sodium spectrum is seen in Fig. 3, and is eminently characteristic. It is distinguished by a single brilliant yellow line Na, and coincident with the dark solar line D.

Fig. 4 exhibits the peculiarities of the lithium spectrum. It shows an intensely brilliant crimson line Li α, and one less distinct orange line Li β.

The strontium spectrum (Fig. 5), is more complex; out of eight remarkable lines, six red, one orange, and one blue, four may be particularized, the orange line Sr α, the two red lines Sr β, and Sr γ, and the splendid blue line Sr δ.

The spectrum represented in Fig. 6 is that of calcium, presenting two characteristic lines, the bright green line Ca β, and the intense orange line Ca α.

Of all these spectra, that of barium, represented in Fig. 7, is the most complicated. Three green lines, Ba α, Ba β, Ba γ, are most to be relied on for the determination of this spectrum.

The new metal cæsium, the spectrum of which is represented by Figure 8, was discovered by Bunsen from the appearance of the two blue lines Ca α and Ca β, in the spectrum produced when the residue from the evaporation of the mineral waters of Baden and of Dürkheim was ignited.

Bunsen afterwards announced the discovery of another of new metal, which he names rubidium, and which he detected in a similar manner in the residues of the same mineral waters, by

* See page 224 of the last volume of *Canadian Naturalist.*

† Reduced from the *London Review.*

the appearance of two red lines beyond the visible red of the solar spectrum. These new metals have since been found widely distributed but in very small proportions. Mr. Grandeau, by the evaporation of several thousand litres of the waters of Vichy, collected about two grammes of the double chloride of platinum and cæsium, and a still smaller proportion of the same salt of rubidium. A larger amount of both these metals is present in the waters of Bourbonne-les-Bains, and the same chimist has found them in different specimens of lepidolite, in the refuse of saltpetre manufactories, and elsewhere. S. P. R.

ARTICLE XI.—List of *Diurnal Lepidoptera* collected (unless otherwise specified) in the immediate vicinity of London, C. W. By W. SAUNDERS.

(Read before the Natural History Society.)

In naming these insects, preference has been given to the family names in the Smithsonian Catalogue, as being the most reliable and easily accessible authority, but where long usage has popularized certain family names they will be found enclosed in brackets.

Papilio turnus, Linn.—Not uncommon.

" *troilus*, Linn.—Common.

" *Philenor*, Linn.—From Rev. Chas. J. S. Bethune, Cobourg. This fine insect taken in such numbers at West Flamboro' by Mr. B. in June 1858, See Canadian Naturalist for August 1858, is not uncommon about Toronto, and has also been taken near Woodstock.

" *Asterias*, Fab.—Common everywhere.

" *Thoas*, Linn.—This splendid butterfly, usually considered peculiarly southern, has been taken in Canada by the Rev. Dr. Sands, of Chatham, C. W. Several years since he captured three specimens on the Mersey, one of which is now in possession of the Lord Bishop of Huron. The Rev. Dr. states that they are not uncommon in that locality, and that they are found through several townships.* He has repeatedly seen specimens on the wing, since the captures above alluded to were made. Although I have no Canadian specimen of *P. Thoas* the fact of its undoubted occurrence in Canada is a matter of too much interest to entomologists to allow it to continue unnoticed.

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* *P. thoas* has also been seen on the wing near Port Stanley, by a resident collector, but the insect being exceedingly difficult to capture, he has never succeeded in taking one.

Pieris Protodice. Boisd.—Common some seasons. Very plentiful last summer.

" *oleracea*, Harris.—Rather scarce around London, but generally common throughout this part of the province.

Terias Lisa, Boisd.—One specimen taken at Port Stanley last August, where it was rare. Mr. T. Reynolds, has sent me a pair from Hamilton, where it appears to be more common.

Danais Archippus, Fab.—Common everywhere.

Argynnis Cybele, Godt.—Usually abundant.

" *Myrina*, Cram.—Common in wet places.

" *Bellona*, Godt.—Common in wet places.

" *Aphrodite*, Godt.—Usually common. Concerning the identity of this species with *A. Cybele* there exists much diversity of opinion. Boisduval states that the difference between them is merely sexual, while other writers regard them as distinct species. They are both undoubtedly subject to considerable variation, and they incline to run into each other, but the larvæ must be made a further subject of study before the opinions of either side can be fully established. In the meantime I must confess I am inclined to look upon them as distinct.

Melitæa Phæton, Cram.—Of this butterfly I have only one specimen, which was taken by a friend last summer at Hall's mills, about seven miles from London. At the time it was captured they were tolerably common in that locality but upon visiting the spot a week or two after not one could be found.

" *ismeria*, Boisd. et Leconte.—Not uncommon, although chiefly confined to one or two favorite spots.

" *Tharos*, Cram.—Abundant.

Grapta (Vanessa) interrogationis, Godt.—Common in the neighborhood of hop-yards.

" " *comma*, Harris.—Not common.

Vanessa J-album,—Boisd. et Leconte.—Generally common, but much scarcer than usual for the last one or two years.

" *Milberti*, Encyc.—Usually abundant.

" *Progne*, Cram.—Common.

" *Antiopa*, Linn.—Plentiful.

Pyrameis (Vanessa) Atalanta, Linn.—Common.

" " *cardui*, Linn.—Usually abundant.

" " *Huntera*, Smith.—Common.

Inonia " *cænia*, Boisd. et Leconte.—Taken at Port Stanley, August 1861. See Canadian Journal for November 1861.

Nymphalis (Limenitis) Ursula, Fab.—Rare. Of this beautiful insect three specimens have been taken in this vicinity within the last two years. It has also occurred at Port Stanley where it has been somewhat more plentiful.

Nymphalis (Limenitis) Arthemis, Drury.—Not common.
" " *disippus*, Godt.—Common.

Neonympha eurythris, Fab.—Very common in wet places and on the borders of swamps.
" *canthus*, Linn.—Rare. Found usually in swamps.

Erebia nephele, Kirby.—Sent from St. Catherines by D. W. Beadle, Esq., where it is usually plentiful.

Thecla falacer, Godt.—Taken at Port Stanley in August 1861, when it was common in one locality not far from the town.

Thecla niphon, Boisd. et Leconte.—Rare.
" *mopsus*, Boisd. et Leconte.—Not common.
" *laeta*, Edwards (new species).—Rare.
" *acadica*, Edwards (new species).—Very rare. These last two are new species which the collector has had the fortune to discover. They were both taken within a mile of London. Of *T. laeta*, which is a very handsome little creature, two specimens have been taken; of *T. acadica* only one. They will probably be soon described by Mr. Edwards who has named them.

Argus Pseudargiolus, Boisd. et Leconte.—Not common.

Polyommatus comyntas, Godt.—Taken at Port Stanley in August 1861, where it is common some seasons.
" *phleas*, Godt.—Abundant everywhere.
" *thoe*, Boisd. et Leconte.—Generally scarce.

Lycæna Scudderi, Edwards.—This handsome little blue, recently described by W. H. Edwards, Esq., in the *Journal of the Proceedings of the Academy of Natural Sciences*, Philadelphia, is very common in one locality near London. It extends from the cemetery to the Great Western Railway track, and along the line for about a quarter of a mile. Here early in June and again in August it may be taken in considerable numbers.

Goniloba (Eudamus) Tityrus, Smith.—Rare.

Nisoniades (Thanaos) Juvenalis, Smith.—Common.
" " *Catullus*, Smith.—Rare.
" " *Brizo*, Boisd. et Leconte.—Common.

Cyclopidas coras, Cram. (Hesperia otho. Boisd. et Leconte) Not common.

Pamphila viatellius, Smith.—Common.
" *origenes*, Fab.—(Hesperia cernes. Boisd. et Leconte) Common.
" *Zabulon*, Boisd et Leconte.—Abundant.
" *Peckii*, Kirby.—Common.

Hesperia bathyllus, Smith.—Not common.

The collector takes this opportunity of acknowledging his indebtedness to Mr. W. H. Edwards, Newburgh, N. Y. for kindly determining a number of the smaller butterflies.

ARTICLE. XII.—*An account of the Botanical and Mineral products, useful to the Chipewyan tribes of Indians, inhabiting the McKenzie River District.* By BERNARD R. ROSS, H.B.C.S.

(Read before the Natural History Society of Montreal.)

A nation of hunters, paying no attention whatsoever to agriculture, can enjoy but few of the numerous benefits afforded by the vegetable kingdom to the human race in general. Such is the condition of the Chipewyan tribes of Indians. Though the benefits derived from the mighty forests which fill the Mackenzie valley, are but few to their denizens, they may be considered notwithstanding their fewness, to be of essential, indeed of vital importance to the existence of the aboriginal dwellers in these wilds; since without fuel to warm them, and without canoes to migrate, they would soon cease to exist.

From the vegetable kingdom are derived fuel, canoes, sleds, paddles, snow-shoes, baskets, dyes and food, besides other articles which will be noticed hereafter. Two trees, the canoe birch (*Betula papyracea*) and the white spruce (*Abies alba*) stand out, from their importance, in bold relief; but the larch and willow are used also, as well as several kinds of plants, which furnish medicines, dyes, and edible berries that are useful in periods of scarcity. Indeed in summer, a considerable portion of the ordinary food, as well as the luxuries of the natives, is drawn from this source.

According to the method adopted in my former paper on the zoological products, I shall pass the various uses of each species briefly in review :—

The Canoe or Paper Birch (Betula papyracea).—The benefits which this valuable tree confers on the inhabitants of the McKenzie River District, are many and important. Its bark is used in the construction of canoes, and in the manufacture of various utensils for domestic use, such as drinking cups, dishes, and baskets. It also yields spunk or touchwood of the best quality. Of its wood, platters, axe-helves, paddles, snow-shoe-frames, dog-sleds and other articles are made, and as it is a strong and durable material, of close grain, and susceptible of receiving a tolerable polish, the white residents avail themselves of it for the construction of furniture. In spring, the sap forms a pleasant drink, from which a syrup can be manufactured by boiling, and which may be further transformed, by fermentation, into an agreeably flavoured wine of considerable potency. Beyond the arctic circle, the birch is rare and stunted, though it is found as high as 70° N. The largest and finest trees in the district, grow on the banks of the Liards, or river of the Mountains. Since the advent of missionaries into these wilds, the natives who are Christianized, use the bark for paper on which to engrave their syllabic literature, as well as for letter-writing.

