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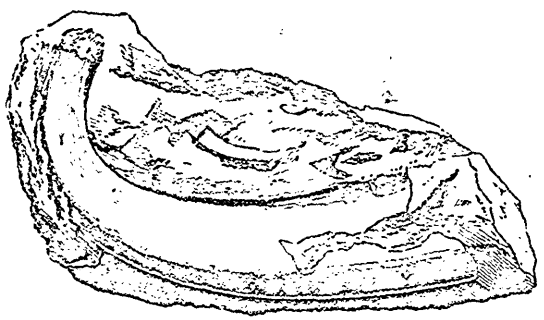

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ARTICLE XV.—*Notes on the History of Petroleum or Rock Oil.* By T. STERRY HUNT, M.A., F.R.S., of the Geological Survey of Canada.

Public attention has lately been drawn to the petroleum furnished by the oil wells in Canada and the United States, and we have therefore thought it well to bring together some few facts which may serve to explain the origin of this and of similar substances, including naphtha, petroleum or rock oil, and asphalt or mineral pitch, all of which are forms of bitumen, the one being solid and the others fluid at ordinary temperatures. These differences are, in many cases at least, due to subsequent alterations; the more liquid of these substances are mixtures of oils differing in volatility, and by exposure to the air become less fluid, and partly by evaporation, partly by oxydation from the air, eventually become solid and are changed into mineral pitch. These substances, which are doubtless of organic origin, occur in rocks of all ages, from the Lower Silurian to the tertiary period inclusive, and are generally found impregnating limestones, and more rarely, sandstones and shales. Their presence in the lower palæozoic rocks, which contain no traces of land plants, shows that they have not been in all cases derived from terrestrial vegetation, but may have been formed from marine plants or animals: the latter

is not surprising when we consider that a considerable portion of the tissues of the lower marine animals is destitute of nitrogen, and very similar in chemical composition to the woody fibre of plants. Besides the rocks which contain true bitumen we have what are called bituminous shales, which when heated burn with flame, and by distillation at a high temperature yield, besides inflammable gases, a portion of oil not unlike in its characters to petroleum. These are in fact argillaceous rocks intermixed with a portion of organic matter allied to peat or lignite, which by heat is decomposed and gives rise to oily hydrocarbons. These inflammable or lignitic shales, which may be conveniently distinguished by the name of *pyroschists*, (the *brandschiefer* of the Germans) are to be carefully distinguished from rocks containing ready-formed bitumen; this being easily soluble in benzole or sulphure of carbon can be readily dissolved from the rocks in which it occurs, while the pyroschists in question yield, like coal and lignite, little or nothing to these liquids.

It is the more necessary to insist upon the distinction between lignitic and bituminous rocks, inasmuch as some have been disposed to regard the former as the source of the bitumen found in nature, which they conceive to have originated from a slow distillation of these matters. The result of a careful examination of the question has however led us to the conclusion that the formation of the one excludes more or less completely that of the other, and that bitumen has been generated under conditions different from those which have transformed organic matters into coal and lignite, and probably in deep water deposits, from which atmospheric oxygen was excluded. Thus in the palæozoic strata of North America we find in the Utica and Hamilton formations, highly inflammable pyroschists which contain no soluble bitumen, and the same is true to a certain extent of some limestones, while the Trenton and Corniferous limestones of the same series are impregated with petroleum or mineral pitch, and as we shall show, give rise to petroleum springs. The fact that intermediate porous strata of similar mineral characters are destitute of bitumen, shows that this material cannot have been derived from overlying or underlying beds, but has been generated by the transformation of organic matters in the strata in which it is met with. This conclusion is accordance with that arrived at by Mr. S. P. Wall in his recent investigations in Trinidad. He has shown that the asphalt of that island and of Venezuela belongs to strata of the

tertiary formation (of upper miocene or lower pliocene age,) which consist of limestones, sandstones and shales, associated with beds of lignite. The bitumen is found not only in the famous pitch lake, but *in situ*, where it is confined to particular strata which were originally shales containing vegetable remains; these have undergone "a special mineralization producing a bituminous matter instead of coal or lignite. This operation is not attributable to heat, nor of the nature of a distillation, but is due to chemical reactions at the ordinary temperature, and under the normal conditions of climate." He also describes wood partially converted into bitumen, which last when removed by solution leaves a portion of woody tissue. (Proc. Geol. Soc. London, May, 1860.)

The sources of petroleum and mineral pitch in Europe and in Asia, are for the most part, like those just named, confined to rocks of newer secondary and tertiary age, though they are not wanting in the palæozoic strata, which in Canada and the United States furnish such abundant supplies of petroleum. In the great palæozoic basin of North America bitumen, either in a liquid or solid state, is found in the strata at several different horizons. The forms in which it now occurs depend in great measure upon the presence or absence of atmospheric oxygen, since by oxydation and volatilization the naphtha or petroleum, as we have already explained, becomes slowly changed into asphalt or mineral pitch, which is solid at ordinary temperature. It would even appear that by a continuance of the same action the bitumen may lose its fusibility and solubility, and became converted into a coal-like matter. Thus in the Calciferous sandrock in New York a black substance, which has been called anthracite, occurs in cavities with crystals of bitter spar and quartz. It sometimes coats these crystals or the walls of the cavities, and at other times appears in the form of buttons or drops, evidently according to Mr. Vanuxem, having been introduced into these cavities in a liquid state, and subsequently hardened as a layer above the crystals, which have conformed to them, showing that this coal-like matter was once in a plastic state. It is very pulverulent, brittle, of a shining black, and according to Vanuxem yielded but little ash, and 11½ per cent of volatile matter, which he regarded as water, (Vanuxem, Geology of New York, iii. 33). A similar material occurs in the Quebec group in Canada, the equivalent of the Calciferous sand-rock, and fills cavities and fissures in the limestones, sandstones, and even in the accom-

panying trap rocks, as at Quebec, Orleans Island, Point Levis, and at Acton, presenting mamillary surfaces as noticed by Vanuxem, which evidently show that it has once been semi-fluid. This matter from the first two localities is completely infusible, and insoluble in benzole; it readily crumbles between the fingers and gives a very black powder. When exposed to a high temperature it gives off abundance of inflammable strong smelling vapors, which condense into a tarry oil, and leaves a black residue, which when heated slowly burns away, leaving only a trace of ash. The volatile portion is equal to from 19.5 to 21.0 per cent. The mineral from the Acton copper mine is much harder and less friable, and approaches to anthracite in its characters. When heated it gives off watery vapor without any bituminous odor. Its loss by heat was 6.9 per cent, and the residue of ash was equal to 2.2 per cent.

An evidence of the presence of unaltered petroleum in almost all the Lower Silurian limestones is furnished by the bituminous odor which they generally exhibit when heated, struck or dissolved in acids. In some cases petroleum is found filling cavities in these limestones, as at Rivière à la Rose (Montmorenci,) where it flows in drops from a fossil coral of the Birdseye limestone, and at Pakenham, where it fills the cavities of large orthoceratites in the Trenton; from some specimens nearly a pint of petroleum has been obtained; it is also said to occur in the township of Lancaster in the same formation. The presence of petroleum in the Lower Silurian rocks of New York is shown in the township of Guilderland near Albany, where according to Beck, considerable quantities of petroleum are collected upon the surface of a spring which rises through the Hudson River or Loraine shales. On the Great Manitoulin Island also according to Mr. Murray, a petroleum spring issues from the Utica state, and he has described another at Albion Mills near Hamilton rising through the red shales of the Medina group; these have probably their origin in the Lower Silurian limestones, which may in some localities prove to be valuable sources of petroleum.

In the Upper Silurian and Devonian rocks bitumen is much more abundant; Eaton long since described petroleum as exuding from the Niagara limestone, and this formation throughout Monroe county in western New York is described by Mr. Hall as a granular crystalline dolomite including small laminæ of bitumen, which give it a resinous lustre. When the stone is burned for

lime the bitumen is sometimes so abundant as to flow like tar from the kiln. In the Corniferous limestone, at Black Rock on the Niagara River, petroleum is described as occurring in cavities, generally in the cells of fossil corals, from which, when broken, it flows in considerable quantities. It also occurs in similar conditions in the Cliff limestone (Devonian) of Ohio.

Higher still in the series, at the base of the Hamilton group, occur what in New York have been called the Marcellus shales; these enclose septaria or concretionary nodules which contain petroleum, while at the summit of the same group similar concretions holding petroleum are again met with. The sandstones of the Portage and Chemung group in New York are in many places highly bituminous to the smell, and often contain cavities filled with petroleum, and in some places seams of indurated bitumen. A calcareous sandstone from this formation at Laona near Fredonia in Chatauque county contains more than two per cent of bituminous matter. At Rockville in Alleghany county, according to Mr. Hall, the same standstones are highly bituminous and give out a strong odor when handled, and in the counties of Erie, Seneca and Cataraugus abundant oil springs rise from the sandstones and have been known to the Seneca Indians from ancient times. In the northern part of Ohio, according to Dr. Newberry, petroleum is found to exude in greater or less quantity from these sandstones wherever they are exposed, and the oil wells of Pennsylvania and Ohio are sunk in these Devonian sandstones, often through the overlying carboniferous conglomerate, and in some cases apparently, according to Newberry, through the sandstones themselves, which are supposed by him to be only reservoirs in which the oil accumulates as it rises through fissures from a deeper source, in proof of which he mentions that in boring wells near to each other, the most abundant flow of oil is met with at variable depths. In some instances the petroleum appears to filter slowly into the wells from the porous strata around, which are saturated with it, while at other times the bore seems to strike upon a fissure communicating with a reservoir which furnishes at once great volumes of oil. An interesting fact is mentioned in this connection by Mr. Hall. In the town of Freedom, Catarragus Co., New York, is a spring which had long been known to furnish considerable quantities of petroleum. On making an excavation about six yards distant, to the depth of fourteen feet, a copious spring of petroleum arose, and for some time afforded large

quantities of oil, after which the supply diminished in both the old and new springs, so that it is now less than at the first settlement of the country. Notwithstanding its general distribution throughout a considerable region in the adjacent portions of New York, Pennsylvania and Ohio, it is only in a few districts that it has been found in quantities sufficient to be wrought with profit. The wells of Mecca in Trumbull Co., Ohio, have been sunk from 30 to 200 feet in a sandstone which is saturated with oil; of 200 wells which have been bored, according to Dr. Newberry, a dozen or more are successfully wrought, and yield from five to twenty barrels a day. The wells of Titusville on Oil Creek, Pennsylvania, vary in depth from 70 to 300 feet, and the petroleum is met with throughout. The oil from different localities varies considerably in color and thickness, and in its specific gravity, which ranges from 28° to 40° Baumé, (from ·890 to ·830.)

The valley of the Little Kenawha in Virginia, which is to be looked upon as as an extension of the same oil-bearing region, contains petroleum springs, which so long ago as 1836, according to Dr. Hildreth, yielded from fifty to a hundred barrels yearly. It here rises through the carboniferous strata, and as elsewhere is accompanied by great quantities of inflammable gas.

The black inflammable shales of the Devonian series in western Canada which were formerly referred to the Hamilton group, and are now considered to belong to the base of the overlying Portage and Chemung, appear at Kettle Point on Lake Huron and in portions of the region southward to Lake Erie, but the oil wells sunk in Enniskillen show that the source of the oil is really below the horizon of these shales, inasmuch as the underlying argillaceous shales and limestones of the Hamilton group are there found near the surface, and have been penetrated 120 feet, at which depth oil is still met with, leaving but little doubt that it is derived from the limestones beneath, which both in New York, and in Canada are impregnated with petroleum. A somewhat slaty brownish-black bituminous dolomite belonging to the Corniferous limestone from Pine Creek near Alma, in Kincardine, gave me not less than 12.8 per cent. of bitumen, fusible and readily soluble in benzole, and another from the Grand Manitoulin Island, which was a brown crystalline dolomite, yielded from 7.4 to 8.8 per cent. of similar bitumen. The solid form of this bitumen at the outcrop of the rocks, is probably due to the action of the air.