The White Spruce (Abies alba).—This is pre-eminently the forest tree of McKenzie's River District, and grows a considerable distance within the arctic circle, as high as the 69th parallel. It is used for the thin hoops or *verrandis* and lining of bark canoes. With its tough roots split to a convenient thickness, and used under the cree name of *wattape* the pieces of canoe bark are sewed together. Tasteful baskets and dishes are also manufactured from it, as well as kettles capable of containing water. Before the arrival of traders the Indians used these for cooking their food, which was done by dropping heated stones into the water until it boiled. In districts where the birch is scarce, or for temporary use, a rude canoe is made from the spruce. For this purpose, a well-grown tree, with thirty feet or so clear of branches, is chosen; an incision is made down to the wood along one side, and the bark being skillfully raised in one piece, receives the canoe shape by being skewered together, and having a few willows inserted for *verrandis* to add to its stiffness. It is serviceable for a short period only, heat and cold being alike destructive to this species of craft, by rendering the spruce bark dangerously brittle. Pieces of the bark are used for covering houses of the white residents, and also by the natives for roofing temporary sheds or cabins. The gum is used for paying the seams of canoes and is chewed by the female aborigines, to the whiteness of whose teeth the habit contributes in no small degree.

From the fibrous bark of the willow a species of twine is made which the natives manufacture into nets of great durability. Sleds are made of the larch and the Banksian pine. The Loucheux Indians use the black seed of the bear-berry for beads, to ornament their dresses with. Alder bark, the wild sorrel, and other shrubs and plants are used for dyes and medicines. While the strawberry, raspberry, gooseberry, mossberry, cranberry, crowberry, mooseberry, red bearberry, the fruit of the rose, and various roots contribute an important item to their summer larder.

Mineral Products.

The mineral kingdom affords but few and unimportant articles for the necessities of the Indians.

Sulphur is found in considerable quantities at the Sulphur Cove on Great Slave Lake. Here sulphur springs occupy a space of several hundred yards in length along the beach. They are very clear, and flow in small rivulets, whose banks are encrusted with a deposit of sulphur which becomes serviceable when thoroughly dried, and is used by the Chipewyan Indians who come to Fort Resolution, in the fabrication of matches.

Common Salt is procured from the salt plains lying about 20 miles up the Salt River, a tributary of the Slave. The springs issue from the base of a long ridge, some hundreds of feet in height, and spreading their waters over a clayey plain, deposit the salt by evaporation in cubical crystals of various degrees of fineness. The mother liquor flows into Salt River, giving a name as well as a most abominable taste to that stream, which is still sensibly brackish at its junction with the Slave. At present, the main supply of salt is confined to one large *jet d'eau* from which a strong brine, mingled with completely formed crystals, is perpetually thrown. Around this spring, evaporation has formed a hillock of dry salt many feet high ; and a pole forty feet long was shoved into the spring without finding bottom. Sir John Richardson considers that these fountains belong to the Onondaga Salt group of the Upper Silurian Series of New York.

Numerous bands of buffalo, elk, and reindeer frequent these plains to lick the mineral, of which they are extremely fond. The salt is of excellent quality, strong and well-flavoured. It preserves meat, meal, and butter, fully as well as that imported from England, being far superior to the description manufactured in the plain country of the Swan River District. As the Salt River is very crooked, with generally too little water to float any craft larger than a small canoe, the transport of the salt from the springs to its mouth is by horses.

Ochres, red and blue, are procured at several points in the District, and are used for painting snow-shoes and sleds, by the natives. The Loucheux of the Youcon River paint their faces with these colors in the same way as the tribes of the Plain.

White earth or Pipe-clay is found associated with the coal beds at the mouth of Bear River. When newly dug, it is plastic, but soon dries. It is eaten in times of scarcity by the natives, and is also used as a soap for washing their clothes, and by the whites for white-washing their houses. At the request of Sir John Richardson it was analyzed by Drs. Davy and Prout, but was not found to contain any nutritious matter.

Mineral Tar is procured at several spots along the Arthabaska or Clear Water River; it is also found on Great Slave Lake, at a short distance N. E. of Big Island, and also near to Fort Good Hope. It is little used by the natives, except to mix with and to soften gum for paying canoes with. It becomes, after being boiled and purified, an excellent tar for boat-building purposes, for which it is used.

Iron Pyrites is found in the Mountain Ranges. The Gens-des-Bois, a tribe living on the banks of the Pelly River, use it instead of flint to strike fire with.

Pieces of Agate are used occasionally as flints, and native copper has been made into knives, spear and arrow heads.

Lignite exists in large quantities near the mouth of Bear River where it is seen in a state of combustion. It is of little value as fuel, and quite unserviceable for forge use. The legend told by the Slave and Dog Rib Indians, of the origin of the fire in these lignite beds is rather curious. The story relates that in the days of old, before Indians roamed the forest, or glided over the waters in their birchen canoes, a giant, tall as a pine tree, dwelt at the eastern end of Slave Lake, then a much larger sheet of water. The giant hungered and he went to hunt. His spear was a tall fir-tree, hardened in the fire, and tipped with native copper. The skins of gigantic elks served him for clothing. Travelling on, he found a beaver-house; the beavers in those days were of extraordinary size, and their houses of corresponding proportions. With great exertion and toil, the house was broken open: it contained two animals, a female and her young. The latter was killed, but the dam escaped, pursued by the giant, who bore the dead cub over his shoulder on the point of his spear. On they sped, until the western end of the lake was reached, where a rocky barrier then stretched across. Through this, the beaver pushed her way, giving vent to the waters of the lake, and thus forming the Tess-chi or McKenzie's River, the flood of which swept her downwards, far out of the pursuer's reach. The giant still continued the chase, until hungry and exhausted, he reached the mouth of Bear River, where he stopped to cook the cub, which was the size of a moose-deer; and thus lit the fire which continues burning to the present day.

With these I think I have completed this series of notes, in which I believe that nothing of importance to the comfort or welfare of the natives omitted.

Among the Eskimos, the arts and manufactures of savage life are in a much more advanced state than among the Indian tribes, and I trust that I shall, at some future period, have the gratification of laying an account of them before the Natural History Society of Montreal.

ARTICLE XIII.—*List of Mammals, Birds, and Eggs, observed in the McKenzie's River District, with Notices.* By BERNARD R. ROSS, Corresponding Member Nat. His. Soc. Montreal.

(Presented to the Natural History Society.)

MAMMALS.

Order 1.—*Rapacia.*

(Insectivora.)

FAMILY SORECIDÆ.

Genus Sorex.

1. *Sorex Fosteri?* (Richardson).
2. *Sorex palustris?* (Bachm).

This genus is abundant throughout the district as far north as the Arctic coast. I cannot speak confidently as to either the names or the number of the species.

(Carnivora.)

FAMILY FELIDÆ.

Genus Lynx.

3. *Lynx Canadensis* (Rafen).—Canada Lynx—Loup-cervier, of the Canadians—Cat, of the Hudson's Bay residents—Pichen of the Cree Indians and Red River half-breeds—Chée-say of the Chipewyan Indians. This animal is numerous some years, but is migratory, following the hare (Lepus Americanus) its principal food. It ranges to the Arctic coast in summer. In winter, it does not leave the shelter of the woods.

FAMILY CANIDÆ.

(Lupinæ.)

Genus Canis.

4. *Canis griseo-albus* (Rich.)—Strongwood Wolf—Loup-gris, of the Canadians—Mahéecan of the Cree Indians—Nun-dée-yah of the Chipewyan Indians—Mah-nuékh of the Anderson River Eskimos—Yess of the Copper Indians. Of this species I consider that there are two varieties, one of which is

of dark color and large size, inhabiting the wooded portions of the district as far north as the Youcon River. The other is usually a dirty white tint, with in general a dark stripe down the back, and frequents the barren grounds N. to the Arctic cost. It is of smaller size than the first mentioned variety, and lives in much larger bands; Indeed it may possibly be a distinct species.

(Vulpinæ.)

Genus Vulpes.

5. *Vulpes fulvus:* var. *fulvus*, var. *decussatus*, var. *argentatus*. Red. Silver, and Cross Foxes. Ma-kày-sis of the Cree Indians—Naw-kée-thay of the Chipewyan Indians. Pee-sooteh of the Anderson River Eskimos. This species, in all its varieties, is found all over this district to the Arctic coast. They are most numerous around the shores of the lakes, and in swampy tracts on the banks of the larger rivers. In the mountain ranges they are rare. The proportions of the various colors killed in the McKenzie district is as follows: Red $\frac{6}{15}$; Cross $\frac{7}{15}$; Silver $\frac{2}{15}$

6. *Vulpes lagopus*, var. *Lagopus*, var. *fuliginosus*.—White and Blue Foxes. Both these varieties inhabit the barren grounds and shores of the Arctic coast. The latter is exceedingly rare, much more so than the Silver Fox is in the fulvus species. White Foxes have been killed on the south shore of Great Slave Lake, and a single blue one on the North shore.

FAMILY MUSTELIDÆ.

(Martinæ.)

Genus Mustela.

7. *Mustela Americana* (Turton)—American Sable—Marten-thà of the Chipewyan Indians—Naw-they or Nau-fey of the Slave Indians. Common wherever there are woods, but migratory. The farther north that the skin is obtained, the darker the tint of the fur. On the Youcon River they strongly resemble the Siberian Sable.

8. *Mustela Pennantii* (Erxleben).—Fisher—Pecan of the Canadians. Zhä-cho, or big Marten of the Chipewyan Indians. Rare-Range to 62° north.

Genus Putorius.

9. *Putorius pusillus* (Aud. v. Bach.)—Least Weasel—New York to Big Iceland. Great Slave Lake.

10. *Putorius Cicognanii* (Bonap).—Small brown Weasel. Boston to 62° North. Common.

11. *Putorius? Richardsonii* (Bonap.)—Little Ermine. Boston to Lapierres House. Rather rare.

12. *Putorius? Noveboracensis* (Dekay).—Ermine. Northern New York to 62° north. Rare.

13. *Putorius? longicauda* (Richards.)—Long-tailed Weasel. Upper Missouri to 62° N.; rare. I am far from certain of the identities of the three last species. All the Ermines which are killed in this district have the white of the winter coat slightly tinged with sulphur-yellow.