The existence of liquid bitumen in the Corniferous limestone in western Canada was pointed out as long ago as 1844 by Mr. Murray, who tells us that this rock is generally bituminous, and that cavities in it are often filled with petroleum; the quarries near Gravelly Bay in Wainfleet are cited as an example, (Report of Geol. Survey, 1846, p. 87). In the Report for 1850 we find a notice of what are called oil springs, in which petroleum rises to the surface of the water near the right bank of the Thames in Mosa, and in two places on Bear Creek in Enniskillen. Subsequently Mr. Murray described a considerable deposit of solid bitumen or mineral tar, which occurs in the same township, extending over about half an acre, and in some places two feet in thickness, doubtless formed by the drying-up of petroleum springs (Report for 1851, p. 90.) I had already in the Report for 1849, p. 99, described this bitumen from specimens in the Museum of the Geological Survey, and called attention to its economic applications, remarking that "the consumption of this material in England and on the continent for the construction of pavements, for paying the bottoms of ships, and for the manufacture of illuminating gas is such that the existence of these deposits in the country is a matter of considerable importance." At this time solid bitumen was thus employed, but in the liquid form of petroleum its use was chiefly confined in Europe to medicinal purposes. Under the names of Seneca oil and Barbadoes tar it had long been known and employed medicinally by the native tribes of America. Its use for burning, as a source of light or heat, in modern times has been chiefly confined to Persia and other parts of Asia, although in former ages the wells of the island of Zante described by Herodotus furnished large quantities of it to the Grecian Archipelago, and Pliny and Dioscorides describe the petroleum of Agrigentum in Sicily, which was used in lamps under the name of Sicilian oil. The value of the naphtha annually obtained from the springs at Bakoum in Persia on the Caspian sea was some years since estimated by Abich at about 600,000 dollars, and the petroleum wells of Rangoon in Burmah are said to furnish not less than 400,000 hogsheads yearly. In the last century the petroleum or naphtha obtained from springs in the Duchy of Parma was employed for lighting the streets of Genoa and Amiano. But the thickness, coarseness and unpleasant odor of the petroleum from most sources were such that it had long fallen into disuse in Europe, when in 1847, the attention of Mr. Young a manufacturing

chemist of Glasgow, was called to the petroleum which had just been obtained in considerable quantities from a coal mine at Riddings in Derbyshire, from which by certain refining processes he succeeded in preparing a good lubricating oil. This source however soon becoming exhausted, he turned his attention to the somewhat similar oils which Reichenbach and Selligue had long before showed might be economically obtained by the distillation of coal, lignite, peat and pyroschists. To this new industry Mr. Young gave a great impetus, and in connection with it attention was again turned to the refining of liquid and solid bitumens, it being found that the latter by distillation gave great quantities of oils identical with those from petroleum. About the year 1853 the attention of speculators was turned to the deposits of bitumen in Enniskillen just described, but it was not till 1857, that Mr. W. M. Williams of Hamilton, with some associates undertook the distillation of this tarry bitumen, when they soon found that by sinking wells in the clay beneath, it was possible to obtain great quantities of the material in a fluid state. Large numbers of wells were subsequently sunk by Mr. Williams and others in the southern part of the township of Enniskillen along the borders of Black Creek, and also about ten miles farther north on Bear Creek. Nearly one hundred wells had been sunk when I visited the place in December last, and many more have since been bored. Of these but a small proportion furnish available quantities of oil, but the whole amount already obtained from the district is perhaps not less than 300,000 or 400,000 gallons. Owing to the difficulties of communication and of procuring casks sufficient for the oil, these wells have not yet been wrought in a continuous manner; large quantities of oil are however taken out at intervals of some days, and it is probable that if continuously worked the supply would be still greater. Here as in Pennsylvania considerable variations are found in the quality of the oil; that from the wells on Black Creek is more liquid and less dense than the oil from Kelly's wells on Bear Creek, and it is said that wells recently sunk to a considerable depth in the rock have yielded an oil still thinner, lighter colored and less dense, which is prized as being more profitable for refining. The present wholesale price of the crude oil from Kelly's wells, delivered at the Wyoming station on the Grand Trunk Railway, is about thirteen cents a gallon. The oil obtained by Mr. Williams is refined in Hamilton, while that from the northern

part of the township has hitherto been sent to Boston, though refining works are now being erected at the wells. The process of refining consists in rectifying by repeated distillations, by which the oil is separated into a heavier part employed for lubricating machinery, and a lighter oil, which after being purified and deodorized by a peculiar treatment with sulphuric acid, is fit for burning in lamps.

These wells occur along the line of a low broad anticlinal axis which runs nearly east and west through the western peninsula of Canada, and brings to the surface in Enniskillen the shales and limestones of the Hamilton group, which are there covered with a few feet of clay. The oil doubtless rises from the Corniferous limestone, which as we have seen contains petroleum; this being lighter than the water which permeates at the same time the porous strata, rises to the higher portion of the formation, which is the crest of the anticlinal axis, where the petroleum of a considerable area accumulates and slowly finds its way to the surface through vertical fissures in the overlying Hamilton shales, giving rise to the oil springs of the region. The oil is met with at various depths; in some cases an abundant supply is obtained at forty feet, while near by it is only met with at three or four times that depth, and sometimes only in small quantities. Everything points to the existence of separate fissures communicating with a deep-seated source. At Kelly's wells however, it would appear that a reservoir has been formed much nearer the surface, where in a bed of gravel and boulders, underlying the superficial clays, the oil rising from the rocks beneath has accumulated. The inflammable gas which issues from the wells is not necessarily connected with the petroleum, inasmuch as it is an almost constant product of the decomposition of organic matters, and is copiously evolved from rocks which are destitute of bitumen. It is similar to the gas of marshes and to the fire damp of coal mines. A curious circumstance is however noticed by Mr. Robb; the gas which accumulates in the oil pits, becomes charged with vapors which produces upon the workmen a sort of intoxication like nitrous oxyd.* This is not surprising when we remember that volatile hydrocar-

* Mr. Charles Robb, C.E., has published in the Canadian Journal for July an interesting paper on the oil wells of Enniskillen, to which, as also to a paper by Prof. E. B. Andrews of Ohio, in Silliman's Journal for July I am indebted for several facts.

bons like amylene, closely related to the hydrocarbons of petroleum, produce similar effects when their vapor is respired.

The oil wells of the United States are for the most part sunk in the sandstones which form the summit of the Devonian series, but the oils of western Virginia and southern Ohio rise through the coal measures which overlie the Devonian strata, while the wells of Enniskillen are situated much lower, and are sunk in the Hamilton shales, which immediately overlie the Corniferous or Devonian limestone. It is not impossible that in Ohio some of the higher strata, such as the sandstone, were originally impregnated with bitumen, but in Canada from the absence of this substance diffused through the shales in question, we are forced to assign it to a lower horizon, which is doubtless that of the bituminous Devonian limestone. This view I have for some time maintained in opposition to those who conceive the bitumen to be derived from the black pyroschists; see my lecture before the Board of Arts, reported in the Montreal Gazette of March 1, where I asserted that the source of the petroleum was to be sought in the bituminous Devonian and Silurian limestones; besides the Corniferous limestone (Devonian,) we have shown that both the Niagara and the Trenton, (of Upper and Lower Silurian age,) contain petroleum. The question of the extent of the supply of petroleum is not easily answered; the oil now being wrought is the accumulated drainings of ages, concentrated along certain lines of elevation, and the experience of other regions has shown that these sources are sooner or later exhausted; but though the springs of Agrigentum, like those of Derbyshire, have nearly ceased to flow, those of Burmah and Persia still furnish, as they have for ages past, immense quantities of oil; nothing but experience can tell us the richness of the subterranean reservoirs. It is not probable that the Devonian limestone is equally rich in petroleum throughout its whole distribution, but the exposures of it in the west are too few to enable us as yet to say in what portions the petroleum predominnates; as however this rock underlies more than one-half of the western peninsula, we may look for petroleum springs much farther east than Enniskillen. A well yielding considerable quantities of petroleum is said to occur in the township of Dereham, about a quarter of a mile S. W. of Tilsonburg, and we may reasonably expect to find others along the line of the anticlinal, or of the folds which are subordinate to it.

It is now many years since Sir William Logan described the occurrence of petroleum springs in Gaspé, and collected specimens of the oil, which are preserved in the Geological Museum. One of these, near Gaspé Bay, is described as occurring on the south side of the St. John's River about a mile and a half above Douglastown, where it may be collected by digging pits in the mud on the beach. Another locality is about 200 yards up a small fork of the Silver Brook, which falls into the Southwest Arm six or seven miles above Gaspé Basin. The oil collects in pools along the stream, and may be gathered in considerable quantities. The cavities in a greenstone dyke on Gaspé Bay were also found to be filled with petroleum, and the odor of it from the rock was perceived at a considerable distance. The dyke, which marks a fold in the stratification, runs in the direction of the petroleum springs, and the evidences of the distribution of petroleum are thus, as Sir William Logan has remarked, visible along a line of twenty miles (Report for 1844, p. 41.) Attention has recently been drawn to these indications, and a company formed with a view of exploring this region for petroleum. Here, as well as in western Canada and the United States, the connection is evident between the springs and undulations of the strata which favor the accumulation of the petroleum.

Supplementary Note.

We have stated in the preceding paper that the different mineral combustibles have been derived from the transformations of vegetable matters, or in some cases of animal tissues analogous to these in composition. The composition of woody fibre or cellulose, in its purest state, may be represented by $C_{\cdot} H_{20}O_{20}$, or as a compound of the elements of water with carbon: the incrusting matter of vegetable cells, to which the name of lignine has been given, contains however a less proportion of oxygen and more carbon and hydrogen than cellulose, so that the mean composition of recent woods, as deduced from numerous analyses of various kinds, may be represented by $C_{24}H_{18.4}O_{16.4}$. We may conceive of four different modes of transformation of woody fibre, all of which probably intervene to a greater or less degree in the production of mineral combustibles; and in considering

these changes we shall for greater simplicity adopt for the composition of woody fibre the first named formula, $C_{24}H_{20}O_{20}$.

I. When wood is exposed to the action of moist air, oxygen is absorbed, and carbonic acid and water are evolved in the proportion of one equivalent of the first for two of the last. We may suppose that for H_2 which is oxydised by O_2 from the air, the wood loses CO_2, so that while the carbon increases in amount the proportions of oxygen and hydrogen are unchanged. In this way an equivalent of cellulose, by absorbing sixteen equivalents of oxygen and losing eight of carbonic acid, (8 CO_2) and sixteen of water, (16 HO) would leave $C_{16}H_4O_4$. Such is the nature of the decay of wood when exposed to the air, and the process, could it be carried out, would leave a residue of carbon only. If however the wood is deeply buried and excluded from the oxygen of the air two reactions are conceivable.

II. The whole of the oxygen of the wood may be given off in the form of carbonic acid, while the hydrogen remains with the residual carbon. The abstraction of ten equivalents of carbonic acid from one of woody fibre, would leave a hydrocarbon, $C_{14}H_{20}$.

III. Instead of combining exclusively with the carbon, a *part of the oxygen of the wood may be set free* as water, *in combination* of the hydrogen. The abstraction from an equivalent of woody fibre of four equivalents of carbonic acid and twelve of water would leave a hydrocarbon $C_{20}H_8$.

IV. These decompositions are however never so simple as we have supposed in II and III, for a portion of hydrogen is at the same time evolved in combination with carbon, chiefly as marsh gas, C_2H_4. The amount of this gas evolved from decaying plants submerged in water, and the immense quantities of it condensed in coal beds and other rocky strata, (forming fire damp,) shew the great extent to which this mode of decomposition prevails.

In nature these various modes of decomposition often go on together, or intervene at different stages in the decomposition of the same mass; they are besides seldom so complete as we have represented them. The first process results in the formation of vegetable mould, which always retains portions of carbon and hydrogen; while the incomplete operation of the processes II, III and IV gives rise to peat, lignite, brown coal, bituminous coal and pyroschists, in all of which the proportion of the oxygen is much less than the hydrogen, so that their composition may be

approximately represented by mixtures of hydrocarbons with vegetable fibre. The following results have been selected from a great number of analyses by various chemists, and are for the most part taken from Bischof's *Chemical Geology*, (Vol. i. cap. XV.) The nitrogen, which in most cases was included with the oxygen in the analysis, has been disregarded, and the oxygen and hydrogen for the sake of comparison, have been calculated for twenty-four equivalents of carbon.

1. Vegetable fibre or cellulose,..... $C_{24}H_{20}O_{20}$
2. Wood, mean composition,..... $C_{24}H_{12\cdot4}O_{16\cdot4}$
3. Peat,.....(Vaux,)..... $C_{24}H_{14\cdot4}O_{10}$
4. do. .....(Regnault,)..... $C_{24}H_{14\cdot4}O_{9\cdot6}$
5. Brown coal,.....(Schrötter,)..... $C_{24}H_{14\cdot4}O_{10\cdot6}$
6. do. do. .....(Woskresensky,). $C_{24}H_{13}O_{7\cdot6}$
7. Lignite,.....(Vaux,)..... $C_{24}H_{11\cdot3}O_{6\cdot4}$
8. do. passing into mineral resin,.(Regnault,)..... $C_{24}H_{1}\ O_{3\cdot3}$
9. Bituminous coal,..... do. ..... $C_{24}H_{1}\ O_{3\cdot3}$
10. do. do. ..... do. ..... $C_{2}\ H_{1}\ O_{1\cdot7}$
11. do. do. ..... do. ..... $C_{2}\ H_{8\cdot4}O_{1\cdot2}$
12. do. do. ..... do. ..... $C_{24}H_{8}O_{0\cdot9}$
13. do. do. .....(Kühnert and Gräger,).. $C_{24}H_{7\cdot4}O_{1\cdot3}$
14. do. do. (mean comp.)....(Johnston)..... $C_{24}H_{9}O_{2}—O_{4}$
15. Albert coal,.....(Wetherell,)..... $C_{2}\ H_{15\cdot9}O_{1\cdot6}$
16. Asphalt, Auvergne,..... $C_{24}H_{17\cdot7}O_{2\cdot2}$
17. do. Naples,..... $C\ H_{1\ \cdot6}O_{2}$
18. do. Gastennes,..... $C\ _{4}H_{1}\ O_{0\cdot7}$
19. Elastic bitumen, Derbyshire,.....(Johnston,)..... $C_{24}H_{\cdot2}O_{0\cdot3}$
20. Bitumen of Idria,..... $C_{2}\ H_{8}$
21. Petroleum and naphtha,..... $C_{24}H_{24}$

In the above table we see the transition from peat and brown coal to lignite, and thence to bituminous coal. Prof. Johnston from his experiments in various coals, including cannel from Wigan, splint coal from Workington and caking coal from Newcastle, deduced the composition given in 14, in which with $C_{24}H_{9}$ the oxygen varies from two to four equivalents. It will be seen from a comparison of the infusible Albert coal with the bitumens 16, 17 and 18, how gradual is the transition to the true petroleums and naphthas, from which oxygen is absent. The asphalts also, as will be observed, differ very much in their composition, and though generally much richer in hydrogen than the bituminous coals, the variety from Naples (17) which is completely fusible at 140° C., contains less hydrogen and more oxy-

gen than the Albert coal analysed by Wetherell; while the idrialine or bitumen found with the mercury ores of Idria, approaches very nearly in composition to the bituminous coals 11, 12 and 13, with which many asphalts may be said to be isomeric. It is however probable that those oxygenized bitumens, unlike the coals, are products of the oxydation of naphtha or petroleum, by a process similar to that by which resins are derived from vegetable hydrocarbons. These formulas must be taken as representing not the true equivalents, but only the proportions of the elements in the bodies in question, which are in most cases mixtures of various substance. This is especially true of naphtha, which may be taken as the representative of pure unoxydised petroleum, and which is separated by distillation into oils of very different boiling points. The late analyses by Uelsmann of the rectified rock oil from Sehnde near Hanover, gave the formula $C_{18}H_{20}$, and according to De la Rue and Müller the greater part of the Rangoon petroleum consists of hydrocarbons in which the number of equivalents of hydrogen is a little greater than the carbon; one gave $C_{26}H_{28}$. Associated with these are however portions of bodies containing a less proportion of hydrogen, so that we may conceive the mean composition of petroleum to be represented, as in the preceding table, by equal equivalents of hydrogen and carbon; many forms of solid bitumen also, as ozokerite and hatchetine, have the same general composition.

By referring to what has been said above it will be seen that the final result of the third process of decomposition of woody fibre, in which the air being excluded, the oxygen is shared between the carbon and hydrogen, would be $C_{20}H_8$. A similar result would be obtained, with the simultaneous evolution of marsh gas, if we suppose $6\ CO_2 + 8\ HO + 3\ CH_2$ to be removed from an equivalent of woody fibre, leaving $C_{15}H_6 = C_{20}H_8 = C_{24}H_{9.5}$, which approaches the composition of most bituminous coals and of idrialine. A farther elimination of marsh gas would leave a residue of pure carbon, and thus, as Bischof has suggested, vegetable matters may be converted into anthracite without the intervention of a high temperature.

The elimination of the whole of the oxygen in the form of carbonic acid would leave a compound with a large excess of hydrogen, of which it would be necessary to remove a portion in the form of water or marsh gas in order to reduce the residue to the composition of petroleum. We know of no combination

of carbon and hydrogen in which the number of atoms of hydrogen surpasses by more than two, those of hydrogen, the general formula being C_nH_{n+2}, so that oils like $C_{18}H_{20}$ and $C_{26}H_{28}$ contain nearly the maximum quantity of hydrogen, and a body like $C_{14}H_{20}$, whose formation we have supposed above, could not exist, but must break up into marsh gas and some less hydrogenous oil like petroleum.

We do not know the precise conditions which in certain strata favor the production of petroleum rather than of lignite or coal, but in the fermentation of sugar, to which we may compare the transformations of woody fibre, we find that under different conditions it may yield either alcohol and carbonic acid, or butyric and carbonic acids with hydrogen, and even in certain modified fermentations the acetic, lactic and propionic acids, and the higher alcohols, like $C_{10}H_{12}O_2$. These analogies furnish suggestions which may lead to a satisfactory explanation of the peculiar transformation by which, in certain sedimentary strata, organic matters have been converted into bitumen.

ARTICLE XVI.—*Remarks on some of the Birds that breed in the Gulf of St. Lawrence.* By HENRY BRYANT, M.D.

(*Extracted from the Proceedings of the Boston Natural History Society, Vol.* 8.)

The trip to Labrador, made by me the past summer, for the purpose of procuring specimens of the eggs of those sea-birds that breed there, and also to ascertain what changes, if any, had taken place in their economy since Audubon's visit, was unfortunately delayed till the 21st of June, so that the results were much less satisfactory than I hoped to have obtained. Instead of visiting Anticosti and the whole of the North shore, I was compelled to sail directly to the Bird Rocks, thence to Romaine, the nearest point on the North shore, and from thence, following the shore line, to Chateau Beau at the outlet of the Straits of Belle Isle, the farthest point reached.

The season was remarkably stormy and cold, and I was informed by every one that such an inclement one had not been known for years. This also delayed my progress and added much to the difficulty of making researches, as many of the breeding places of this class of birds are accessible only in pleasant weather.

We sailed from Gaspé on the 21st, and arrived at the Bird Rocks on the morning of the 23rd; these are two in number, called the Great Bird or Gannet Rock, and the Little or North Bird; they are about three quarters of a mile apart, the water between them very shoal, showing that, at no very distant epoch, they formed a single island. They are composed entirely of a soft, reddish-brown sandstone, the strata of which are very regular and nearly horizontal, dipping very slightly to the S. W. The North Bird is much the smallest, and though the base is more accessible, the summit cannot, I believe, be reached, at least, I was unable to do so; it is the most irregular in its outline, presenting many enormous detached fragments, and is divided in one place into two separate islands at high water; the northerly one several times higher than broad, so as to present the appearance of a huge rocky pillar. Gannet Rock is a quarter of a mile in its longest diameter from S. W. to N. E. The highest point of the rock is at the northerly end, where, according to the chart it is 140 feet high, and from which it gradually slopes to the southerly end, where it is from 80 to 100.

The sides are nearly vertical, the summit in many places overhanging. There are two beaches at its base on the southerly and westerly sides, the most westerly one comparatively smooth and composed of rounded stones. The easterly one, on the contrary, is very rough and covered by irregular blocks, many of large size and still angular, showing that they have but recently fallen from the cliffs above. This beach is very difficult to land on, but the other presents no great difficulty in ordinary weather; the top of the rock cannot, however, be reached from either of them. The only spot from which at present the ascent can be made, is the rocky point between the two beaches; this has probably, from the yielding nature of the rock, altered materially since Audubon's visit; at present, it would be impossible to haul a boat up from want of space. The landing is very difficult at all times, as it is necessary to jump from a boat, thrown about by the surf, on to the inclined surface of the ledge, rendered slippery by the fuci which cover it, and bounded towards the rock by a nearly vertical face. The landing once effected, the first part of the ascent is comparatively easy, being over large fragments and broad ledges, but the upper part is both difficult and dangerous, as in some places the face of the rock is vertical for eight or ten feet and the projecting ledges very narrow, and the rock itself so soft that it

cannot be trusted to, and in addition rendered slippery by the constant trickling from above and the excrements of the birds that cover it in every direction.

Since Audubon's time the fishery, which was carried on extensively in the neighborhood of Bryon Island, has failed, or at least is less productive than on the North shore, and I am inclined to think that at present the birds are but little disturbed, and that consequently their number, particularly of the Guillemots, has much increased. There was no appearance of any recent visit on the top of the rock, and though after making the ascent it was obvious that others had preceded us, still the traces were so faint that it was several hours before we succeeded in finding the landing-place. The birds breeding there, at the time of our visit, were Gannets, Puffins, three species of Guillemots, Razor-billed Auks, and Kittiwakes. These birds are all mentioned by Audubon, with the exception of Brünnich's Guillemot, and the Bridled Guillemot confounded by him with the common species. No other breeding-place on our shore is so remarkable at once for the number and variety of the species occupying it.

Of the seven species mentioned, I am not aware that three, namely, the Kittiwake and the Bridled and Brünnich's Guillemot, are known to breed at any other place south of the Straits of Belle Isle; of the remaining four, two, the Foolish Guillemot and Razor-billed Auk, are found at many other places and in large numbers; the Puffin in much greater abundance on the North shore, particularly at the Perroquet Islands, near Mingan and Bras D'Or; the Gannet at only two other points in the Gulf, at Percé Rock near Gaspé, which is perhaps even more remarkable than Gannet Rock, but is at present inaccessible; and at Gannet Rock near Mingan, which will soon be deserted by those birds in consequence of the depredations of the fishermen.

The following list of birds is not intended to comprise all those observed by me,—all the land birds are omitted, as well as those water birds to our present knowledge of which I could add nothing. Before leaving home I had flattered myself that I should have an opportunity of seeing some of the rarer Rapacious birds, or the Iceland or Greenland Falcon, Duck Hawk, &c. Strange as it may seem, during the whole of my visit to the North Shore, I saw only a single bird of this class—a fine Golden Eagle at Bras D'Or. I mention this, not as proof that those birds are unknown, for I frequently found on the shores unmistakable evidence

of their visits, but to show with how much caution the results of any individual's experience should be received as positive evidence in Natural History.

As Audubon has generally given the average dimension only of the eggs of the birds described by him, which affords but a very incorrect idea of the variation in size and shape, I have made careful measurement of the extremes in length, breadth, and size of the eggs of all the varieties procured by me, not, however, including those which were evidently abnormal. In this class, I found eggs of the common Cormorant and Herring Gull; they were not more than one quarter of the average size, without exception contained nothing but albumen, and the shell was remarkably thick and strong. One egg of the Cormorant was not symmetrical in its longitudinal axis, and had the appearance of having been deposited in a soft state on a convex surface; in other respects it presented nothing remarkable. I have been lead to make these remarks because Naumann, in his description of the eggs of *Uria troille*, states that the eggs of very small size are found, caused by the birds laying more than their normal number. I do not think that this is the cause, as the eggs found by me were in nests with other eggs that presented no deviation from the ordinary shape or size.

Sometaria mollissima, Linn. This bird though constantly harassed by the fishermen and inhabitants, still breeds in great abundance along the whole extent of the North shore, and, as it is not gregarious during the breeding season, and ranges over such an immense extent of island and shore, it will probably continue to do so, even if unprotected, for many years. I found but few of their nests, placed under the shelter of the dwarf firs and junipers; their favourite breeding-places seemed to be the small grassy islands found in bays, and particularly those where small spots of turf were protected by a rock from the prevailing wind. On many of the islands a species of umbelliferous plant grows abundantly, the thick foliage of which forms an admirable shelter that they gladly avail themselves of. It is not often that many nests are found on one island; from one to a dozen is the ordinary number, though on Greenlet Island, in the Straits of Belle Isle, I found over sixty, probably not more than a quarter of the whole number, as two other persons besides myself were searching for them at the same time, and it is not probable that all the nests would be discovered; indeed, I found nearly as many returning

as on first going over the ground. This island is, however, peculiarly adapted to their wants, being covered with a thick growth of the plant above mentioned, hardly elevated above the water and at a sufficient distance from the main land to prevent it being often visited by the inhabitants. I found on this island a nest in a small stone hut, made for the purpose of concealing the hunters in the spring, at which time they shoot immense numbers of the Eider or Sea Ducks, as they call them.

I found many nests in which the down was quite clean, and am inclined to believe that it is always so if the bird is undisturbed; but after having been frequently robbed, the supply not being sufficiently great, it is forced to eke it out with the most convenient substitute, and late in the season it is not at all uncommon to find nests without any down. I found some containing fresh eggs, and others that had just been finished after the middle of July, and many birds had already hatched their brood by the first, it is probable that others had made at least three nests that season. Audubon states that the eggs are deposited on the grass, &c., of which the nest is principally composed. I did not see an instance, where there was any down, that this was the case. Nearly every day, during the first week or two, I found nests containing one, two, three, or more freshly laid eggs lying on a bed of down so exquisitely soft and warm that, in that almost painfuly barren and frigid region, it was the ideal of comfort, almost of beauty. When the bird leaves her nest without being suddently disturbed, I believe the eggs are generally covered with down, always so after the full complement has been laid. The largest number of eggs found by me in a nest was six, and this in so many instances that I am inclined to think it the normal number; in color, they present two varieties, one of a pale greenish-olive or oil green, and the other a brownish or true olive; the former are frequently marked with large spots or splashes of the same color of much greater intensity; the latter are invariably unspotted. After the eggs have been incubated for some time, they are always more or less scratched and marked, probably by the claws of the bird while sitting on them or rolling them over. In shape they present little variety, being always nearly oval; the diameter is considerable. In size, the difference is perhaps less than in the majority of birds.

Four selected eggs measured as follows: 75 x 47 mill,—83 x 55 —17 x 44—75 x 47. Of these the first was the most elongated;

the 2d, the largest; the 3d, the most broadly oval, and the last the smallest.

Sula bassana, Linn. The northerly or highest half of the summit of Gannet Rock, and all the ledges on its sides of sufficient width, the whole upper part of the pillar-like portion of the Little Bird, and the greater part of the remaining portion of this rock, were covered with the nests of the Gannet at the time of my visit. On the ledges the nests were arranged in single lines nearly or quite touching one another; on the summit, at regular distances one from the other of about three feet. Those on the ledges were built entirely of sea-weed and other floating substances; on the summit of the rock they were raised on cones, formed of earth or small stones, about ten inches in height and eighteen in diameter when first constructed, presenting, at a short distance, the appearance of a well-hilled potato field. I saw no nests built of zostera, or grass, or sods; the materials were almost entirely fuci, though anything available was probably used; in one case the whole nest was composed of straw, and in another, the greater part of manilla rope-yarn.

The nests on the summit of the Great Bird were never scattered, but ended abruptly in as regular a line as a military encampment. Through the midst of the nests were several open spaces, like lanes, made quite smooth by the continued trampling of the birds, which seemed to be used for play-grounds; these generally extended to the brink of the precipice, and reminded me very much of the sliding places of otters.

The birds were feeding principally on herring, but also on capelin filled with spawn, some fine-looking mackerel, a few squids, and, in one instance, a codfish weighing at least two pounds. The surface was swarming with a species of staphylinus that subsisted on the fish dropped by the birds. Occasionally, a nest could be seen in which the single egg had not been deposited, and perhaps one, in two or three hundred, with a newly laid one; on all the rest the Gannets were already sitting, and though none of the eggs were as yet hatched, many of them contained fully formed chicks. On being approached the birds manifested but slight symptoms of fear, and could hardly be driven from their nests; occasionally one more bold would actually attack us. Their number on the summit could be very easily and accurately determined by measuring the surface occupied by them; by a rough computation I made it to be about fifty thousand pairs, and probably

half as many more breed upon the remaining portion of the rock and on the Little Bird.

All the birds I saw were in adult plumage, differing in this respect from those breeding in the Bay of Fundy, where many were young birds. The egg of the American bird has not, I think, been described. Audubon was unable, on account of the weather, to ascend the rock, and I think his description was without doubt taken from a European specimen.

In shape and general appearance the egg is more like that of the brown Pelican than of any other North American bird, and it is sometimes stained with blood, as that commonly is. The cretaceous or calcareous coating is thicker than it is on the egg of any other bird that I am acquainted with, and it is very generally marked with scratches and furrows, as if deposited in a soft state; in one specimen this coating is two millimetres in thickness, nearly one twelfth of an inch; so that the egg, though emptied of its contents, feels nearly as heavy as an ordinary one that has not been blown. In shape there is a greater tendency to elongation or flattening of the ellipse than in the Pelicans. The color when first laid is a chalky white, which soon becomes a dirty drab.

Four eggs selected from many hundreds gave the following measurements: 89 x 45½ mill.—84 x 52—66 x 48—67½ x 42.