14. *Putorius vison* (Rich.)—Brown Mink—Teth, jew-say, of the Chipewyan Indians. Trai-ek-puck, of the Eastern Eskimos. Florida to the Arctic coast. Common.

15. *Putorius nigrescens* (Aud. & Bach.)—Little black Mink. Northern New York to 62° north. This species is nothing more than the young of the *P. Vison.*

Genus Gulo.

16. *Gulo luscus* (Sabine).—Wolverine—carcajou—No-gah, of the Chipewyan Indians;-kha-vig of the Eastern Eskimos. North-New York to Arctic coast. Common.

LUTRINÆ.

Genus Lutra.

17. *Lutra Canadensis* (Sabine).—Otter.—Naw-pée-ah of the Chipewyan Indians. Florida to the Arctic coast. Not uncommon.

MELINÆ.

Genus Mephitis.

18. *Mephitis mephitica* (Shaw).—Common Skunk. Texas to Fort Resolution, Great Slave Lake. I have never seen a living specimen of this animal in McKenzie's River: but I found the bones and a part of the [illegible]n of one at a short distance from the shores of Great Slave Lake.

FAMILY URSIDÆ.

Genus Ursus.

19. *Ursus horribilis* (Ord).—Grizzly Bear. Sas-tel-kie of the Chipewyan Indians. Plains of Upper Missouri to Youcon River. Not rare in the mountain ranges.

20. *Ursus Americanus:* var. *Americanus* var. *cinnamoneus* (Aud & Bach). Black and brown Bears: Sas of the Chipewyan Indians. Common throughout to the Arctic circle and beyond. The brown variety is very rare.

21. *Ursus arctos?* Barren-ground bear. Inhabits the barren-grounds and Arctic coasts. Distinguished from the *U. horribilis* by its smaller size and reddish coloration.

22. *Ursus maritimus* (Linn.)—Polar Bear. Nait-suck of the Eastern Eskimos. Common along the Arctic coasts.

Order 5.—*Rodentia.*

FAMILY SCIURIDÆ.

(Steturinæ.)

Genus Steturus.

23. *Sciurus Hudsonius* (Pallas).—Chickaree. Throughout to within the Arctic circle.

Genus Pteromys.

24. *Pteromys alpinus* (Rocky Mountain flying Squirrel) (Richardson). Found on the mountain ranges of the Liards River. Rather rare.

Genus Tamias.

25. *Tamias quadrivittatus* (Richardson).—Missouri striped Squirrel, from Lat. 53° 30′ to 67° north. Very abundant on the Liards River.

Genus Arctomys.

26. *Arctomys monax* (Gmelin).—Ground-hog. South Carolina to 62° North. Rare.
27. *Arctomys pruinosus* (Gmelin).—N. to Arctic circle. Abundant in the mountain ranges.
28. *Arctomys Kennicottii* (Ross).—This I consider to be a new species, but may be wrong. It is of small size, and inhabits the northernmost ranges of the Rocky Mountains.

(Castorinæ.)

Genus Castor.

29. *Castor Canadensis* (Kuhl).—Beaver. Isă of the Chipewyan Indians. Throughout North America, to within the Arctic circle; very abundant.

FAMILY MURIDÆ.

(Murinæ.)

Genus Jaculus.

30. *Jaculus Hudsonius* (Wagler).—Jumping Mouse—Pennsylvania to Youcon River. Common at Portage La Sache; rare in McKenzie's River.

Genus Hesperomys.

31. *Hesperomys* (Gapper).—Hamster Mouse. New York to the Arctic Sea, very abundant E. of the Rocky Mountains; not found westward on the Youcon River. This species is very annoying in dwellings, as it carries off quantities of sugar, rice, &c. in its cheek pouches, to store them up for its winter consumption.

Genus Arvicola.

32. *Arvicola riparia* (Ord).—Middle States to Arctic Sea. Common.
33. *Arvicola Richardsonii* (Dekay).—62° north. Rare.
34. *Arvicola xanthognathus* (Leach).—Red-cheeked Arvicole. North to the Arctic Sea. Common.

Genus Fiber.

35. *Fiber zibethicus* (Cuvier).—Musk-rat; Dyin of the Chipewyan Indians. North America to the Arctic Sea, abundant.

FAMILY HYSTRICIDÆ.

Genus Erithezon.

36. *Erithezon dorsatus* (Cuvier).—White-haired Porcupine. From Pennsylvania to within the Arctic circle. Common.

37. *Erithizon epixanthus* (Brandt).—Yellow-haired Porcupine. From Upper Missouri to Liards River.

FAMILY LEPORIDÆ.

Genus Lepus.

38. *Lepus Americanus* (Erxl.)—White Rabbit. Khă of the Chipewyan Indians. From Virginia to within the Arctic circle. Abundant; Migratory.

39. *Lepus glacialis* (Leach).—Arctic Hare—Newfoundland N. to the Arctic Sea; not common.

Genus Lagomys.

40. *Lagomys princeps* (Richardson).—Little Chief Hare—Common among the mountain ranges of the Liards River.

Order 3.—Ruminantia.

FAMILY CERVIDÆ.

(Cervinæ.)

Genus Alce.

41. *Alce Americanus* (Jardine).—Moose—Fin-dée-yah of the Chipewyan Indians. New York to within the Arctic circle. Abundant.

Genus Rangifer.

42. *Rangifer caribou* (Aud. & Bach.)—Strong-wood Caribou. From Maine to the Youcon River. Abundant.

43. *Rangifer Groënlandicus.*—Barren-ground Caribou. Barren grounds, and Arctic coasts in spring, summer and autumn. Fringes of the woods in winter.

FAMILY CAVICORNIA.

. (Antilopinæ.)

Genus Aptocerus.

44. *Aplocerus montanus* (Richardson).—Mountain Goat. From Northern Cascade Mountains to the Arctic Sea. Not common.

(OVINÆ.)

Genus Ovis.

45. *Ovis montana* (Cuvier).—From the Upper Missouri to within the Arctic circle.

(BOVINÆ.)

Genus Ovibos.

46. *Ovibos moschatus* (Blainville).—Musk ox. Eh-gir-ray-yaz-ey,

(Little Buffalo) of the Chipewyan Indians. Barren grounds and Arctic coast. Not rare.

Genus Bos.

47. *Bos Americanus* (Gmelin).—Bison—North to Little Buffalo River; Great Slave Lake.

Order 4.—Cheiroptera.

48. *Vespertilio subulatus,* (Say.)—North to Salt River. Very rare.

BIRDS.

(Those marked * are winter residents: † Eggs procured.)

Order 1.—Raptores.

Family Falconidæ.

Genus Falco.

1. *Falco anatum,* (Bonap.)—Duck Hawk. North to Slave Lake. Rare.

†2. *Falco columbarius,* (Linn.)—Pigeon Hawk. North to Lapierre's House. Common.

†3. *Falco sparverius,* (Linn.)—Sparrow Hawk. North to Lapierre's House. Rather rare.

Genus Astur.

4. *Astur atricapillus,* (Bonap.)—Black Hawk. North to Fort Good Hope. Rare.

Genus Archibuteo.

5. *Archibuteo sancti, Johannis,* (Gray.)—Black Hawk. North to Salt River. Rare.

6. " *lagopus,* (Gmelin.)—Rough-legged Hawk. North to Lapierre's House. Common.

7. " *ferrugineus?* (Gray.)—Squirrel Hawk. N. to Simpson. Uncertain. Rare.

Genus Buteo.

†8. *Buteo Swainsonii,* (Bonap.)—Swainson's Buzzard. N. to Slave Lake. Rare.

Genus Accipiter.

†9. *Accipiter fuscus,* (Gmelin.)—Sharp shinned Hawk. N. to Simpson. Common.

Genus Circus.

10. *Circus Hudsonicus,* (Lacep.)—Marsh Harrier. N. to Slave Lake. Rather common.

Genus Aquila.

11. *Aquila Canadensis,* (Linn.)—Golden Eagle. N. to Arctic Coast. Rare.

Genus Haliaetus.

†12. *Haliaetus leucocephalus,* (Linn.)—Bald Eagle. N. to Arctic Coast. Common.

Genus Pandion.

†13. *Pandion Carolinensis,* (Gmelin.)—Osprey. N. to Arctic Coast Common.

FAMILY STRIGIDÆ.

Genus Bubo.

•14. *Bubo Virginianus*, var. *subarcticus*, (Swains.)—Horned Owl. N. to Arctic circle and beyond.

Genus Otus.

•15. *Otus Wilsonianus*, (Lesson.)—Long Eared Owl. N. to Fort Simpson. Rare.

Genus Brachyotus.

•16. *Brachyotus Cassinii*, (Brewer.)—Short Eared Owl. N. to Fort Simpson. Common.

Genus Nyctale.

†•17. *Nyctale Richardsonii*, (Bonap.)—Sparrow Owl. N. to Fort Simpson. Rather rare.

Genus Nyctea.

•18. *Nyctea nivea*, (Daudin.)—White Owl. N. to Fort Norman. Rare.

Genus Surnia.

†•19. *Surnia ulula*, (Linn.)—Hawk Owl. N. to Arctic coast. Common.

Order 2 —Scansores.

FAMILY PICIDÆ.

Genus Picus.

•20. *Picus villosus*, (Linn.)—Hairy Woodpecker. N. to Fort Simpson. Common.

•21. " *pubescens*, (Linn.)—Downy Woodpecker. N. to Fort Liards. Not rare.

Genus Picoides.

•22. *Picoides Arcticus*, (Swains.)—Black-backed Woodpecker. N. to Fort Simpson. Rare.

•23. " *hirsutus*, (Vieillôt.)—Banded Woodpecker. N. to Fort Good Hope.

•24. " *dorsalis*, (Baird.)—Striped Woodpecker. N. to Fort Simpson. But one specimen of what I am disposed to consider to be this very rare bird, has been secured. It resembles the *P. hirsutus*, except that the white is marked on the back in longitudinal instead of lateral lines.

Genus Sphyrapicus.

†25. *Sphyrapicus varius*, (Baird.)—Yellow-bellied Woodpecker. N. to Fort Simpson. Common.

Genus Hylatomus.

26. *Hylatomus pileatus*, (Baird ?)—Black Woodcock. N. to Fort Liards. Rare.

Genus Colaptes.

†27. *Colaptes auratus*, (Swains.)—Golden Woodpecker. N. to Peel's River. Common.

Order 3.—Insessores.

FAMILY CAPRIMULGIDÆ.

Genus Chordiles.

†28. *Chordiles popetue*, (Vieillôt.)—Night Hawk. N. to Lapierre's House. Rather rare.

FAMILY ALCEDINIDÆ.

Genus Ceryle.

†29. *Ceryle alcyon*, (Boie.)—Kingfisher. N. to Peel's River. Common.

FAMILY COLOPTERIDÆ.

(Tyranninæ.)

Genus Tyrannus.

30. *Tyrannus Carolinensis*, (Baird.)-King bird. N. to Fort Simpson. Rare.

Genus Sayornis.

†31. *Sayornis fuscus*, (Baird.)—Jewee. N. to Fort Simpson. Rare.

32. " *sayus*, (*Baird.*)—*Say's Flycatcher. N. to Fort Simpson.* Rare.

Genus Contopus.

33. *Contopus borealis*, (Baird.)—Olive-sided Flycatcher. N. to Fort Resolution. Rare.

Genus Empidonax.

†34. *Empidonax pusillus*, (Swain.)—N. to Fort Simpson. Rare.

†35. " *Traillii*, (Traill's Flycatcher.)—N. to Fort Resolution. Rare.

†36. " *minimus*, (Baird.)—Least Flycatcher. *N. to Fort Simpson.* Common.

FAMILY TURDIDÆ. (Oscines.)

(Turdinæ.)

Genus Turdus.

†37. *Turdus Pallasii?* (Cabanis.)—Hermit Thrush. N. to Fort Simpson. Identity uncertain.

†38. " *Swainsonii*, (Cabanis.)—Olive-backed Thrush. N. to Lapierre's House. Abundant.

†39. " *aliciae*, (Baird.)—N. to Youcon River. Only found W. of Rocky Mountains.

†40. " *migratorius*, (Linn.)—Robin. N. to Lapierre's House. Abundant.

(Regulinæ.)

Genus Regulus.

41. *Regulus calendulus*, (Licht.)—Ruby-crowned Wren. Fort Resolution. Rare.

FAMILY SYLVICOLIDÆ.

(Motacillinæ.)

Genus Anthus.

42. *Anthus ludovicianus*, (Licht.)—Tit-Lark. N. to Fort Simpson. Not common.

(Sylvicolinæ.)

Genus Mniotilta.

43. *Mniotilta varia*, (Vieilltôt.)—Black and White Creeper. N. to Fort Simpson. Very rare.

Genus Opornis.

44. *Opornis agilis?* (Connecticut Warbler.)—Fort Simpson. Identity very doubtful.

Genus Helmintophaga.

†45. *Helmintophaga peregrina*, (Cabanis.)–Tennessee Warbler. N. to Fort Simpson.

†46. " *celata*, (Baird.)—Orange-crowned Warbler. N. to Resolution. Rare.

47. " *ruficapilla*, (Wilson.)—Nashville Warbler. N. to Resolution. Rare.

Genus Seiurus.

†48. *Seiurus noveboracensis*, (Gmelin.)—Water Thrush. N. to Lapierre's House. Common.

Genus Dendroica.

†49. *Dendroica coronata*, (Linn.)—Myrtle bird. N. to Lapierre's House. Rare.

†50. " *striata*, (Forster.)—Black-poll Warbler. N. to Lapierre's House. Common.

†51. " *æstiva*, (Gmelin.)—Yellow Warbler. N. to Lapierre's House. Abundant.

†52. " *maculosa*, (Gmelin.)—Black-and-Yellow Warbler. N. to Fort Simpson. Rather rare.

†53. " *palmarum*, (Gmelin.)—Yellow-red-poll Warbler. N. to Resolution. Rare.

Genus Myiodioctes.

54. *Myiodioctes pusillus*, (Wilson.)—Green-Blackcap Flycatcher. N. to Lapierre's House. Very rare.

Genus Setophaga.

†55. *Setophaga ruticilla*, (Linn.)—Red-start. N. to Fort Good Hope. Common.

Family Hirundinidæ.

Genus Hirundo.

57. *Hirundo horreroum*, (Barton.)—Barn Swallow. N. to Fort Resolution. Rare.

†58. " *lunifrons*, (Say.)—Cliff Swallow. N. to Rat River. Common.

59. " *bicolor*, (Vieillôt.)—White-bellied Swallow. N. to Fort Good Hope. Rare.

Genus Cotyle.

†60. *Cotyle riparia*, (Linn.)—Bank Swallow. N. to Fort Simpson. Abundant.

Family Bombycillidæ.

Genus Ampelis.

†*61. *Ampelis garrulus*, (Linn.)—Wax-wing. North to Youcon River, Not rare. An egg of this bird has been obtained on the Youcon, by Mr. R. Kennicott. I have been informed by Mr. John Hope, a schoolmaster of the Church Missionary Society, resident at Fort Franklin on Bear Lake, that these birds build in numbers in that vicinity; but so high up the trees as to render it a difficult task to obtain the eggs. A specimen was shot in February at Fort Liards, which causes me to mark the species as a winter resident.

Family Laniidæ.

Genus Collyrio.

62. *Collyrio borealis*, (Bon.)—Northern Shrike. N. to Fort Good Hope. Not rare.

63. " *ludovicianus?* (Linn.)—Loggerhead Shrike. Rare. Fort Simpson. Doubtful.

(Vireoninæ.)

Genus Vireo.

64. *Vireo olivaceus*, (Vieilltôt.)—Red-eyed Flycatcher. N. to Fort Simpson. Rare.

65. " *gilvus*, (Bon.)—Warbling Flycatcher. N. to Fort Simpson. Rare.

Family Paridæ.

Genus Parus.

*66. *Parus septentrionalis*, (Harris,)—Chickadee. N. to Fort Simpson. Not rare.

*67. " *atricapillus*, (Linn.)—*Blackcap Tit. N. to Fort Simpson.* Rare.

*68. " *Hudsonicus*, (Forster.)—Hudson's Bay Tit. N. to Fort Simpson. Not common.

Family Fringillidæ.

(Cocothraustinæ.)

Genus Pinicola.

*69. *Pinicola Canadensis*, (Brisson.)—Pine Grosbeak. N. to Fort Good Hope. Not rare.

Genus Curvirostra.

*70. *Curvirostra leucoptera*, (Gmelin.)—N. to Fort Good Hope.

Genus Aegiothus.

†*71. *Aegiothus Linaria*, (Linn.)—Lesser Red-poll. N. to Fort Good Hope. Abundant.

†*72. " *canescens*, (Gould.)—Mealy Red-poll. N. to Lapierre's House. Common.

Genus Plectrophanes.

(Plectrophanes.)

73. *Plectrophanes nivalis*, (Meyer.)—Snow Bunting. N. to Fort Good Hope. Abundant.

(Centrophanes.)

74. " *lapponicus*, (Selby.)—Long-spur. N. to Fort Simpson.
75. " *pictus*, (Swainson.)—Painted Bunting. N. to Fort Simpson. Rather rare.

(Spizellinæ.)

Genus Passerculus.

*76. *Passerculus Savanna*, (Bon.)—Swamp Sparrow. N. to Fort Simpson. Abundant around Slave Lake.
77. " *Sandwichensis*, (Baird,)—N. to Fort Simpson. Rare.
78. " *Anthinus?* (Baird.)—Great Bear Lake. Uncertain.

Genus Zonotrichia.

†79. *Zonotrichia leucophrys*, (Forster.)—N. to Resolution. Rare.
†80. " *Gambelii*, (Nuttall.)—N. to Lapierre's House. Abundant.
†81. " *albicollis*, (Gmelin.)—N. to Fort Simpson. Rather rare.

Genus Tunco.

82. *Tunco Oregoneus*, (Towns.)—Oregon Snow Bird. N. to Fort Simpson. Rare.
†83. " *hyemalis*, (Sclater.)—Snow Bird. N. to Fort Good Hope.

Genus Spizella.

†84. *Spizella Montecola*, (Baird.)—Tree Sparrow. N. to Lapierre's House. Abundant.
†85.[a] " *socialis*, (Wilson.)—Social Sparrow. N. to Fort Simpson. Abundant.
†85.[b] " *socialis*, (Wilson.)—Striped-crown variety. N. to Fort Simpson. Common.
†86. " *pallida*, (Bonap.)—N. to Fort Resolution. Rare.

Genus Melospiza.

†87. *Melospiza Lincolnii*, (Baird.)—Lincoln's Finch. N. to Fort Simpson. Not rare.
88. *Melospiza palustris*, (Baird.)—Swamp Finch. N. to Fort Resolution. Rare.

(Passerellinæ.)

Genus Passerella.

†89. *Passerella Iliaca*, (Swainson.)—Fox Sparrow. N. to Lapierre's House. Common.

FAMILY ICTERIDÆ.

Genus Molothrus.

90. *Molothrus pecoris* (Swains.)—Cow-bird. N. to Fort Simpson. Very Rare.

Genus Agelaius.

†91. *Agelaius Phœniceus,* (Vieill.)—Swamp Blackbird. N. to Fort Norman.

92. *Agelaius gubernator,* (Bon.)—Red-shouldered Blackbird. N. to Fort Simpson. Common.

93. *Agelaius tricolor,* (Nutt.)—Red and white-shouldered Blackbird. N. to Fort Simpson. Rare.

Genus Xanthocephalus.

94. *Xanthocephalus sterocephalus,* (Baird.)—Yellow-headed Blackbird. Though no specimen of this bird has been procured, I once observed it at Fort Simpson.

(Icterinæ.)

Genus Scolecophagus.

95. *Scolecophagus ferrugineus,* (Swains.)—Rusty Blackbird. N. to Fort Good Hope. Common.

96. *Scolecophagus cyanocephalus* (Cabanis.)—Brewer's Blackbird. N. to Fort Simpson. Not rare.

(Quiscalinæ.)

Genus Quiscalus.

97. *Quiscalus versicolor,* (vieill.)—Crow Blackbird. N. to Fort Simpson. Rare.

FAMILY CORVIDÆ.

Corvinæ.