Phalacrocorax carbo, Linn. On the 26th of June I had the pleasure of visiting, for the first time, a breeding-place of this species. It was situated on the south side of the rocky wall that bounds the gulf at Wapitaguan, and is probably much the same as it was twenty-seven years ago at the time of Audubon's visit; it extends for nearly half a mile along the face of the cliff, which is there from a hundred to a hundred and fifty feet in height, not perfectly vertical, but falling back slightly towards the land as it rises. Although not by any means easy of access, it is yet much less dangerous than Gannet Rock, as the smallest projection can be depended on, and the rough surface of the granite enables one to crawl over it without fear of slipping. As the eggs are not considered worth collecting, and it requires a good deal of time and patience to ascend the precipice, the birds had not, I think, been disturbed before my visit. The nests were built precisely as described by Audubon, and placed wherever there was any room for them. Some of them contained half-grown young, and others were but just finished, but by far the larger number either young

or eggs that were nearly hatched. I did not see a single bird that had more than the merest trace of the long white feathers of the neck and thighs, The full number of eggs is four, and, excepting when first laid, they are filthy in the extreme. In shape they are more regular than in the Florida Cormorants, but less so than in the double-crested, the only species of this genus with whose eggs I am sufficiently acquainted to properly compare them. The calcareous coating of this egg, as also of that of the *dilophus*, is much softer than that of the *floridanus*, and can readily be rubbed off with the fingers; in some specimens it is quite thick, and is frequently deposited in irregular sheets, or even lumps. The birds were very tame, and, though they flew off on our approach, returned to their nests the moment we moved to another spot. On alighting on the sides of the precipice they cling to it with their tail and claws, much like swifts or woodpeckers, and before alighting almost always swooped down nearly to the surface of the water and then rose in a curved line to the surface of the cliff, without moving their wings, and almost with the regularity of a pendulum. Though these birds breed on many other points on the coast, I did not find them in as large numbers anywhere else. The number at Wapitaguan was from 4,000 to 5,000.

Four eggs measured as follows: 71 x 40 mill.—64 x 40—63 x 43—67½ x 43½.

Phalacrocorax dilophus, Swains. This species, so closely resembling the Florida Cormorant, I found breeding only at one place, Wapitaguan; it was not so abundant as the *P. carbo*, being in the proportion of about one of the present to four of the other. The northerly part of the breeding-place was occupied exclusively by the present species, the central part by both, and the southerly by the common species only. Though so early in the season, there was hardly a trace of the crest remaining on any of the birds. Their nests were apparently as bulky as those of the common species, and as they are certainly occupied for more than one year, I am inclined to think it not uncommon for the nest built by one species to be occupied by the other the next season. As a general rule, they preferred the lowest ledges, where the two species were breeding in common; but the highest nest of all was one of the present species. Where the ledge was long enough to admit of several nests, they were generally occupied by the same species; where there were only two or three, much more frequently by the two. In one or two places near the summit, where the rock was broken in such

a way as to present a series of little niches, they seemed to alternate, as if by design. The two species were evidently on terms of perfect friendship, and when not sufficiently near to be distinguished by color or size, no difference could be detected in their habits or motions. The nests contained the same variety of eggs and young as those of the preceding species; if anything, the number of newly laid eggs was proportionably less. The eggs, four in number, were of a more regular oval, but otherwise similar in appearance, and the difference in size by no means proportioned to that of the birds themselves. At the time of Audubon's visit none of the present species were seen at Wapitaguan, and he says that he never found them breeding on precipices, but always on flat rocks. I was unable to visit the breeding-place mentioned by him, near Cumberland Harbor, though I passed near, both going and returning, and even remained two days at *Tête de Baleine*, in hopes that the sea might go down sufficiently to make it possible to land on the rock.

Four eggs gave the following measurements: 62½ x 36½ mill.—57 x 40½—56 x 38—59 x 39.

Thallassidroma Leachii, Bon. These birds were frequently seen but do not breed in numbers or in many places on the North shore. I found them but at two places, on Gull Island, at Romaine, and on a small island between Mecattina and Bras D'Or. As the opposite shore of Newfoundland is lower, and the islands less rocky, it probably breeds there. On the Atlantic shore it is found breeding everywhere that a suitable island exists, from Mount Desert, in Maine, to the Straits of Belle Isle. At Romaine the eggs were but just laid on the 26th of June.

Puffinus——? Shearwaters were very numerous in the Straits, and as at that time they must have been feeding their young, their breeding-places were probably at no very great distance. Owing to the stormy weather I was unable to procure a specimen so as to identify the species, and did not succeed in finding their breeding-place. None of the inhabitants, questioned by me, had ever found the egg or knew anything about their breeding-place.

Lestris arcticus. Also very abundant in the Straits, but not found breeding.

Larus marinus, Linn. This beautiful and powerful Gull we found breeding on almost all the grassy islands North of Romaine in greater abundance as we approached the Straits. I saw nothing in its habits not already well known. I am sure, however,

that it has been represented as much more rapacious and tyrannical than it deserves to be. On Greenlet Island, which I have already mentioned as the abode of great numbers of Eider Ducks, I found twenty-two nests of this bird, among the number one not a foot from the nest of an Eider, both containing eggs. I did not see a single egg-shell or any apperance of any eggs having been destroyed by the Gulls. On all the islands where the Herring Gulls breed, this species is found in greater or less numbers, apparently on as good terms with them as with its own species. I saw no peculiarity in its flight, and have often watched one for some time to ascertain what species it belonged to, before a good look of his black back betrayed it.

The nest is much oftener placed on the bare rock than that of the following species, and is not unfrequently found singly on some small rocky island, which the other never is. The eggs are three in number, and are generally easily distinguished from those of the Herring Gull by the color as well as size. The spots are generally fewer in number and much larger, and this is almost a specific character.

The dimensions of four were as follows: 81 x 50 mill.—69 x 51½—70 x 57—69½ x 59.

Larus argentatus, Brünn. This bird was not found by Audubon breeding anywhere on the coast of Labrador. I can hardly attempt to account for this. It is difficult to believe that a bird, now one of the most abundant on the coast, breeding on nearly all the grassy islands, and which the inhabitants state to have always been abundant, could have been overlooked by Audubon; still, this is the most probable supposition, and he mentions, as a fact, something that would seem to favor this view, namely, that the Black-backed Gulls change their plumage so as to resemble large Herring Gulls.* I visited probably thirty breeding-places of this bird, between Romaine and Chateau Beau, at all of which there were Black-backed Gulls in greater or less abundance, but in the whole of this distance found but one spot on which the Black-backed Gulls were breeding by themselves in a greater number than one, or, at most, two pairs.

*"The most remarkable circumstance relative to these birds is that they either associate with another species, giving rise to a hybrid brood; or that when very old they lose the dark color of the back, which is then of the same tint as that of the *Larus argentatus*, or even lighter." *Aud. Birds of America* 8vo. vol 7, p. 178.

As the islands on which these birds breed are all known by the inhabitants, and the eggs and young are both favorite articles of food, they are much harassed by them. At Flat Rock, for instance, where many of these birds breed, on the 26th of July there were from fifty to sixty young birds, the greater number of which, as well as all the eggs, were carried off, and many of the old birds shot by a party of eight whalers, who landed on the island at the same time with ourselves. Nothing remarkable was observed in their method of building their nests. The eggs are subject to a larger amount of variation in form and color than those of most of the genus; the large spots found in the Saddle-back are seldom seen.

Four of them measured as follows: 73 x 44 mill.— 67 x 49— 55 x 48—78 x 52.

Alca torda, Linn. This species, though abundant, is probably less numerous than the Foolish Guillemot; it is, however, much more generally distributed, and breeds on almost all the rocky islands in greater or less numbers, even on those at some distance from the open waters of the Gulf, which the *U. troille* I believe never does.

The eggs can generally be easily distinguished from those of the Guillemots, though some of the latter are so similar that I think they cannot be determined with positive certainty. Naumans says that they can be distinguished by the spots being always shaded on their edges with reddish-brown. This is not strictly true, and I have seen eggs of the Guillemots in which the spots were similarly shaded. The number of eggs is stated by Audubon to be two ; though I have seen hundreds of them, I never found more than one laid by the same bird, and in no instance anything like a nest. The greatest number found breeding at any one place, was on an island called Tête de Baleine, near the Fox Islands. From the eggs being generally deposited in cracks and fissures, or under projecting masses of rock, they are more difficult to be obtained, and consequently the birds are not so much disturbed as the Guillemots. In the ninth volume of the Pacific R. R. Survey, it is stated that the white line from the nostril to the eye is never absent in this bird in any state of plumage. Naumann says, on the contrary, that in the first plumage it is nearly impossible to distinguish it from the young *U. arra*. I have a fine adult specimen in winter plumage, and also a young bird of the year, without a trace of the white line.

Four eggs measured as follows: 71 x 43½ mill.—75½ x 49—83½ x 47½—80½ x 49.

Uria grylle, Linn. Breeding everywhere in abundance. One specimen had the posterior edges of the upper mandible and the lower edges of the rami of the under mandible deep red. I never found more than two eggs laid by the same bird, On July 3rd, on a small island where there was no appearance of the birds having been disturbed, the greater number had but just commenced incubating, and none of the eggs were hatched.

Four eggs measured: 57 x 36 mill.—55 x 38—51 x 37—58 x 39.

Uria troille, Linn. The most common bird on the Labrador coast,—breeding at various points, from the southern extremity of Nova Scotia to the entrance to Hudson's Bay. From the number in which they asssmble at their chosen breeding-places, the eggers and fishermen are enabled to collect their eggs with great ease; the extent to which these birds are persecuted may be imagined from the fact that, though on the 23rd of June young birds were common at Gannet Rock, where they are but little if at all disturbed, up to July 20th I saw but one young bird on the Labrador coast. At the Murre Rock, so famous at the time of Audubon's visit for the number of Guillemots breeding there, on the 2nd of July not more than a hundred eggs could be collected, and apparently not over a thousand birds were breeding on it, probably not a hundreth part of their former numbers. On account of the violence of the sea, I was unfortunatety unable to visit the Foxes, as they are called, a short distance north of the Murre Rocks, and at present said to be their favourite breeding-place. Naumann in his description of the eggs of this bird states that he has never seen an unspotted specimen. I have several in my possession, and it would be strange if in a bird, whose eggs are so extremely varied in their coloration, they should not occasionally be found of a uniform color.

Four eggs measured as follows: 84 x 47 mill.—47 x 51—84 x 51—78 x 45.

Uria ringvia, Brünn. As this bird was unfortunately confounded by Audubon with the preceding species, it is at present impossible to ascertain what were its limits or numbers at the time of his visit. There can be little doubt, however, that it was not at all rare on the Labrador shore. None were seen by me at any place, except Gannet Rock, though I think it must breed at

other points on the coast. The eggs are said by Naumann to be larger than those of the Foolish Guillemot, and the shell to be smooth, and the spots to be seldom large, &c. The largest Guillemot egg found by me was one of the present species, but in respect to the coloration I notice no particular mark by which they could be distinguished. When at Gannet Rock I unfortunately supposed that I should find this and the succeeding species equally common on the North Shore, and neglected to procure many specimens. The largest and handsomest egg procured is one of the green variety, and marked over the whole surface with lines that present very much the appearance of Chinese characters; it resembles, however, specimens of the eggs of *Uria troille*, and I see no character by which it could be distinguished from them.

Naumann gives, as one of the distinguishing features of the eggs of this bird, a peculiarly fine spotting or dotting, which gives the whole egg, at a short distance, the appearance of being uniformly dark colored. I saw no eggs at Gannet Rock that presented this peculiarity, but in the collection of the Smithsonian Institution there are eggs from California of another species, which are so marked. The species to which these eggs belong is as yet doubtful. Among the thousands of eggs of *U. troille* seen by me at Labrador, not one presented this peculiarity.

Four eggs measured: 79 x 47 mill.—75x48—70 x 46—80 x 50.

Uria lomvia,* Linn. Every available spot on the sides of Gannet Rock, not already occupied by the Gannets or Kittiwakes, had been taken possession of by the three last-mentioned species of Guillemots and the Razor-billed Auks; their comparative numbers were about three of *U. troille* to two of *U. lomvia* and one of *U. Ringvia*, and about one Auk to fifty Guillemots. I noticed nothing in the habits of these birds not already well known.

According to Naumann, the eggs of *U. lomvia* resemble a turkey's in form: though their shape is generally more ovate quently larger and less numerous, I have not been able to find any character by which they can certainly be distinguished. I have eggs, particularly of *U. ringvia*, that present these peculiarities as strikingly as any of the present species.

Four specimens measured as follows: 79 x 47 mill.—75 x 48—70 x 48—70 x 45.

ARTICLE XVII.—*List of Recent Land and Fresh-water Shells collected around Lakes Superior and Huron in* 1859-60. By Mr. Robert Bell, Assistant to Alexander Murray, Esq., Geological Survey of Canada.

(*For the "Canadian Naturalist."*)

TERRESTRIAL GASTEROPODA.

1. *Helix alternata*, Say. North shore of Lake Huron; Manitoulin Islands and the smaller islands between them and the main land; S. W. side of Georgian Bay. On a small island near Lacloche Island about a pint of these shells was collected in the space of two yards.
2. " *albolabris*, Say. Keweenaw Point; Grand Island; north shore of L. Huron; Manitoulin Islands; S. W. side of Georgian Bay.
3. " *monodon*, Raskett. Grand Island; E. shore of L. Superior; Grand Manitoulin Island; S. W. side of Georgian Bay; Sarnia.
4. " *tridentata*, Say. S. W. side of Georgian Bay.
5. " *concava*, Say. Rabbit Island; Sarnia.
6. " *multilineata*, Say. Abundant on swampy ground at Sarnia.
7. " *aborea*, Say. East side of L. Superior; Sault Ste. Marie; N. side of L. Huron; Manitoulin Islands; S. W. side of Georgian Bay.
8. " *striatella*, Anthony. East shore of L. Superior and north of L. Huron; Grand Manitoulin Island.
9. " *lineata*, Say. East shore of L. Superior; Sault Ste. Marie; Bruce Mines; Mississaugi River; Grand Manitoulin Island.
10. " *labyrinthica*, Say. Batch-ah-wah-nah Bay; Sault Ste. Marie; Mississaugi River; Grand Manitoulin Island.
11. " *chersina*, Say. Bruce Mines.
12. " *fuliginosa*, Griff. S. W. side of Georgian Bay; Sarnia.
13. *Succinea ovalis*, Gould. Tequamenen River (near Whitefish Point); Mississaugi River; Grand Manitoulin Island; Sarnia.
14. " *avara*, Say. Manitouwaning Bay.
15. *Bulimus harpa*, Say. Bruce Mines.
16. *Vertigo* ——. Various localities on the East side of L. Superior.

FRESH-WATER GASTEROPODA.

1. *Physa heterostropha*, Say. Numerous localities on the south side of L. Superior; Goulais River; Sugar Island; Manitouwaning Bay; White Cloud Island; Owen Sound; Sarnia.
2. " *elongata*, Say. Township of Nottawasaga.
3. *Limnæa stagnalis*, Lam. L'Anse; Grand Marais; Grand Island; Sarnia.

4. *Limnæa umbrosa*, Say. Manitouwaning; Lacloche Island; Owen Sound; Sarnia.
5. " *umbilicata*, Say. Manitouwaning.
6. " *caperata*, Say. Tequamenen River; Batch-ah-wah-nah Bay.
7. " *modicella*, Say. Sarnia.
8. *Planorbis trivolvis*, Say. Sousonwagami Creek (S. side L. Superior); Sarnia.
9. " *campanulatus*, Say. Lacloche Island; Manitouwaning; Owen Sound; Small lake at Cape Rich; Sarnia.
10. " *bicarinatus*, Say. Tequamenen River; Batch-ah-wah-nah River; Lacloche Island; Manitouwaning; Sarnia.
11. " *armigerus*, Say. Bruce Mines; Manitouwaning.
12. " *parvus*, Say. Sousonwagami Creek.
13. *Amnicola porata*, Say. Sousonwagami Creek; Owen Sound.
14. *Valvata tricarinata*, Say. Sousonwagami Creek, Owen Sound.
15. " *humeralis*, Say. Owen Sound.
16. *Paludina decisa*, Say. Tequamenen River; Goulais River; Batch-ah-wah-nah River; Owen Sound; Sarnia.
17. *Melania Niagarensis*, Lea. Tequamenen River; Batch-ah-wah-nah Bay, a large coarse variety; common along the shore of Georgian Bay from Cabot's Head to Collingwood.
18. " *acuta*, Lea. Abundant in St. Mary's River below the Sault.

FRESH-WATER LAMELLIBRANCHIATA.

1. *Unio complanatus*, Lea. Sousonwagami Creek; Tequamenen River; Batch-ah-wah-nah Bay; Goulais River; Mississaugi River; Lacloche Island.
2. " *radiatus*, Lam. Sousonwagami Creek; Batch-ah-wah-nah Bay; Goulais River; Sugar Island; Mississaugi River; Lacloche Island.
3. " *ventricosus*, Barnes. Mississaugi River, very abundant.
4. " *rectus*, Lam. Mississaugi River.
5. " *ellipsis*, Lea. Mississaugi River.
6. *Margaritana rugosa*, Barnes. Mississaugi River.
7. " *marginata*, Lea. Mississaugi River.
8. *Anodonta cygnea*, Linn. Sousonwagami Creek; Lacloche Island.
9. " *subcylindraca*, Lea. Batch-ah-wah-nah Bay; Goulais River; Sousonwagami Creek.
10. " *Benedictiana*, Lea. Sousonwagami Creek; Grand Marais; Batch-ah-wah-nah Bay; Sugar Island; Lacloche Island.
11. " *fragilis*, Lam. Sousonwagami Creek.
12. " . A species like *A. implicata*, Say, Batch-ah-wah-nah Bay.
13. *Cyclas similis*, Say. Owen Sound.

14. *Cyclas partumeia*? Say. Amagoos Creek (Batch-ah-wah-nah Bay); Tequamenen River.
15. *Cyclas*——. A very small species was found in great numbers in the stomachs of whitefish at Marquette in the beginning of July.
16. *Psidium dubium*? Say. Tequamenen River.

ARTICLE XVIII.—*Catalogue of Birds collected and observed around Lakes Superior and Huron in* 1860. By Mr. Robert Bell, Assistant to Alexander Murray, Esq., Geological Survey of Canada.

(*From the Report of the Geological Survey for* 1860.)

1. *Haliætus leucocephalus*, (L.) Bald-headed Eagle. On Sugar Island I met with an Indian having in his possession an old female and two young ones shot on the 12th of June. The bodies of the young birds were nearly as large as that of the parent, but almost unfledged. The nest from which the Indian obtained them was on a large dead poplar-tree, standing on low wet ground, near the water. Bald-headed eagles were frequently seen during the summer, often in the act of robbing the industrious fish hawks of their prey.
2. *Buteo borealis*, (Gmel.) Hen Hawk. South shore of Lake Superior and north of Lake Huron; rare.
3. *B. Pennsylvanicus*? (Wils.) Broad-winged Buzzard. A specimen which appeared to be of this species was shot in Batch-ah-wah-nah Bay, 15th August, and another in the township of Torontorus, 4th September.
4. *Pandion haliætus*, (L.) Fish Hawk or Osprey. Common around Lake Superior.
5. *Falco columbarius*, (L.) Pigeon Hawk. South side of Lake Superior; June.
6. *F. sparverius*, (L.) Sparrow Hawk. Very common on both sides of Lake Superior, and on the north side of Lake Huron, especially about bold rocky places, till the first week in October.
7. *Astur fuscus*, (Gmel.) Slate-coloured Hawk. Common on the south side of Lake Superior.
8. *A. Cooperi*? (Bonap.) Blue-winged Hawk. One seen at the Pictured Rocks in June.
9. *Circus cyaneus*, (L.) Marsh Harrier. Seen at Portlock Harbour, 15th September; Walker's River, (opposite Campment D'Ours,) 11th September; Mississaugi, 22nd September; La Cloche Island, 4th October.

10. *Syrnium nebulosum*, (L.) Barred Owl. Campment D'Ours, beginning of September.
11. *Surnia nyctea*, (L.) Snowy Owl. I was informed by a good authority that this owl has been seen on Manitoulin Island.
12. *Bubo Virginianus*, (Gmel.) Great Horned Owl. Seen and heard at the mouth of Root River, 7th September. Mr. Murray informs me that he has killed two of these owls on the Meganitouwau River.
13. *B. asio*? (L.) Little Screech Owl. One seen on Kee-wee-naw Point.
14. *Caprimulgus vociferus*, (Wils.) Whip-poor-will. Mouth of Root River, 6th and 7th September; near Campment D'Ours, 9th September.
15. *Chordeiles Virginianus*, (Briss.) Night Hawk. Common along the south side of Lake Superior and the St. Mary's River. A nest with an almost full grown young one and an egg, on which the parent bird was still sitting, was found at Point aux Pius, 23rd July.
16. *Hirundo bicolor*, (Vieill.) White-bellied Swallow. Numerous on the south shore of Lake Superior, especially about the mouths of rivers.
17. *H. fulva*, (Vieill.) Cliff Swallow. Pictured Rocks, Grand Island, Gorlais Bay, Namainse.*
18. *Muscicapa tyrannus*, (L.) Tyrant Flycatcher or King Bird. South side of Lake Superior and north of Lake Huron. A nest of this bird in an old shed at the Sault Ste. Marie contained four eggs on the 20th of July.
19. *Sylvicola maculosa*, (Lath.) Black and Yellow Warbler. South side of Lake Superior; does not appear to be common. A male was shot near Iroquois Point, 15th June.
20. *Parus atricapillus*, (L.) Black Cap Titmouse. Abundant on both sides of Lake Superior and north side of Lake Huron.
21. *Dolichonyx oryzivora*? (L.) Rice Bird. Observed at Two-Heart River, 19th June; Sousonwagami Creek, 9th July.
22. *Sialia Wilsonii*, (Swainson.) Common Blue Bird or Blue Robin. Numbers at Little Current on the 7th of October.
23. *Turdus migratorius*, (L.) Common Robin. On the south and east shores of Lake Superior, at the Sault Ste. Marie, and various places on the north shore of Lake Huron. On the 6th of October great numbers of robins were congregating on La Cloche Island evidently preparing to start for the south.

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*The name of this promontory is generally spelled Mamainse, which is incorrect. The word Namainse means Little Sturgeon.

24. *Turdus solitarius*, (Wils.) Hermit Thrush. One of these birds was shot at Penetanguishene by Mr. Murray.
25. *Troglodytes hyemalis*, (Vieil.) Winter Wren. Occasionally seen in the bush on both the south and east sides of Lake Superior.
26. *Anthus ludovicianus*, (Lich.) American Pipit or Titlark. In small flocks at the Sault Ste. Marie in the begining of September, and on St. Joseph's Island in the middle of the same month.
27. *Emberiza Canadensis*, (Lath.) Canada Bunting. One specimen shot near Iroquois Point, 15th June.
28. *Niphæa hyemalis*, (L.) Common Snow Bird. Around both lakes.
29. *Carduelis tristis*, (L.) Common Yellow Bird or Goldfinch. Sault Ste. Marie and its neighbourhood.
30. *Fringilla melodia*, (Wils.) Song Sparrow. Numerous along the south shore of Lake Superior, and at the Sault Ste. Marie.
31. *Erythrospisa purpurea*, (Gmel.) Purple Finch. One specimen shot at the Sault Ste. Marie, 1st September.
32. *Quiscalus ferrugineus*, (Lath.) Rusty Grackle. Mouth of Mississaugi River, 24th September.
33. *Corvus corax*, (L.) Raven. Numerous at Grand Island near the end of June; sometimes seen on the east side of Lake Superior, July and August; La Cloche Island, 3rd October.
34. *C. Americanus*, (Aud.) Common Crow. Abundant around both lakes; a large flock seen at Hilton, (St. Joseph's Island,) 12th September.
35. *Garrulus Canadensis*, (L.) Canada Jay or Moose Bird. Abundant around both lakes. It is a little remarkable that this bird although so common in fall and winter is scarcely ever seen till after the first frosts.
36. *G. cristatus*, (L.) Blue Jay. Both sides of Lake Superior, Portlock Harbour, Manitoulin Island.
37. *Orpheus felivox*, (Swainson.) Cat Bird. Observed on the Batch-ah-wah-nah River, middle of August.
38. *Bombycilla Carolinensis*, (Briss.) Cedar Bird. Common around both Lakes Superior and Huron. A nest with three fully fledged young ones in it was found at the head of Batch-ah-wah-nah Bay, 19th August.
39. *B. garrula*, (Bonap.) Bohemian Chatterer. Sousonwagami Creek, (south side Lake Superior), 9th July; Sault Ste. Marie, 30th August.
40. *Sitta Canadensis*, (L.) Red-bellied Nuthatch. Occasionally seen on the south and east shores of Lake Superior in June, July and August.
41. *Trochilus colubris*, (L.) Humming Bird. Sault Ste. Marie, 20th July.

42. *Alcedo alcyon*, (L.) King Fisher. Abundant everywhere around both lakes, and along the creeks and rivers entering them.

43. *Picus pileatus*, (L.) Pileated Woodpecker. East shore of Lake Superior, Bruce Mines, La Cloche and Manitoulin Islands.

44. *P. erythrocephalus*, (L.) Red-headed Woodpecker. Mr. Ironside informs me that he has seen this bird at Manitouwaning.

45. *P. villosus*, (L.) Hairy Woodpecker. Around both lakes.

46. *P. auratus*, (L.) Highholder or Golden-winged Woodpecker. Common on the south and east sides of Lake Superior, and north side of Lake Huron, particularly near settlements.

47. *Coccyzus erythrapothalmus*, (Wils.) Black-billed Cuckoo, or "Chick-ko-ko." One shot near Grand Island, 25th June.

48. *Ectopistes migratoria*, (L.) Passenger Pigeon. Small flocks and single birds were met with around both lakes during the whole summer. The largest flocks were seen at Grand Island on the 23rd and 24th of June.

49. *E. Carolineus?* (L.) Carolina Long-tailed Dove. A pair of doves supposed to be of this species, was seen by our party on the east side of Lake Superior. Mr. Murray informs me that he has shot them on the north side of Lake Huron.

50. *Tetrao umbellus*, (L.) Ruffed Grouse. Around both lakes. Rather abundant in many places on the north side of Lake Huron.

51. *T. Canadensis*, (L.) Canada Grouse or "Spruce Partridge." Everywhere on the Canadian side of the lakes, but not common; rare on the south side of Lake Superior.

52. *T. rupestris*, (Leuh.) Rock Ptarmigan. Said to be found on the north side of Lake Superior in winter.

53. *Ardea Herodias*, (L.) Great Blue Heron. Portlock River, 15th September; Mississaugi Marsh, 22nd September.

54. *A. lentiginosa*, (Swainson.) American Bittern. Common on the south side of Lake Superior and north of Lake Huron. A nest with five unfledged young ones, about the size of pigeons, was found near Marquette on the 20th of June. A specimen was shot near La Cloche as late as the 27th of September.

55. *A. exilis*, (Wils.) Little Bittern. Several specimens shot on the south side of Lake Superior, where it is found in almost every marsh. Mr. Murrray shot one some years ago on the Meganitouwan River.

56. *Scolopax Wilsonii*, (Temm.) Snipe. Several brace shot at Mississaugi and La Cloche in the latter part of September.

57. *Microptera Americana*, (Aud.) American Woodcock. A single bird shot at L'Anse, 2nd July. Numerous at the Sault Ste. Marie and Mississaugi, in August and September.

58. *Choradrius marmoratus*, (Wayler.) American Golden Plover. A specimen, in summer plumage, was shot at the mouth of the Mississaugi, 24th September. Very numerous about Little Current and La Cloche Island in the beginning of October, some of them in winter plumage.

59. *Tringa arenaria*, (Aud.) Wandering Sandpiper. A number of specimens shot at the mouth of the Mississaugi, 24th September.

60. *T. semipalmata.* (Wils.) Semipalmated Sandpiper. Three specimens shot near the mouth of Batch-ah-wah-nah River, 11th August.