Genus Corvus.

*98. *Corvus carnivorus,* (Bartram.)—Raven. N. to Arctic coast. Abundant.

99. *Corvus Americanus,* (Aud.)—Common Crow. N. to 61° north lat. Abundant.

(Garrulinæ.)

Genus Pica.

*100. *Pica Hudsonica,* (Bon.)—Magpie. On west of Mountains N. to Lewis and Pelly Rivers. Not seen in the Mackenzie valley.

Genus Perisoreus.

*101. *Perisoreus Canadensis,* (Bon.)—Canada Jay. N. to Lapierre's House Abundant.

Order 4.—Rasores.

(Columbæ.)

FAMILY COLUMBIDÆ.

(Columbinae.)

Genus Ectopistes.

102. *Ectopistes migratoria,* (Swains.)—Wild Pigeon. N. to Fort Norman. Not common.

(Gallinæ.)

FAMILY TETRAONIDÆ.

Genus Tetrao.

*103. *Tetrao Richardsonii*, (Douglas) Black Partridge. N. to Fort Halkett. Only in the Mountains.

†*104. *Tetrao Canadensis*, (Linn.)—Spruce Partridge. N. to Arctic coast. Abundant.

Genus Pediœcetes.

†*105. *Pediœcetes phasianellus*, (Baird.)—Sharp-tailed Grouse. N. to Fort Good Hope.

Genus Bonasa.

†*106*a* *Bonasa umbellus*, (Steph.)—Ruffed Grouse. N. to Fort Simpson. Common.

†*106*b* *Bonasa umbellus*, var. *umbelloides*, (Baird.)—Grey Mountain Grouse. N. to Lapierre's House. Common.

Genus Lagopus.

*107. *Lagopus albus*, (Aud.)—White Ptarmigan. N. to Arctic coast. Common.

*108. *Lagopus rupestris*, (Leach.)—Ptarmigan. N. to Arctic coast. Rather rare.

*109. *Lagopus leucurus*, (Swains.)—White-tailed Ptarmigan. N. to Lapierre's House in the mountains.

Order 5.—*Grallatores.*

(Herodiones.)

FAMILY GRUIDÆ.

Genus Grus.

110. *Grus Americanus*, (Ord.)—White Crane. N. to Fort Simpson. Rare.

†111. *Grus Canadensis*, (Temm.)—Brown Crane. N. to Arctic coast. Common.

112. *Grus fraterculus*, (Cassin.)—N. to Youcon River: but only west of the mountains.

Genus Botaurus.

113. *Botaurus lentiginosus*, (Steph.)—Bittern. N. to Arctic coast. Rare northward.

(Grallæ.)

FAMILY CHARADRIDAE.

Genus Charadrius.

114. *Charadrius Virginicus*, (Bork.)—Golden Plover. N. to Arctic coast. Abundant.

Genus Aegialitis,

115 *Ægialitis semipalmatus*, (Cab.)—Semipalmated Plover. N. to Fort Simpson. Common.

Genus Squaterola.

116 *Squaterola Helvitica*, (Cuv.)—Black bellied Plover. N to Fort Simpson. Rare.

FAMILY HŒMATOPODIDAE.

Genus Strepsilas.

117 *Strepsilas interpres,* (Illig.)—Turnstone. N. to Big Island. Rare.

FAMILY RECURVIVOSTRIDAE.

Genus Recurvirostra.

118 *Recurvirostra Americana,* (Gmelin.)—American Avosit. N. to Fort Rae. Rare.

FAMILY PHALAROPODIDAE.

Genus Phalarophus.

†119 *Phalarophus hyperboreus,* (Temm.)—N. to Fort Rae. Rare.

FAMILY SCOLOPACIDAE.

(Scolopacinae.)

Genus Gallinago.

120 *Gallinago Wilsonii,* (Bon.)—English Snipe. N. to Fort Simpson. Rare.

Genus Macrorhampus.

†121 *Macrorhamphus griseus,* (Leach.)—Red-breasted Snipe. N. to Fort Norman. Rather rare.

122 *Macrorhamphus scolopaceus,* (Lawrence.)—N. to Lapierre's House. Rare.

Genus Tringa.

123 *Tringa maculata,* (Vieill.)—Sack Snipe. N. to Fort Simpson. Common.

124 *Tringa Wilsonii,* (Nuttal.)—Least Sandpiper. N. to Fort Simpson. Rather rare.

†125 *Tringa Buonapartii,* (Schlegel.)—N. to Fort Simpson. Rare.

Genus Calidris.

126 *Calidris arenaria,* (Illiger.)—Sanderling. N. to Big Island. Rare.

Genus Ereunetes.

127 *Ereunetes petrificetus,* (Ill.)—Semipalmated Sandpiper. N. to Fort Simpson. Rare.

Genus Micropalama.

†128 *Micropalma himantopus,* (Baird.)—N. to Fort Simpson. Very rare.

(Totaninae.)

Genus Gambetta,

129 *Gambetta melanoleuca,* (Tell-tale) (Bon.)—N. to Fort Simpson. Rare.

†130 *Gambetta flavipes,* (Bon.)—Yellow legs. N. to Lapierre's House. Abundant.

Genus Ryacophilus.

131 *Rhyacophilus solitarius,* (Bon.)-Solitary sandpiper. N. to Fort Simpson. Common. It is rather a misnomer to call this bird solitary, as I have generally observed them in large flocks.

Genus Tringoides.

†132 *Tringoides macularius*, (Gray.)—Spotted sand-piper. N. to Fort Simpson. Abundant. I have never observed this species to keep in flocks.

Genus Tryngites.

133 *Tryngites rufescens*, (Cabanis.)—Buff breasted sandpiper. Rare. N. to Fort Simpson.

Genus Limosa.

134 *Limosa Hudsonica*, (Swainson.)—N. to Big Island and Fort Rae. Rare.

Genus Numenius.

135 *Numenius borealis*, (Latham.)—Eskimos Curlew. N. to Fort Good Hope. Rare.

FAMILY RALLIDÆ.

Rallinæ.

Genus Porzana.

(Porzana.)

136 *Porzana Carolina*, (Viell.)—Common Rail. N. to Big Island. Rare.

Genus Fulica.

137 *Fulica Americana*, (Gmelin.)—Coot. N. to Fort Simpson. Rather rare.

Order 6.—Natatores.

(Anserès.)

FAMILY ANAPIDAE.

(Cygninæ.)

Genus Cygnus.

(Olor.)

138 *Cygnus Americanus*, (Sharpless.)—American Swan. N. to Arctic Coast. Not common.

†139 *Cygnus buccinator*, (Richardson.)—Trumpeter Swan. N. to Arctic Coast. Common.

(Anserinæ)

Genus Anser.

(Chen)

140. *Anser hyperboreus*, (Sallas.)—Snow Goose. N. to Arctic Coast. Abundant.

141. *Anser albatus*, (Cassin,)—North to Fort Resolution. Although no specimen of this Goose is among our collections, I am confident that I have shot it on Slave Lake.

*142 *Anser Rossii*, (Baird).—Ross's Wavy. N. to Fort Resolution. Rather common. There can be little doubt of the existence of these three species of Snow Geese, (exclusive of the Blue Wavy of Hudson's Bay) as the Slave Lake Indians have a different name for each kind. The first which arrives is the middle-sized species which I believe to be the *A. albatus;* next comes the smallest sort, the *A. Rossii;* and lastly the *A. Hyperboreus*, which arrives when the trees are in leaf, and is called the yellow wavy by the Indians.

(Anser.)

143 *Anser Gambelii*, (Hartlaub).—White-fronted Goose. N. to Arctic Coast. Common.

Genus Bernicla.

†144 *Bernicla Canadensis*, (Boie).—Canada Goose. N. to Arctic Coast. Common.

†145 *Bernicla Hutchinsii*, (Bonap).—Hutchin's Goose. N. to Arctic Coast. Rather common.

*146 *Bernicla Barnstonii?* (Ross).—This Bird was shot at Fort Simpson. It is of very large size, with the breast of a bright fawn color. The delta of feathers running up into the lower mandible, is white, instead of black as in *B. Canadensis*. The tail is of sixteen feathers. The Indians consider it a species distinct from the Canada Goose. It seldom flies in parties of more than five or six. I cannot however positively state it to be a new species, until the Berniclæ of North America are properly worked up, as our knowledge of them is at present very imperfect.

147 *Bernicla Brenta*, (Stephens).—Brant. N. to Youcon River. From information. This may probably be the *B. nigricans*, (Cassin), as the Youcon has in all likelihood a Pacific Fauna.

(Anatinæ.)

Genus Anas.

†148 *Anas boschas*, (Linn).—Mallard. N. to Arctic Coast. Abundant.

Genus Dafila.

†149 *Dafila acuta*, (Senyns).—Pin-tail. N. to Lapierre's House. Common.

Genus Nettion.

†150 *Nettion Carolinensis*, (Baird).—Green-winged Teal. N. to Peels River. Abundant.

Genus Querquedula.

†151 *Querquedula discors*, (Steph).—Blue-winged Teal. N. to Fort Resolution. Rare.

Genus Spatula.

†152 *Spatula clypeata*, (Boie).—Shoveller. N. to Fort Good Hope. Not common.

Genus Moreca.

†153 *Moreca Americana*, (Stephens).—American Widgeon. N. to Peels River. Common.

(Fuligulinæ).

Genus Fulix.

154. *Fulix marila*, (Baird).—Big-black-head. N. to Fort Resolution. Rather rare.

†155. *Fulix affinis*, (Baird).—Little-black-head. N. to Peels River. Abundant.

156. *Fulix collaris*, (Baird).—Ring-necked duck. N. to Fort Simpson. Rare.

Genus Aythya.

†157. *Aythya vallisneria*, (Bon).—Canvass Back. N. to Slave Lake. Common.

Genus Bucephala.

†158. *Bucephala albeola*, (Baird).—Spirit duck. N. to Arctic Coast. Abundant.

†159. *Bucephala americana*, (Baird).—Golden-eye. N. to Arctic Coast. Not rare.

Genus Histrionicus.

160. *Histrionicus torquatus*, (Bon).—Harlequin duck. N. to Arctic Coast. Rare.

Genus Harelda.

161. *Harelda glacialis*, (Leach).—South-southerly. N. to Arctic Coast. Abundant.

Genus Malanetta.

†162. *Malanetta velvetina*, (Baird).—Velvet duck. N. to Arctic Coast. Not rare.

Genus Pelionetta.

163. *Pelionetta perspicillata*, (Kaup).—Surf duck. N. to Seels River. Abundant.

Genus Somateria.

164. *Somateria V. nigra*, (Gray).—Slave Lake Eider. A male specimen of this very rare bird was shot by me at Fort Resolution in 1858, and a female was obtained by Mr. Alex. McKenzie in 1861 at the same place. It is exceedingly rare, having never been seen anywhere else in this District.

(Erismaturinæ.)

Genus Erismatura.

165. *Erismatura rubida*, (Bon).—Ruddy duck. N. to Slave Lake. Rare

(Merginæ.)

Genus Mergus.

166. *Mergus serrator*, (Linn).—Red-breasted Merganser. N. to Peels River. Common.

Genus Lophodytes.

167. *Lophodytes cucullatus*, (Reich).—Hooded Merganser. N. to Slave. Lake. Rare.

(Gaviæ).

Family Phalacrocoracidæ.

Genus Graculus.

168. *Graculus dilophus*, (Gray).—Double-crested Cormorant. Slave Lake. Rare.

Family Pelecanidæ.

Genus Pelecanus.

(Cyrtopelicanus.)

169. *Pelecanus erythrorhynchus*, (Gmelin) (American Pelican).—N. to Big Island. Common

Family Laridæ.

(Lestridinæ.)

Genus Stercorarius.

170. *Stercorarius pomarinus*, (Temm).—Pomarine skua. Slave Lake. Very rare.

171. *Stercorarius parasiticus*, (Temm).—Arctic skua. N. to Fort Simpson. Rare.

†172. *Stercorarius parasiticus*, var. *Richardsonii*.—Slave Lake. Rare.

173. *Stercorarius catarractes*, (Temm.)—Slave Lake. Very rare.

174. *Stercorarius cepphus*, (Brünn).–Buffon's skua. N. to Lapierres & Co. Rare.

(Larinæ.)

Genus Larus.

†175. *Larus glaucescens*, (Licht).—Glaucus-winged Gull. Slave Lake. Abundant.

†176. *Larus argentatus*, (Brünn).—Herring Gull. N. to Arctic Coast. Abundant.

†177. *Larus Californicus*, (Lawrence).—California Gull. Slave Lake. Abundant.

Genus Chroicocephalus.

178. *Chroicocephalus Philadelphia*, (Lawrence).—N. to Fort Simpson. Not rare.

Genus Rissa.

179. *Rissa septentrionalis*, (Lawrence).—Slave Lake. Common.

(Sterninæ.)

Genus Sterna.

†180. *Sterna Caspia*, (Pallas).—Caspian Tern. Slave Lake. Rare.

†181. *Sterna Wilsonii*, (Bon).—Wilson's Tern. Slave Lake and Bear Lake. Rather rare.

†182. *Sterna macroura*, (Naum).—Arctic Tern. N. to Bear Lake. Abundant.

Genus Hydrochelidon.

183. *Hydrochelidon plumbea*, (Wils).—Short-tailed Tern. Slave Lake Rare. Numerous other species of the sub-family Lari

næ doubtless exist in this District, which will appear by degrees, as the collections increase.

FAMILY COLYMBIDÆ.

(Colymbinæ).

Genus Colymbus.

184. *Colymbus torquatus*, (Brünnich).—Loon. N. to Arctic Coast. Abundant.

185. *Colympus Adamsi.*—Abundant on Great Slave Lake.

†186. *Colympus arcticus* var. *Pacificus*, (Linn).—N. to Arctic Coast. Rather rare.

187. *Colymbus septentrionalis*, (Linn).—Red-throated Diver. N. to Arctic Coast. Abundant.

(Podicipinæ).

Genus Podiceps.

†188. *Podiceps griseigena*, (Grey).—Red-necked Grebe.—to Peel's River. Common.

†189. *Podiceps cornutus*, (Latham).—Horned Grebe. N. to Lapierres & Co. Common.

190. *Podiceps auritus*, (Lath).—Eared Grebe. Slave Lake. Rare.

Genus Podilymbus.

†191. *Podilymbus podiceps*, (Lawrence).—Slave Lake. Not common.

(Additional.)

192. *Numenius Hudsonicus*, (Latham).—Hudsonian Curlew. Slave Lake. Rare.

The Northern range of the birds means the Northernmost Post at which a specimen has been obtained. I have on hand about 300 specimens, as yet unexamined, among which a few additional species will doubtless be found.

The following other collections have been made :—

Fish. At Fort Resolution, Big Island, Simpson and Bear Lakes, and Fort Liards.

Insects. At Resolution, Simpson, Youcon, Peel's River and Fort Good Hope.

Geological specimens, Fossils, &c., at the Clear Water, Elk, MacKenzie, Anderson, and Rat Rivers, and Slave Lake.

Ethnological specimens. In the District generally.

ARTICLE XIV.—*Notes on Chemical Subjects. By Prof. S. P. Robbins.*

Much attention has been directed within the past ten years to the economical value of silica as a preservative of metals and stone, and as a water-proof, and to some extent fire-proof coating for wood, as well as an important ingredient in the manufacture of artificial stone. Heretofore, however, it has been commonly applied in the form of a solution of the soluble silicate of potash and soda—the so-called water-glass—the alkali, to which the solubility was due, being removed either by the slow action of the weather, or by chemical agents specially employed for the purpose. Thus superfluous and even injurious compounds were necessarily introduced, which, when removed by solution or efflorescence, left the preservative coating porous and permeable. It is now known, however, that pure silica may in certain cases be dissolved in pure water; thus, if sulphide of silicium be dissolved in water sulphuretted hydrogen is evolved, and silica remains perfectly dissolved and in large amount; or if pure water be separated by a septum of parchment paper from a solution of silicate of soda supersaturated with hydrochloric acid, after a few days the hydrochloric acid and chloride of sodium passing through the septum will leave an aqueous solution of silica on the other side of the diaphragm. It is obvious that such a solution, which may be prepared in many other ways than those here described, will possess many advantages over a solution of water-glass, as a preservative whether of wood or of stone.

As aluminum from its malleability, ductility, tenacity, remarkable lightness, beautiful colour and impassivity to the action of those ever present chemical agents which so rapidly tarnish silver and the commoner metals, promises to become of great economic value, it is gratifying to find that the cost of its production is rapidly diminishing, so that its price has descended from £60 per lb. to 60s., at which price it is now furnished by the Aluminum Works at Newcastle.

Wood publishes in the Journal of the Franklin Institute the following formula for a fusible metal which becomes perfectly liquid at 180°F.; cadmium 1 part, lead 6 parts, bismuth 7 parts. This alloy has a bright metallic colour, is flexible in thin plates, is imperfectly malleable, and about as hard as coarse solder.

ARTICLE XV.—*On the date of the Report on the Geology of Wisconsin, noticed in this Journal, Vol. VI. p. 465.*

In the number of this Journal for December last, there is a notice of one sheet of Prof. Hall's recent Report on the Geology of Wisconsin. On the 12th of March, 1862, two copies of the same report were received at the office of the Geological Survey of Canada, by mail. Both of these are dated January 1, 1861. On one of the copies there are indorsed with pen and ink the words, "Published Nov., 1861." I do not recognize the handwriting, but it is evident that one of the dates must be incorrect, and I believe both are. I have some evidence that the report was not published until about the middle of December, 1861, eleven months after the date printed on the cover, and I am obliged to call attention to it for the following reasons:

On the 21st of November last, I published a paper containing descriptions of a number of new species of fossils, principally from the Potsdam sandstone and other associated formations. On the 22nd I sent a copy to Prof. Hall by mail. In the January No. of Silliman's Journal, he alludes to it in his letter on the Potsdam sandstone, and Hudson River rocks of Vermont. As a general rule, articles intended for that Journal must be in the hands of the publishers about one month previously to the date of publication. It seems quite certain, therefore, that my paper was in Prof. Hall's possession in the latter part of November, most probably about the 24th of the month. In my paper I described a new genus of fossil Brachiopoda under the name of *Obolella*. One of the species to which I referred as exhibiting the characters of the genus, occurs in the Potsdam sandstone of Wisconsin. Prof. Hall has described this species on p. 24 of his report, under the name of *Lingula polita*, and has also pointed out that its characters are not the same as those of either *Obolus* or *Lingula*. His remarks are in substance the same as mine except that he notices an "obtuse dental process on each side of the rostral cavity," which is not visible in any of our specimens. On comparing the two papers any person would be justified in supposing that I had taken the idea of the genus *Obolella* from Prof. Hall. Thus by antedating his report eleven months, he lays me open to the charge of plagiarism, which is certainly very unfair. I never saw his report, nor had any knowledge of its contents, nor of its existence, until I saw the notice of it in this Journal in the beginning of February, 1862, at which time the December number was issued,—more than two months after my paper was distributed, and fourteen months after the time he has given the public to understand that his was published. I am compelled, therefore, in self-defence, to correct his erroneous date.

Some of my scientific friends have advised me to take no notice of this and similar matters. They, however, are engaged in different fields of research from that occupied by Prof. Hall and myself, and as they cannot come into collision with him, they can look upon these affairs with the most stoical composure. Were they in my position, they would soon feel their magnanimity very sensibly diminished, and rapidly oozing away from them. For the last four years I have been subjected to great annoyance in consequence of Prof. Hall's extraordinary practice of antedating his publications, and I have a perfect right, and shall not hesitate on every occasion, to resist in the most public manner.

E. BILLINGS.

Montreal April 15, 1862.

REVIEWS AND NOTICES OF BOOKS.

A Manual of the Sub-Kingdom Cœlenterata. By JOSEPH REAY GREENE, B.A., Professor of Natural History in the Queen's College, Cork. London, 1861. Longman & Co. 12mo, pp. 271.