61. *Ortygometra Carolinus*, (L.) Sora Rail. Sault Ste. Marie and La Cloche. At the former place a male was shot, 30th August.

62. *Fulica Americana*, (Gmel.) American Coot. Mr. Murray has shot this bird at Lake Nipissing and Whitefish Lake.

63. *Podiceps Carolinensis*, (Lath.) Red-billed Dobchick or "Hell Diver." Abundant on the north side of Lake Huron after the middle of September.

64. *Colymbus glacialis*, (L.) Loon or Great Northern Diver. Common on both Lakes. Fishermen on both sides of Lake Superior set what they term "pound nets" for all kinds of fish. Loons allured by the fish at the extremities of these circular enclosures frequently alight inside of them. After gorging themselves they are unable, from want of room to start, to rise over the top of the net which is generally four feet above the water. When thus imprisoned they are easily captured alive; in this way we obtained two fine specimens.

65. *Larus argentatus*, (Brunn.) Silvery Gull. Abundant on both lakes. Numbers of these gulls were constantly hovering over the jumbling water at the foot of the Sault Ste. Marie. Half-fledged young ones were seen on projecting shelves of sandstone at the Pictured Rocks, 12th July.

66. *Sterna hirundo?* (L.) Common Tern. Tern supposed to be of this species have been seen at Little Current, and shot by Mr. Murray at the mouth of the French River.

67. *Mergus serrator*, (L.) Red-breasted Merganser. Numerous along the shores of both lakes during the whole season. They were seen in considerable flocks about St. Joseph's Island in the middle of September. Very young birds were met with near the end of August. The members of different broods varied much in size at the same season.

68. *Anser Canadensis*, (L.) Canada Goose. In spring as the wild geese are going northward many of them stop for a few days at the mouths of the numerous rivers and creeks entering the north side of Lake Huron.

69. *Fuligula fusca*, (L.) Velvet Duck. Common in the neighbourhood of La Cloche Island after the 2nd of October; said to be common along the whole north shore in October.

70. *F. clangula*, (L.) Golden-eyed Duck. St. Joseph's Island and Portlock Harbour in the middle of September.

71. *F. albeola*, (L.) Buffle-headed Duck. One specimen shot on the Batch-ah-wah-nah River, 10th August. Numbers of these little ducks are said to pass the winter at the Little Current, where the water remains open the whole year.

72. *Anas Boschas*, (L.) Mallard or Grey Duck. In marshes, &c. On the south and east sides of Lake Superior and north side of Lake Huron, from the middle of June till the beginning of October.

73. *A. sponsa*, (L.) Wood or Summer Duck. Everywhere with the last species, but rather more frequently met with. The first drake in full plumage was shot in Mississaugi Marsh on the 22nd of September.

74. *A. obscura*, (Gmel.) Dusky or Black Duck. Occasionally met with in marshes on the east side of Lake Superior and north of Lake Huron, from the middle of August till the beginning of October.

75. *A. Carolinensis*, (Steph.) Green-winged Teal. Batch-ah-wah-nah River, 9th August; Walker's River, Portlock Harbour and Mississaugi Marsh, during September. Mr. Murray has shot both the green and blue-winged teal at Lake Nipissing.

76. *A. discors*, (L.) Blue-winged Teal. Almost always found in company with the last species on the north shore of Lake Huron.

77. *A. acuta*, (L.) Pin-tail Duck. Mr. Murray has shot these ducks on Lake Nipissing and the Wanapitie River.

ARTICLE XIX.—*On the Flora of Hamilton and its vicinity.* By JUDGE LOGIE.

(*Read to the Botanical Society of Canada; Kingston, 28th March*, 1861.)

There are probably few places in Canada where the study of Botany can be prosecuted with greater advantage than in the neighbourhood of Hamilton, or where the botanist will be more amply rewarded for his labours, by the number and variety of plants he will be able to collect.

The climate at the head of Lake Ontario, and particularly of the strip of land lying between the high table land or mountain as it is called, in rear of the city of Hamilton, and extending from the Niagara River round the head of the lake as far as Wellington Square, is milder than the climate of most other parts of the Province. The peach and some of the other more tender kinds of fruit, grow and thrive there, and many trees and plants not to be found in the colder parts of the Province are indigenous. Among these I may mention the black walnut, (*Juglans nigra.*) a large and handsome tree. Few of a large size are now to be found in the neighbourhood of Hamilton, though in a smaller form it is common; it is found also in the low rich lands of some of the western townships, but does not, so far as I can learn, extend to the east much beyond Hamilton. The tulip tree, (*Liriodendron tulipifera,*) is also found in several places in the neighbourhood of Hamilton: there are two large trees near the Railway Station, and last summer I found a very large tree having a diameter of nearly five feet, in the township of Glanford, some miles to the south of Hamilton. I have not heard of its being found in Canada, except near Hamilton and towards the Niagara River. The American plane tree or button wood, (*Platanus occidentalis,*) is said to be the largest North American tree except the Wellingtonia gigantea of California; none of those that I have seen, however, are so large as the tulip tree I have mentioned, or the large elm and walnut trees I have seen. The sweet chestnut, (*Castanea vesca,*) is very abundant, particularly on the hill sides in the neighbourhood of Ancaster, some miles to the west of Hamilton. The flowering dogwood (*Cornus florida,*) is common in the same locality, and in various other places. The Sassafras officinale is also common in the neighbourhood of Ancaster, in East Flamborough, on Prince's Island, and other places. In addition to

these we have most of the trees common in other parts of Canada.

Among the smaller plants and flowers found in the neighbourhood of Hamilton, I will briefly enumerate some of those most abundant in the different localities near the city. In the spring, besides the flowers common everywhere, such as the Hepatica triloba, Trillium erectum, Aquilegia Canadensis, Arum triphyllum, and some others, I have found growing on the sides of the mountain in great numbers Claytonia Virginica, Asarum Canadense, Erythronium Americanum, Sanguinaria Canadensis, Hydrophyllum Virginicum, Dicentra cucullaria, and Dicentra Canadensis, also several species of Cruciferæ, such as Cardamine rhomboidea, Cardamine Virginica, Dentaria laciniata, and Dentaria diphylla. On the other side of Burlington Bay, I found early in the spring Symplocarpus fætida, several species of Anemone, and later in the season several species of Pyrola, Lobelia spicata, Lobelia syphilitica, Ceanothus Americanus, several species of Vaccinium, also several species of Gerardia.

On Prince's Island, (which however is not an island,) Gillenia trifoliata and Diervilla trifida are very common. I have also found there Sisyrinchium officinale, Collinsonia Canadensis, Polygala Senega, Polygala Nuttallii, Hypoxis erecta, Cypripedium pubescens, several species of Platanthera, Gentiana crinita, Apios tuberosa, two species of Lespideza, and several species of Gerardia.

On the sands of Burlington Beach, Polanisia graveolens and Datura Stramonium are to be found in abundance, and in the waters of Burlington Bay at the beach, besides the Nymphæa odorata and Nuphar advena, (the white and yellow water lilies,) Sagittaria variabilis, Ranunculus aquatilis, and several species of Potamogeton are common. Zizania aquatica or wild rice, Peltederia cordata and Nesæa verticillata are also found.

On the shores of Lake Medad, a small lake about 10 miles from Hamilton, and in a sphagnous bog near Milgrove, I found Sarracenia purpurea, (the pitcher plant,) Calypso borealis, Cypripedium spectabile, Pogonia ophioglossoides, Moneses uniflora, Dalibarda repens, Calla palustris, Coptis trifolia, Linnæa borealis, Ledum latifolium, Cornus Canadensis, and some others.

[Judge Logie submitted a systematic list of the Flora of Hamilton, accompanied by a very large collection of preserved specimens, which were most beautifully prepared, and excited much

interest among the members. His list will be printed at length, with special localities, &c., for the various species, in the Annals of the Botanical Society, part II.]

ARTICLE XX.—*The Great Comet of* 1861.

(From advanced sheets of Silliman's Journal, Sept. 1861.)

The suddenness of the apparition of the comet in northern latitudes was one of the most impressive of its characteristics. On the 2d of July after the twilight had disappeared, the head, to the naked eye, was much brighter than a star of the first magnitude, if only the effective impression be taken into account, although as to intensity it was far inferior to α Lyræ, or even to α Ursæ Majoris. I should describe the head as nearly equal in brightness to that of the great comet of 1858 between the 30th of September and the 5th of October; it should be considered, however, that the present comet was better situated, from its higher position above the horizon at the end of twilight.

The aspect of the tail suggested a resemblance to the comet of March, 1843. It was a narrow, straight ray, projected to a distance of one hundred and six degrees (106°) from the nucleus, being easily distinguishable quite up to the borders of the milky way. The boundaries for the most part were well defined and easily traced among the stars. It was not until after two or three hours of observation, that I could gain a clear comprehension of the structure of the tail or tails as they presented themselves to the naked eye and through a small opera-glass. It was then evident that a diffuse, dim light with very uncertain outlines, apparently composed of hazy filaments, swept off in a strong curve towards the stars in the tail of Ursa Major—the southern edge directed as low as towards Mizar. This was evidently a broad curved tail, intersected on its curved side at the distance of a few degrees from the nucleus by the long straight ray which at the first glance, from its greatly superior brightness, seemed alone to constitute the tail. The two were in fact counterparts of the principal tail and the supplementary rays of the great comet of 1858, with this remarkable difference, that in the latter the straight rays were so far inferior in brightness to the curved tail as to have been recognized at only three observatories, those of Poulkova, Göttingen, and Cambridge, U. S.—while with the

present comet, the predominating feature was the straight ray to which the curved tail seemed scarcely more than a wisp-like appendage.

On further scrutiny with the aid of an opera-glass, two sharply cut and very narrow dark channels, bounding the principal ray, could be traced for ten or fifteen degrees from the nucleus; while outside of them, on either side, were two additional faint rays. The whole issue of nebulous matter from the nucleus far into the tail was curiously grooved and striated. It was noticed that both the principal ray and the dark channels penetrated within the outline of the curved tail, the latter being clearly separated from the principal ray even to the naked eye by a dark cleft just above their intersection. The well-defined margin of the principal ray admitted of a very exact delineation, even as far as α Ophiuchi, 100° from its origin.

On the third, the bright rays and dark channels were traced to a distance of 40° from the nucleus, the principal ray to nearly 100°. Five or six alternations were distinguished, besides the hazy filaments constituting the curved tail. Some of the streaks could be traced quite up to the nucleus. The rays were not only separated by the dark channel parallel to their axis, but they were disconnected at intervals in the direction of their length.

On the fourth, there were two or more regions of contrary flexure on the north following margin of the ray, which, in a theoretical point of view, are of very great interest when taken in connection with the direction of the ray almost precisely in a great circle from the sun continued through the nucleus. This peculiarity presented itself still more decisively on the 5th, when the tortuous path of the ray could not be overlooked.

The very singular aspect of the northern edge of the principal ray for the first thirty or forty degrees of its course, attracted particular attention, and the charts were revised with all possible care. The sky was perfectly clear and the outlines so distinct that there could be no room for doubt as to the reality of the reflexure of the curve. Subsequently on projecting an arc of a great circle from the sun through the nucleus, it was found to lie clearly within the margin of the ray as far as a distance of thirty degrees (30°) from the nucleus, and there was still haziness beyond it almost to the distance of sixty degrees (60°). The charts on other dates indicate similar results, but the data cannot be properly

discussed without requiring more labour than can be, at present, devoted to them.

Within the last few days the principal ray in the part near the nucleus, has assumed a more regular sweep in the direction opposed to that of the diffuse tail, which now reaches nearly to the centre of Corona Borealis, scarcely changing the course of its southern limit between $\varkappa$ and ι Bootis and ζ Coronæ Borealis from night to night.

The telescopic phenomena, though interesting, have not presented equally strongly defined features with those which characterized the great comet of 1858. We should perhaps except from this remark their structure for a day or two after their first emission from the nucleus. In this stage they were intersected by jets of luminous matter projected from the nucleus, and these limits were pretty clearly outlined.

On the 2d, portions of three were visible; the inner one showing a variety of details. In its outline and general aspect it was, like others which followed it, almost a fac simile on an enlarged scale of some of those exhibited by the great comet of 1858. They rapidly faded, or were lost in the surrounding haze and their places were filled by new ones. Latterly, two, at most, could be seen at one time. It is quite important to remark that the successive envelopes resembled their predecessors not only in their general aspect but quite closely in the details of their structure; the luminous jets not issuing at random from all points alike of the nucleus, but continuing to follow a nearly similar course at each new discharge from its surface.

The most natural inference from this would seem to be that the nucleus, if it rotates at all upon an axis, does so very slowly. Of the pendulum-like vibrations of the luminous sectors ascribed by Bessel to the comet of Halley, nothing was seen; although the opportunity of witnessing them, had they existed, was very favorable, as the sectors were well displayed.

The nucleus was throughout brilliant, and, to appearance, solid, with a diameter of from 2″ to 3″.

The disposition of the nebulosity in the part of the tail contiguous to the head was nearly uniform throughout; the axial darkness being scarcely distinguishable, excepting on one occasion, July 3d.

The following positions have been derived from comparisons with neighbouring stars.

1861.	Cambridge mean solar time.	α	δ
July 2,	$8^h\ 28^m\ 38^s$	$8^h\ 37^m\ 43^s.22$	$+62°\ 51'\ 17''.1$
3,	8 21 33	9 49 15.85	66 6 15 .3
3,	10 39 52	9 56 6.58	66 16 05 .1
4,	10 39 18	11 2 7.48	66 53 26 .4
5,	12 9 26	11 57 9.67	66 3 22 .0
6,	9 17 39	12 31 2.60	64 51 33 .3
8,	10 20 5	13 21 36.05	61 46 13 .7
9,	10 40 47	13 37 37.88	60 21 45 .2
10,	9 39 12	13 49 26.80	59 9 34 .1
12,	11 57 47	14 8 0.59	56 54 47 .2
13,	9 47 55	14 13 59.24	56 5 25 .7

The nucleus admitted of very precise observations; indeed it is a curious fact that it would be quite possible by means of proper comparisons with neighbouring stars, to obtain the differences of terrestrial longitudes of the principal points at which it was observed, with a degree of precision only surpassed by the more refined methods known in astronomy.