"The author of this work is already favourably known by his "Manual of Protozoa," with a general introduction on the Principles of Zoology—which is an excellent text-book for students. The present volume is an abridgment of a larger work, which the author hopes ere long to publish. The Cœlenterata include such animals as the Hydra, Sertularia, Medusa, Actinia, and Zoophyte. They are all furnished with an alimentary canal, freely communicating with the general or somatic cavity. The substance of the body consists essentially of two separate layers; an outer, or ectoderm, and an inner, or endoderm. These two membranes, but especially the former, are in general provided with ciliæ. In the integument of those organisms we constantly meet with peculiar thread-cells, which, when they come into contact with the human skin, frequently produce disagreeable stinging sensations. The sub-kingdom is divided into two orders:—1. *Hydrozoa,* in which the wall of the digestive sac is not separated from that of the somatic cavity, and the reproductive organs are external; 2. *Actinozoa,* in which the wall of the digestive sac is separated from that of the somatic cavity by an intervening space, subdivided into chambers by a series of vertical partitions, in the faces of which the reproductive organs are developed. The author gives the morphology, physiology, classification, and distribution as regards space and time, of the animals included in these two orders. The facts are stated in a clear and interesting manner, and are illustrated by numerous excellent woodcuts. The author has given the most recent observations in regard to the anatomy and physiology of the animals, and has produced a manual of great value to the student of zoology, to whom these lower types of animals must ever present attractive subjects for observation. Physiology is indebted in no small degree for its progress to the labours of naturalists who have made researches into the functions of these animals, and we do not know any department of natural history more deserving of attention. Much has been done of late years in the illustration of the various divisions of the Cœlenterata by Forbes, Allman, Huxley, Hincks, Busk, Strethill, Wright, Gosse, Agassiz, Sars, Siebold, Steenstrup, Müller, Milne-Edwards, Gegenbaur, Leuckart, and others. We have much pleasure in recommending Mr. Greene's work as an excellent epitome of all that has been done by these authors. There is a valuable bibliography appended, along with a series of questions which are well calculated to test the student in regard to his knowledge of the subject."—*Edinburgh New Philosophical Journal.*

Scripture and Science not at variance; with Remarks on the Historical Character, Plenary Inspiration, and Surpassing Importance of the Earlier Chapters of Genesis. By JOHN H. PRATT, M.A., Archdeacon of Calcutta. 4th Edition, London: Thomas Hatchard. 1861. 8vo, pp. 158.

"It has often been said that the discoveries of science are at variance with the statements of Scripture, and it is sometimes difficult for those who believe in the inspiration of the sacred volume to repel the charge made against it by sceptical men of science. The object of Archdeacon Pratt's work is to present such persons with a reply in a concise and portable form. It points out the difficulties to be met with and the objections to be removed, and tends to strengthen the faith of those who believe the Word of God. The author gives instances in which Scripture and science were supposed to be antagonistic, but which were cleared up by subsequent discoveries. He then enters on an examination of the earlier part of the Book of Genesis, and concludes that no new discoveries, however startling they may appear at first, need disturb our belief in the plenary inspiration of the sacred volume, or damp our ardour in the pursuit of science. The vexed questions in regard to the six days of creation, the origin of man and of species, of death before Adam, the nature of the Deluge, the origin of languages, are ably handled. Many apparent discrepancies are explained, and several false theories are exposed. The author writes as a man of science, and at the same time a believer in the Bible; and he supports his views by able and judicious arguments. "The *hasty* and *immature* deductions of science may sometimes stand in opposition to Scripture; but their *settled* results, in which the body of philosophers agree, often confirm and illustrate the statements of the inspired Volume. Let us then hold firm our grasp upon this truth, that the Scriptures are the infallible Word of God, true in every statement they contain, although the interpretation sometimes demands more knowledge than we at present possess; but let us at the same time remember, that there is no ground whatever for ceasing to pursue science, in all its branches, with an ardent and fearless mind. God's Word and Works never have contradicted each other, and never can do so. The progress of science in inevitable, and it is the glory of man's intellectual endowments. It is the setting forth of the greatness and wisdom of the Creator in His works. Let us therefore push on investigations to the utmost with untiring energy. We have nothing to fear. The greatest perplexities may at any time surround us; but both reason and experience have armed us with arguments which assure us that all will be right. Whatever happens, let our persuasion always be avowed, that Scripture cannot err. Let us be content rather to remain puzzled, than to abandon, or even question, a truth which stands upon so immovable a basis."—*Edinburgh New Philosophical Journal.*

Erratum.—On Page 87 last line, for "*Plectrophanes nivalis*" read "*Fringilla nivalis*, Wilson."

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

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

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

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in tenths.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	30.177	29.977	29.992	— 4.0	28.4	17.4	.024	.142	.087	.45	.88	.84	N. E. by E.	N. E. by E.	N. E. by E.	64.70	3.0	...	1.10	Cu. Str. 10.	Snow.	Snow.
2	205	30.250	30.349	6.0	20.5	5.0	.087	.075	.040	.64	.70	.70	N. N. W.	N.	N.	64.80	1.5	...	...	Clear.	Cirr. Cum. 4.	Clear. Zodiacal Light Bright.
3	364	339	197	—17.1	12.1	4.9	.008	.045	.032	.40	.60	.60	E. by S.	N. E. by E.	N. E. by E.	18.30	1.0	...	...	Clear.	C. C. Str. 8.	Snow.
4	139	112	254	4.1	14.2	4.5	.038	.061	.038	.73	.73	.73	N. E. by E.	N. E. by E.	S. S. E.	189.40	3.0	Inapp.	0.57	Cu. Str. 10.	Cu. Str. 6.	Cu. Str. 10.
5	367	279	258	—12.1	18.9	8.1	.012	.077	.048	.50	.76	.77	S. S. E.	S. E.	S. S. E.	2.70	2.5	...	...	Hoar frost.	Clear.	Clear. Imp. Lunar Halo.
6	046	29.769	29.085	1.0	24.1	17.1	.032	.094	.078	.70	.73	.85	N. E. by E.	N. E. by E.	N. E. by E.	119.00	4.5	...	0.51	C. C. Str. 4.	Cu. Str. 10.	Snow.
7	29.759	862	30.060	14.1	21.0	14.8	.067	.075	.051	.81	.71	.65	W.	W. N. W.	W. N. W.	293.30	2.5	...	1.10	Cu. Str. 10.	" 6.	C. C. Str. 4.
8	30.098	30.096	29.988	0.0	24.0	11.0	.030	.094	.048	.69	.73	.69	N. W.	N. W.	N. W.	27.20	1.5	...	...	Clear.	" 2.	" 10. Lunar Halo.
9	29.885	29.847	994	0.0	27.0	10.3	.034	.111	.049	.71	.75	.70	S. by E.	S. W.	S. W.	8.30	1.5	...	...	Str. 2.	Clear.	Clear.
10	30.008	949	960	—17.0	15.6	— 5.4	.011	.065	.030	.51	.74	.82	N. E. by E.	E. by E.	E. S. E.	1.90	1.0	...	...	Clear.	"	C. C. Str. 8. Lunar Corona.
11	29.840	757	600	— 4.7	17.0	11.0	.029	.053	.067	.82	.58	.79	N. E. by E.	N. E. by E.	N. E. by E.	68.00	2.0	...	...	C. C. Str. 4.	Cu. Str. 4.	C. Cirr. 4. Lunar Halo.
12	560	644	762	18.0	28.8	27.7	.078	.127	.129	.81	.76	.88	S. S. E.	W.	S. W.	57.50	3.0	...	1.17	Snow.	C. C. Str. 4.	Cu. Str. 10.
13	990	951	923	1.1	17.4	14.1	.088	.047	.067	.85	.50	.81	W.	S. S. W.	N. E. by E.	48.80	2.0	...	0.51	Clear.	Cu. Str. 10.	C. C. Str. 10.
14	778	700	30.004	16.0	24.7	4.2	.080	.105	.036	.91	.80	.70	N.	N. by W.	W. by N.	122.10	3.0	...	0.77	Snow.	C. C. Str. 4.	Clear.
15	30.115	997	29.952	—19.9	14.0	7.9	.002	.051	.048	.67	.63	.77	S. S. E.	N. E. by E.	N. E. by E.	29.30	2.0	...	...	Cu. Str. 4.	Cu. Str. 4.	C. Str. 4. Imp. Solar Halo.
16	106	30.300	30.382	2.0	19.0	3.8	.034	.061	.028	.71	.60	.57	W. by N.	W. by N.	W. by N.	138.40	2.0	...	...	Clear.	Clear.	Clear.
17	427	325	190	— 2.1	19.7	10.6	.027	.081	.048	.67	.77	.69	S. S. E.	S. S. E.	N. N. E.	33.10	1.5	...	...	Cirr. Str. 4.	Cu. Cir. 4.	"
18	29.845	29.764	030	12.5	34.0	25.0	.060	.155	.105	.80	.79	.80	N. E. by E.	W. S. W.	W. by S.	148.10	2.0	...	1.14	Snow.	Cu. Str. 8.	Clear. Zodiacal Light Bright.
19	30.204	30.154	29.949	10.0	25.3	19.4	.054	.105	.093	.78	.80	.92	S. E.	N. E. by E.	N. E. by E.	46.90	2.5	...	...	Cu. Str. 10.	" 2.	Cu. Str. 10.
20	29.747	29.714	791	16.1	21.4	9.0	.074	.090	.050	.84	.78	.76	N. E. by E.	W.	W.	190.00	2.0	...	4.14	" 4.	" 4.	Clear. Au. Bor. & Zod. Lt. Bright.
21	30.174	30.111	30.047	2.0	31.0	20.2	.034	.166	.090	.71	.78	.84	W. by S.	W. S. W.	W. S. W.	247.60	1.0	...	...	Clear.	" 2.	Cu. Str. 10.
22	29.882	29.814	29.084	16.0	34.2	20.0	.073	.155	.097	.82	.79	.92	E. by N.	W.	S. by E.	5.00	1.5	...	Inapp.	Cu. Str. 10.	Clear.	Clear.
23	734	679	620	18.0	37.9	32.1	.082	.177	.162	.84	.80	.89	S. W.	S. W.	W. S. W.	28.70	1.0	...	...	" 8.	Cu. Str. 10.	Cu. Str. 10.
24	431	324	679	31.1	27.9	7.1	.155	.117	.045	.89	.77	.76	N. E. by E.	N. E. by E.	W.	283.16	3.0	...	12.16	Snow.	Snow.	" 10.
25	30.103	30.152	30.206	—11.1	16.4	5.5	.014	.059	.016	.54	.66	.87	W. by N.	W. by N.	W. by N.	525.20	1.5	...	...	Clear.	Clear.	Clear. Zodiacal Light Bright.
26	090	29.901	29.769	—10.1	25.6	2.0	.017	.094	.034	.57	.68	.71	S. S. W.	S. W.	S. S. W.	37.80	1.0	...	...	"	"	" " " "
27	29.614	507	578	4.0	20.0	17.4	.038	.081	.072	.75	.77	.75	N. E. by E.	W. S. W.	W. S. W.	124.59	2.0	...	1.10	Cu. Str. 10.	Snow.	Snow.
28	490	474	513	14.0	28.4	22.0	.067	.123	.101	.81	.82	.86	W. S. W.	W. S. W.	W.	241.60	2.0	...	3.50	Snow.	"	Cu. Str. 10.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