The near approach of the present comet to the earth and the sharply defined point of its nucleus, illustrates the practicability of a method of determining the solar parallax with perhaps greater exactness than can be attained by any other means. Many comets have stellar points for their nuclei, visible in the larger telescopes, which admit of as accurate comparisons with neighbouring stars as is practicable in measurements among the stars themselves. Many such have appeared within the last fifteen years. Suppose such a comet to be suitably placed so as to be observed simultaneously in different quarters of the globe, when at a distance from the earth of less than one-twentieth of the sun's distance. Under favorable circumstances it would not be hazarding too much to say, that in the course of its apparition the probable error of the solar parallax could be reduced within smaller limits than is possible by means of transits of Venus or of any other method. Such an opportunity might possibly afford an improved value of the mass of the earth.

From the above elements, the diameter of the nucleus may be variously estimated at from one hundred and fifty to three or four hundred miles. On July 2d the breadth of the head at the nucleus was 156,000 miles, the height of the inner envelope 11,500 miles, and the length of the tail about 15,000,000 miles.

The comet was seen between one and two o'clock on Sunday morning, June 30th, by Dr. Brunnow, at the Observatory of Ann

Arbor. This is the earliest authentic account of its visibility which has come to my notice. The head could not have been seen on Friday evening, although observations to that effect have been reported. The extremity of the tail, however, must have been within view for some time previous, though too faint to attract notice.

The reports current of the identity of the comet with those of 1264 and 1556 are without any foundation.

ARTICLE XXI.—*What to observe in Canadian Lichens.* By W. LAUDER LINDSAY, M.D., F.L.S., Neill Medallist of the Royal Society of Edinburgh, and Hon. Mem. Bot. Soc. of Canada.

(*From Annals of the Botanical Society of Canada.*)

An account was given of the importance of Lichens in the phenomena of nature, and of their applications to the wants of man, in affording food, dyes and fodder. Specimens of many of the most valuable dye species were shown, including Roccella tinctoria from Greece; a series of Umbilicariæ named by Leighton, in accordance with his Monograph; Sticta pulmonaria and dye prepared from it, from the woods around Kingston; and an interesting collection of Lichens made in the United States by Mr. A. O. Brodie, of the Ceylon Civil Service. The points brought before the Society by Dr. Lindsay were the following:

1. There are no plants so variable in character as the lichens; none in which it is consequently so difficult to decide what are species and what are varieties. In order to a comprehensive knowledge of species, it is necessary to study individuals in every condition of growth and from every possible habitat. Hence the commonest species and varieties become of value—the more so if collected in countries comparatively unexplored botanically, for lichens are no exceptions to the rule that geographical differences are attended by corresponding differences in the characters of the same plants. Every Canadian collector of lichens—however common and well known the latter may be—may therefore consider himself as contributing towards a more scientific and philosophical, because more comprehensive, knowledge of a very Protean, but interesting, group of plants.

2. If the collector make a point of gathering specimens of everything he meets which belongs to the lichen family, he will run a good chance of including some novelties, perhaps new species or varieties. This is extremely probable in a country like Canada,

seeing that it is seldom a miscellaneous collection of lichens is made in any part of Britain at all remote from the largest towns without the discovery of interesting novelties. New species are most likely to be met with among the very minute crustaceous lichens which grow on rocks or trees, and which cannot be properly studied without the aid of the microscope; among species belonging, for instance, to such genera as Lecidea, Lecanora, Graphis, Opegrapha, Calicium. It is not to be expected that the tyro should make these microscopical examinations or discoveries for himself: he will probably require the assistance of some experienced microscopist or lichenoligost.

3. The applications of lichens to the arts are daily becoming more numerous and important. New dye-lichens are being discovered in India and the East. Among specimens of the latter recently sent me from India, I have found species not hitherto known to be of any practical use. Again recently the probability has been shown, on good grounds, that a lichen—the Lecanora esculenta of Pallas—was the Manna of the Bible.

4. The colorific capability of a lichen, so far as regards a red or purple dye of the nature of orchill or cudbear, may be readily discovered by simply macerating the lichen—chopped into small fragments or pulverised according to the nature of its thallus—in a weakish solution of common hartshorn (the quantity not much covering the lichen in a vial of any sort)—that is, the "liquor ammonia" of druggists—allowing the mixture to stand a few days in a warmish part of the house, and shaking it frequently, so as to expose the mass to the action of the air. Colorific lichens of this class belong chiefly to the genera Roccella, Umbilicaria, Romelia, and Lecanora.

5. The colorific capability of a lichen, so far as regards other colors—chiefly brown and yellow—may be easily ascertained by simply boiling the lichen, chopped or pulverised as before, in a small quantity of water. Colorific lichens of this class belong chiefly to the genera Romelia, Sticta, Cetraria, &c.

6. Whether and how much mucilage or starch a lichen contains may be ascertained by the same means as last mentioned, and allowing the mixture to cool, when it will gelatinise more or less, if it contain much mucilage. Cetraria Islandica and some of the Umbilicariæ are illustrations.

7. Contributions may also be made to our knowledge of the economical applications of lichens by ascertaining whether any

and what species are, or have been, used in Canada by the native Indians to yield food, dyes, &c., noting all the particulars of such uses.

8. Lichens are very easily collected and transported; they require no sort of preparation; they may be simply allowed to dry in the open air and packed as convenient. Those growing on trees generally require the piece of bark on which they grow to be sliced off with a knife, and those on stones the piece of rock to be broken with a hammer. Both may be wrapped in paper like mineralogical specimens. In all cases the localities and dates of collection should be mentioned, and any futher information as to uses, &c., which may be known to the collector.

The Rev. Principal Leitch, the President, in drawing the proceedings to a close, congratulated the Members on the success of the Meeting, and the wide interest manifested in the Society's proceedings. This meeting differed from those previously held in regard to one circumstance—the presence, of the Lady members. Botanical researches of great value had been carried out by ladies in other countries and all Departments of Scientific knowledge had benefited by their exertions. It was gratifying, therefore, that the ladies of Kingston were not behind in this respect, and he looked forward with interest to the contributions which they would no doubt continue to make to the Society's Meetings, in imitation of the example set by Mrs. Lawson. The President concluded by giving some interesting details regarding the employment afforded by the silk culture in Judæa.

The Society then adjourned.

ARTICLE XXII.—*On the Mammals and Birds of the District of Montreal.* By Archibald Hall, M.D., L.R.C.S.E.

"When accurate lists of the resident birds in each region, and of the "summer and winter visitors, are obtained, many highly interesting and "unexpected deductions will doubtless be made, and much theoretical "reasoning exploded."—*Fauna Boreali Americana.*
Richardson and Swainson.

Editorial Note.

[The following paper is a portion of an extended memoir of 153 MS. pages, prepared by Prof. A. Hall, M.D., for the Natural History Society of Montreal, in 1839. It received the silver medal offered by the Society; but unfortunately for the interests of science and the reputation of the Society, was not printed.

Some years after, its printing was recommended by the Council, but nothing was done. Subsequently it was entrusted to Prof. Cassin of Philadelphia, to be used in the preparation of his work on American birds, in which it is frequently quoted with expressions of high commendation. Dr. Cassin retained the M.S. for some years, and it has only recently been returned by him. Had it been printed when written, it would have been a most important contribution to American Natural History, and would have brought to its author and to the Society a large meed of scientific reputation. Even now, after much of the work involved in its preparation has been done over again, it contains so much that is of interest in Canadian Natural History, that its publication should no longer be delayed.

The portion now presented is the introduction and the account of the mammalia; the birds, which occupy the greater part of the memoir, being reserved for a subsequent opportunity.]

Introduction.

In submitting the following pages to the Natural History Society of Montreal, a few introductory observations are requisite, as well to explain the object contemplated in the work, as to offer an explanation why the obvious intention of the Society in offering for a subject "the Zoology of the District of Montreal," could not be attained, at least by the author.

With respect to the first, the motto which has been selected for the essay, is amply explanatory, and in reality, little more has been attempted beyond that object. It was rather with this intention, than to enter into competition for a prize, that the author has bestowed his labour. The necessity of attempting to establish the migratorial ranges of the feathered tribes, is acknowledged at the present day, and it has become an important matter of speculation among zoologists; and nothing can advance this end so materially as correct lists of the resident and non-resident birds in various distantly situated localities. With the view of attempting a solution of the problem, this has been carried into effect in several places. Those of the northern, and north-eastern coasts of this continent have received a partial elucidation. Richardson has given us a tolerably correct list of those of the Saskatchewan district. Charles Lucien Buonaparte has furnished a list of those which are resident or visitors in the neighbourhood

of Philadelphia, and the splendid work of Wilson and Buonaparte supplies us with those met with in more Southern States.*

Those of Lower Canada have not yet received any attention, a desideratum which it has been the professed aim of the author to supply, how feeble soever the attempt may prove. The author by no means puts forward the following catalogue as complete—*to render it as much so as possible, has been his constant care*, and he has invariably preferred omitting a doubtful species altogether than to include it in the list. It requires many years of careful attention, and unceasing watching to ascertain the varied species of a district. Those which are subsequently enumerated have all been observed by the author in this district, and have been with very few exceptions described from prepared or killed specimens. This method has been preferred to giving compiled descriptions from authors; but under circumstances where a reference to a prepared specimen could not be had, the author's name from whom the description is taken is given.

With respect to the second it must be observed, that zoology embraces a most comprehensive field, and includes within its range every animated being from man to the zoophyte. A work such as this could not be completed satisfactorily within as many years as months, nine months having been the time allotted by the Society, and taking this circumstance into consideration, I construed the term more liberally, and confined myself to the mammalia and aves, leaving the remainder of the subject for subsequent work at my own convenience, if opportunity offered. Should the present essay accord with the Society's views on the subject, one step will have been gained in elucidating the Zoology

* Since the preceding has been written Prof. Cassin and Mr. Baird of Philadelphia, have bestowed great labour and pains upon this subject, and the beautiful volume "Illustration of the birds of California, Texas, Oregon, and British and Russian America," intended as a supplement to Audubon's work, has appeared, and is a proof of the industry of the former gentleman, and his devotion to this branch of natural science. The writer, in obedience to the request of the Editors, was desirous of arranging his work in accordance with the published modernized *classification of the latter gentleman, but was obliged to give up* the task, as he found something more to be necessary than a mere detailed list of names, besides which he has discovered that Mr. Baird in his catalogue of North American Mammals, has made no allusion whatever to the genera and species under the families of the vespertiliones and cetaceæ.

of the district of Montreal, and one of by far the greatest importance.

It was the intention of the author at the commencement of his task, to have given a general outline of the habits of the species which would come under notice. It was found, however, that such a step would render the essay far too voluminous; and as *nothing* could be *said* beyond what is contained in any ordinary work on the subject, it was deemed a superfluous repetition, and moreover foreign to the real object which he had in view.

Of the mammalia, 43 have been described as being met with in the district of Montreal, the description of 39 of which have been taken from prepared specimens, two from dead ones which had been placed in the author's way for the purpose, and two compiled. Of these the genera sorex, scalops, condylura, putorius, sciurus and mus, are the most common, and generally speaking resident in the district. The others are all more or less migratory, and range throughout all parts of the fur countries, remaining in different places a greater or less period of time, according to the plenty or scarcity of their food.

The birds are by far the more numerous, interesting and important, and amply repay the labour of their investigation. Of 290 species described, the descriptions of about 24 or 25 are compiled, and that of all the others taken from prepared or dead specimens, and where the author has had it in his power to verify the description by reference to other specimens, it has invariably been done, so that the descriptions may be relied on as correct, as far as laid in the author's power. A table is annexed, "the winter quarters," and "extreme northern migratorial range" of which are taken from a similar table in the valuable work of Richardson and Swainson's American Fauna, its other columns being filled up according to the author's observations. The months in it are given without dates, and in such cases, a date, say from 1st to 20th is to be understood. In this country it must be observed, that it is impossible to assign dates, or to give an approximation to the actual times of the arrival and departure of birds. These events depend altogether upon the temperature or state of weather at the time, and bear a ratio with it.

The district of Montreal, the locality of the subsequent list, in the Province of Lower Canada, is bounded on the west by the north-eastern boundary of the Fief Durablé or Nouvelle York, on the north side of the St. Lawrence; east by the county of St.

Maurice; south-east by the counties of Yamaska, Drummond and Sherbrooke; west and south-west by the Province of Upper Canada, the River Ottawa, and the most western limits of the Province; south by the Province Line, lat. 45° N. from St. Regis to the River Connecticut, and thence by that river to its source in the highlands, and thence by the northern boundaries of the States of New York and Vermont. The River Ottawa bounds it for 335 miles, and it is amply watered by other streams, rivers and lakes, the principal of which are the following:—

RIVERS.

N. of St. Lawrence.	*S. of St Lawrence.*
Gatineau.	Richelieu.
Lievres.	Sorel.
Petite Nation.	Yamaska and its various branches.
Riviere Blanch.	Pyke.
Riviere du Nord.	Montreal.
Mascouche.	Chateauguay and its branches.
Achigan.	Lacolle.
L'Assomption.	Magog.
Lachenaye.	Coaticook.
Berthier.	Missisquoi, part of.
Chaloupe.	St. Lawrence.
Duchesne.	Ottawa.

LAKES.