REPORT FOR THE MONTH OF MARCH, 1862.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	29.679	29.700	29.791	11.1	23.0	19.1	.057	.095	.077	.79	.79	.77	W. S. W.	W.	W.	302.70	2.5	...	0.75	Snow.	C. C. Str. 4.	Cirr. Str. 10.
2	929	942	952	17.1	32.1	15.0	.078	.143	.161	.87	.79	.73	W. by S.	W.	W.	76.70	1.5	...	...	Cirr. Cum. 4.	Clear.	Clear. Zodiacal Light Bright.
3	920	814	742	— 3.1	32.1	25.6	.025	.143	.111	.66	.79	.81	E.	N. E. by E.	N. E. by E.	0.70	2.5	...	...	Clear.	C. C. Str. 4.	Cu. Str. 10.
4	318	420	507	33.1	34.6	24.6	.168	.162	.105	.89	.84	.80	N. E. by E.	N. E. by E.	N. E. by E.	363.50	3.5	...	1.85	Snow.	Cu. Str. 10.	Snow.
5	498	500	504	23.0	31.4	24.1	.106	.130	.111	.86	.74	.86	W. S. W.	W. S. W.	W. by W.	330.00	3.5	...	5.00	"	Snow.	Cirr. Str. 10.
6	511	574	601	22.1	41.0	28.0	.098	.212	.135	.78	.82	.96	W. S. W.	S. W.	W. by W.	119.70	3.5	...	1.09	Cu. Str. 10.	Cu Str. 10.	Snow.
7	662	741	779	20.0	50.1	35.2	.091	.283	.182	.83	.78	.89	W. by S.	W. S. W.	W.	34.10	2.0	...	...	Fog.	Clear.	Cirr. Str. 2.
8	823	947	30.051	26.2	56.2	34.2	.126	.391	.160	.86	.87	.86	W. by S.	S. W.	S. W.	10.40	1.5	...	...	Cirr. Str. 8.	"	Clear.
9	30.152	30.147	062	24.1	49.7	34.2	.094	.265	.155	.76	.74	.80	S. W.	W.	S. W.	10.60	1.5	...	...	Clear.	"	C. C. Str. 10.
10	29.790	29.592	29.417	33.1	36.7	34.7	.168	.164	.169	.89	.76	.84	S. by E.	S. by E.	S. E.	203.60	3.5	0.581	...	Rain.	Rain.	Rain.
11	800	897	901	30.0	36.4	30.0	.130	.170	.132	.78	.80	.79	S. E.	N. W.	S. W.	242.50	3.5	...	...	Cu. Str. 4.	C. C. Str. 4.	C. Cum. 4. Lunar Halo.
12	802	789	30.064	21.4	39.7	21.3	.105	.188	.095	.80	.77	.79	W. by S.	N. by W.	N. N. E.	201.10	2.5	...	0.40	Cirr. 4.	Snow.	Str. 2.
13	30.211	30.279	213	6.4	30.3	26.1	.040	.124	.120	.70	.73	.86	W. S. W.	S. S. W.	N. E. by E.	44.20	1.5	...	0.09	Clear.	Cirr. Cu. 4.	Snow.
14	057	030	057	25.1	36.4	23.4	.117	.146	.106	.88	.87	.86	N. E. by E.	N. E. by E.	N. E. by E.	200.50	3.5	...	0.63	Snow.	Snow.	Cu. Str. 10.
15	29.934	29.817	29.749	24.2	30.4	23.4	.111	.142	.100	.86	.84	.79	N. E. by E.	N. E. by E.	N. E. by E.	326.90	4.0	...	3.98	Cu. Str. 10.	"	" 10.
16	609	579	600	21.1	27.0	26.1	.085	.105	.117	.78	.70	.82	N. E. by E.	N. E. by E.	N. E. by E.	641.40	2.0	...	...	" 10.	Cu. Str. 10.	Snow.
17	647	727	734	24.1	27.9	24.2	.111	.117	.094	.76	.74	.87	N. E. by E.	N. E. by E.	N. E. by E.	403.60	3.0	...	1.47	" 10.	Light snow.	Slight Snow.
18	999	30.074	30.027	25.1	45.6	24.3	.117	.245	.094	.87	.80	.73	N. E. by E.	S. S. W.	N. N. E.	6.90	1.5	...	0.74	C. C. Str. 4.	Clear.	Str. 4.
19	30.079	29.977	054	6.1	39.0	19.0	.029	.195	.072	.51	.82	.70	N. E. by E.	W. S. W.	E. S. E.	24.70	1.0	...	...	Str. 4.	Cu. Str. 4.	Clear. Zodiacal light. Au. Borealis.
20	29.977	997	002	7.4	43.0	34.2	.040	.209	.162	.64	.75	.80	S. S. W.	S.	E. N. E.	0.00	1.0	...	...	Clear.	Clear.	"
21	834	730	29.648	20.1	34.6	32.0	.091	.169	.162	.85	.84	.89	N. N. E.	N. E. by E.	S. E.	79.30	2.5	...	1.75	Cu. Str. 10.	Snow.	Snow.
22	440	437	432	30.0	36.4	35.4	.136	.170	.189	.83	.80	.92	N. E. by E.	N. E. by E.	N. E. by E.	1.10	2.0	...	...	" 4.	Cu. Str. 4.	Sleet.
23	519	574	637	33.4	50.0	34.2	.162	.283	.162	.84	.78	.84	S. E. by E.	S. E.	S. W.	0.30	1.8	...	...	" 10.	C. C. Str. 10.	Nimb. 10.
24	496	644	630	32.4	42.6	32.0	.175	.194	.143	.89	.74	.79	W.	S. W.	W. S. W.	0.10	2.5	0.040	...	C. C. Str. 8.	Cu. Str. 4.	Clear.
25	727	751	804	31.1	36.9	28.8	.140	.156	.111	.80	.75	.71	W.	W. S. W.	W.	183.20	1.0	...	...	Cu. Str. 2.	Clear.	C. C. Str. 8.
26	807	900	952	28.4	42.7	23.0	.129	.193	.087	.83	.71	.72	[illegible]	S. S. W.	W.	159.00	1.0	...	...	Clear.	"	Clear. Aurora Borealis.
27	927	841	960	14.1	52.0	35.0	.051	.315	.183	.63	.83	.90	W. [illegible] S.	S. S. W.	S. W.	50.70	1.0	...	...	"	"	Cu. Str. 4.
28	824	917	30.050	17.1	32.9	26.2	.068	.137	.105	.75	.73	.75	W.	N. E. by E.	N. E.	314.70	1.5	...	...	C. C. Str. 4.	"	Clear. Zodiacal Light Bright.
29	30.124	30.121	120	15.7	42.4	32.4	.065	.215	.143	.74	.73	.79	W. S. W.	W. S. W.	W. S. W.	22.20	1.0	...	...	Clear.	"	"
30	097	109	29.917	18.7	48.1	32.1	.077	.234	.143	.76	.80	.79	W. S. W.	W. S. W.	S. S. E.	4.90	1.0	...	...	"	C. Cirr. 4.	"
31	29.821	29.820	924	32.6	60.2	34.2	.175	.203	.162	.94	.82	.84	S. S. E.	S.	E. by N.	207.20	2.5	Inapp.	Irapp.	Snow.	Sleet.	Cu. Str. 10.

REMARKS FOR FEBRUARY, 1861.

Barometer ...... Highest, the 17th day, 30·427 inches.
Lowest, the 6th day, 29.085 "
Monthly Mean, 29.943 day, "
" Range, 1.342

Thermometer ... Highest, the 23rd day, 37°9.
Lowest, the 15th day,—19°9.
Monthly Mean, 13°25.
Monthly Range, 57°8.

Greatest intensity of the Sun's rays, 78°8.
Lowest point of Terrestrial radiation,—20°4.
Mean of Humidity, .740.
Rain fell on 1 day, Inapp.

Snow fell on 13 days amounting to 27.77 inches; it was snowing 101 hours 44 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, the E. by S.
Most windy day the 25th day, mean miles per hour, 20.88.
Least windy day the 5th day, mean miles per hour, 0.11.
Aurora Borealis visible on 1 night.
Zodiacal Light bright and well defined.
3 Lunar Haloes and 1 Corona seen.
1 Solar Halo.
The Electrical state of the Atmosphere has indicated moderate intensity.
Crows 1st seen on the 16th day.

REMARKS FOR MARCH, 1862.

Barometer. ...... Highest, the 13th day, 30.279 inches.
Lowest, the 4th day, 29.318 "
Monthly Mean, 29.858 "
Monthly Range, 0.961 "

Thermometer. Highest, the 27th day, 52°0.
Lowest, the 3rd day,—4°1.
Monthly Mean, 29°29.
Monthly Range, 56°1.

Greatest intensity of the Sun's rays, 73°1.
Lowest point of Terrestrial radiation,—5°7.
Mean of humidity, ·793.
Rain fell on 4 days, amounting to 0.621 inches; it was raining 34 hours.

Snow fell on 12 days amounting to 17·75 inches; it was snowing 128 hours and 50 minutes.
Most prevalent wind, N. E. by E.
Least prevalent wind, E.
Most windy day, the 16th day; mean miles per hour, 26,74.
Least windy day, the 20th day; Calm.
Aurora Borealis visible on 2 nights.
Solar Halo visible 1 day.
Lunar Halo visible 1 night.
Zodiacal light frequently very bright.
The Electrical state of the Atmosphere has indicated feeble intensity.

CONTENTS OF NUMBER II.

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