N. of St. Lawrence	*S. of St. Lawrence.*
White Fish.	Memphremagog.
Sables.	Tomepobi.
Killarney.	Missisquoi Bay.
Temiscaming.	Scaswapenepus, part of.
Lievres.	Yamaska Bay.
La Roque.	St. Louis.
Rocheblave.	Two Mountains.
Pothier.	St. Francis.
Nimicachenché.	Chaudiere.
Papineau.	Chats.
Maskinonge.	Allumets.*

Generally speaking the character of the district is low and level, with here and there a scattered mountain, which is far more apparent on the southern than on the northern shores of the St. Lawrence. The soil is that best adapted for cultivation, and it

* Bouchette's Topographical Dictionary of Lower Canada, 1831.

has been amply taken advantage of. Swamps can scarcely be said to enter into the character of the district, although there are several and rather extensive ones on the south of the St. Lawrence. The streams are, generally speaking, small, and diminish severally considerably in size towards the fall of the year, by which means a muddy alluvium presents itself, which furnishes a place of resort for the Grallatores. Dependant as this circumstance is, however, on the general temperature of the summer months, supplies of food are often rendered scarce, and consequently the visits of this class of birds are not made so frequently, nor in such considerable numbers as in the district of Quebec, where the recess of the tide presents much more favourable scenes for their operations. On the whole, therefore, it may be remarked, that the Grallatores in the district of Montreal are not constant visitors, a few stragglers only being killed from time to time, which appear to have dropped *en passant*, for the purpose of rest or refreshment. The district on the contrary, is abundantly supplied with the Accipitres, Passarinæ and Scansoriæ, the second class being especially numerous, diversifying the landscape by their varied richness of plumage, while they equally invite attention by their melody.

As connected with this subject, the author deems it proper to annex the following tables of mean temperature, compiled for the city of Montreal, which from its almost central situation in the district, may be taken as a standard for the whole. They are all deduced from observations of 15 years.

Mean Temperature of the Months.

January	14.10	July	72.09
February	19.36	August	69.58
March	29.46	September	59.90
April	43.24	October	47.56
May	58.54	November	34.87
June	68.04	December	18.56

Mean temperature of the city of Montreal, deduced from observations of 15 years..... 44.60.

The following abbreviations are used opposite the species described:—

V. S. P.—Vidi specimen preparatum.
V. S. P. et M.—Vidi specimen preparatum et mortuum.
D. C.—Descriptio compilata.
V. S. P. et V.—Vidi specimen preparatum et vivum.

CLASS MAMMALIA.

Ord. III. Carnaria.

Fam. Cheiroptera—Sub gen. Vespertilio.

Sub gen. char. Incisors $\frac{4}{6}$, canines $\frac{1\,1}{1\,1}$, molars $\frac{4\,4}{5\,5}$ or $\frac{5\,5}{6\,6} = 32$ to 36. Upper incisors separated in pairs, acuminate; anterior molars conical; posterior ones having two or three trenchant points in rows with one another. Ears lateral and distinct; nose simple; tail long, enveloped in the femoral membrane. Arms, forearms and fingers elongated, forming with the membrane which occupies their intervals, and thence extended to the tarsi of the hind legs, true wings. Thumbs short, a single joint armed with a claw; fur soft and thin; sebaceous glands under the skin of the face, differing in size and shape, according to the species.

V. pruinosus. Hoary bat of Say.

v.s.p. Length from tip of nose to tip of tail $5\frac{1}{4}$ inches; length of tail $1\frac{7}{8}$ inch; alar expanse 14 inches; superior incisors acuminate, and close to the canines; inferior incisors approximate; upper canines conical and sharp; inferior ones slightly lobed at their internal base, both prominent; molars $\frac{5}{6}$ with high conical trenchant points. Fur blackish beneath, changing to a dirty yellow, then to a black, and lastly tipped with white. Muzzle and throat dirty yellow, changing to a brown on the abdomen, and towards the axilla assuming a dirty white hue, which changes to a brownish yellow, with which the anterior inferior membrane of the wings is covered, as far as the carpus. Upper surface of interfemoral membrane like the back, and the inferior also for about $\frac{1}{4}$ next the body. Membrane entirely envelopes the tail. Toes 5, whitish, furred above; claws black and curved, extremely sharp. Head short; ears large and round, not so long as the head; tragus arcuate; nostrils naked, slightly prominent, divergent.

(Described from a specimen in the museum of the Natural History Society, Montreal.)

V. subulatus. Say's bat.

v.s.p. Length from tip of nose to tip of tail 3 inches; of tail $1\frac{1}{8}$ inch; of ears $\frac{3}{8}$ inch; alar expansee 8 inches. Upper incisors short, and close to the canines; lower ones short, bilobed internally; canines long acuminate; molars $\frac{5\,5}{6\,6}$ short, with tren-

chant points, two rows below and three above; 2nd, 4th and 6th in lower jaw largest. Fur blackish beneath, with shining brown tips; chesnut coloured on back, and paler on the abdomen; interfemoral membrane slightly hairy on both sides, with the end of the tail projecting beyond it. Hind feet long, slightly hairy, 5 dactyle; claws horn-colour and curved; wing membrane naked. Head short, flat, tips of nose and lower jaw naked; eyes almost imperceptible, placed close to the base of the ear; ears nearly as long as the head, ovate obtuse; tragus subulate; whiskers few, and almost imperceptible from their fineness.

(Described from a specimen in the museum of the Natural History Society, Montreal.)

V. noctivagans. Silver haired or Audubon's bat.

V. Audubonii. Harlam.

V. noctivagans. Annals of New York Lyceum, 1837.

v.s.p. Length from tip of nose to tip of tail 4 inches; of tail $1\frac{3}{8}$ inch; of head $\frac{5}{9}$ inch; of ears $\frac{5}{8}$ inch; alar breadth 11 inches. Fur black beneath, changing to brown, and tipped with white along the back and abdomen, white tips less frequent towards the head which is brown; cheeks, tip of nose, and sides and extremity of lower jaw almost naked; nostrils prominent; eyes visible; ears as long as the head, erect, subrotund, emarginate and revolute behind; anterior tips white and ciliate; whole ear internally sparingly covered with hair; tragus arcuate, obtuse, about $1\frac{1}{4}$ lines long; wing membrane slightly pubescent along the humerus; interfemoral membrane triangular, enveloping the whole tail except the half of the last joint, pubescent beneath, hairs in lines; superiorly the half next the body covered thickly with hairs slightly tipped with white, the hair nearly three lines long; nails crooked, horn colour, grooved beneath. A very pretty bat, rarely met with.

(Described from a specimen in the museum of the Natural History Society, Montreal.)

Ord. III. Carnaria.

Fam. Insectivora.—Gen. Sorex.

Gen. char. Incisors $\frac{2}{2}$, canines $\frac{3}{2}\frac{3}{2}$, molars $\frac{4}{4}\frac{4}{4} = 28$ to 30. Upper incisors base-indented; molars pointed; head elongate; snout moveable; ears and eyes small; nails short and curved. Teats 6 to 8, pectoral and ventral; strong smelling sebaceous glands on each flank.

S. palustris. American marsh shrew. (Richardson.)
S. Richardsonii. Baird!

D.C. Length 5½ inches. Fur dark coloured, soft and close, presenting a silky appearance; ash coloured below. Feet paler than the back, and a little hoary; nails whitish; tail rounded, subtetragonous, and covered with short close hairs; upper lip whiskered; muzzle naked, bilobed; eyes visible; ears imbedded in the fur. Found in the neighbourhood of swamps, feeding on insects, worms and tender roots.

S. Forsteri. Forster's shrew.
S. tetragonurus. Geoffroy & Desmartes!!
S. fodiens. Cuvier!

D.C. Length 2¼ inches. Fur greyish brown above, yellowish brown beneath; tail tetragonous, tufted at its extremity; muzzle slender, bilobed; whiskers long, composed of a few white hairs intermixed with black ones; ears as long as the fur, perceptible. More common than the former species, extending to 67° N.L. Its tiny footsteps are often seen on the snow in winter.

Genus Scalops.

Gen. char. Incisors $\frac{2}{4}$, conical teeth $\frac{3}{3}\frac{3}{3}$, molars $\frac{3}{3}\frac{3}{3} = 30$. Head long, conical, terminating in a flexible cartilaginous snout; two outer conical teeth larger than the centre one; molars bristled; external ear scarcely perceptible: feet short, 5-toed; anterior very broad, having all the phalanges except the last, united by a strong membrane; eyes very small.

S. Canadensis. Shrew mole.
S. aquaticus. Linnæus!
Talpa fusca. Pennant!
Blarina talpoides. Baird!

V.S.P. Length 7 inches. Fur brownish black, velvety, rather paler on the forehead; limbs short and concealed by the fur of the body; fore legs extended under the auditory apertures. The toes in consequence of their membranous connection, form a broad palm, admirably adapted to burrowing; tail thick, short and tapering, sparingly covered with hair; snout long and linear, projecting about ½ inch from the incisors, naked above, pubescent below, furrowed the whole length above, and about half the distance inferiorly.

Genus Condylura.

Gen. char. Incisors $\frac{6}{4}$, canines $\frac{3}{1}\frac{3}{1}$, molars $\frac{4}{3}\frac{4}{3} = 40$. Six inferior incisors anomalous; two intermediate ones large, spoon-shaped; next one conical, subtriangular at the base, with a basal, exterior and interior tubercle; molars bristled, the points composed of two folds of enamel; muzzle elongate, furnished with membranous appendages surrounding the nasal apertures; ears and eyes very small; feet, toes and nails, like the shrew mole.

C. cristata. Radiated or star-nosed mole.

Sorex cristatus. Linnæus!

V.S.P. et M. Length 3 to 4 inches. Fur brown and dry looking, paler beneath; snout elongated, terminated at its extremity by a star-shaped fringe of a pale flesh colour; eyes and ears scarcely perceptible; tail $\frac{2}{3}$ the length of the body, thick, and loosely covered with stiff hairs; toes black, with strong, slightly hooked nails.

ORD. III. CARNARIA.

Fam. Carnivora.—Tribe 1. *Plantigrada.*

Genus Ursus.

Gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{4}{4}$ to $\frac{7}{7} = 32$ to 44. False molars small, make their appearance late, and are deciduous; posterior molars very strong, with a square crown and blunt tubercles; body thick, strong-set, covered with coarse hair; ears somewhat long, slightly acuminate; toes five, with strong claws, not retractile; tail short; two mammæ pectoral, and four ventral.

U. Americanus. American black bear.

V.S.P. Length 4 to 5 feet, rarely exceeding the latter. Fur black, shining, not curled along the centre of the nose and forehead; a black line, bounded on each side on the muzzle with yellowish brown patches; nose continued on nearly the same line as the forehead, slightly arched; ears oval, small, rounded at tips; tail very short; hair of the feet enveloping the claws, and projecting beyond them.

Genus Procyon.

Gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{6}{6}\frac{6}{6} = 42$. Canines large and compressed; the three molars next in the series are acuminate, and the three last ones are large and tuberculate; body rather slightly made, but heavy posteriorly; tail long; 5

toes, with sharp nails not retractile; muzzle pointed; ears small; teats 6 in number, ventral.

P. lotor. The racoon.
Ursus lotor. Linnæus!

V S.P. Length 1½ to 2 feet. Fur greyish brown, composed of long white hairs of a dirty hue, ringed with black; belly paler; cheeks on each side black; streaks of a similar colour between the eyes, extending to the forehead; tail bushy, of a dirty white colour, with six distinctly marked black rings; extremities short, particularly the hind ones; toes five, with strong nails; tail 12 inches long.

Genus Meles.

Gen. char. Incisors $\frac{6}{6}\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{5}{6}\frac{5}{6} = 38$. First molar is rudimentary, 2nd and 3rd acuminate, 4th cutting on its outer side, 5th disproportionately large, having on its external edge three tubercles, on its internal edge a serrated crest, and on its middle another crest, separated into two parts by a groove; on the lower jaw they present nothing remarkable; body thick; feet with five toes, and strong nails; muzzle projecting; ears short and round; eyes small; tail short, with an anal pouch containing a fætid secretion.

M. Labradoricus. American badger.
Ursus Labradoricus. Linnæus!
Taxus Labradorica. Desmarets & Geoffroy.

V.S.P. Length 1½ to 2 feet. Fur greyish brown on sides, back and tail, and black on the abdomen and legs; two narrow white lines from the nose to the nape of the neck, these stripes are bounded by black, which fades to grey, and then to white, as it approaches the ears which are black; a greyish brown patch encloses the eyes, extending to the nose; claws long, strong, and of a dark colour; tail 5 to 6 inches long and bushy; extremities though short are strong and muscular. It differs considerably from the European species, which has a darker, coarser fur, more conspicuous demarcations on the head; larger ears tipped with white, larger head and generally larger figure. The Meles Hudsonius of Cuvier is probably the animal just described. Cuvier describes it as nearly similar to the European species. The European and American species were for a long time confounded, but a closer examination of specimens, has ascribed to each their distinctive characters.

Fam. Carnivora.—Tribe 2nd. Digitigrada.
Gen. Mustela.—Sub gen. Putorius.

Sub gen. char. Incisors $\frac{6}{6}\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{4}{5}\frac{4}{5}$ to $\frac{6}{6}\frac{6}{6}$ = 34 to 38. Head small; ears short and round; body long and slender; legs short; toes 5; an anal follicular gland containing a rancid fætid secretion.

M. erminea. Ermine.

V.S.P. et M. Length 10 to 13 inches. Summer pelage, reddish brown, deeper on the head and nose; abdomen, interior of legs, thighs, and the whole feet yellowish white; tip of tail black. There is occasionally a slight yellow tinge on the abdomen; claws concealed by the hair; whiskers black; tail long and cylindrical, 4 to 5 inches; ears short and round circumventing the meatus auditorius.

M. vulgaris. Weasel.

V.S.P. Length of body 9 inches; of tail $2\frac{3}{4}$ inches. Summer pelage yellowish brown, deeper on head, and white on abdomen; under jaw, half of upper lip, as far as the orbit, pure white; tail coloured like the black, tipped at its extremity with blackish brown. This species has a flatter forehead, a longer nose, and a shorter tail than the ermine.

M. lutreola. Mink.
Mus vison.
Mus putorius. Gmelin & Linnæus!!

V.S.P. Length 17 inches. Colour of upper fur umber brown and glossy; of the under fur brownish grey; upper pelage paler on the head and belly, and deepening as it approaches the tail; lower jaw white, with inconstant white markings on the throat; (I have seen in several instances a broad white band stretching from the lower jaw to the breast.) Whiskers black; body long; legs short and muscular; toes 5 with strong black hooked claws; two brown coloured glands between the tuberosities of the ischium and tail secreting a very fætid matter.

Sub genus Mustela.
M. martis. Pine martin.
M. Americana. Baird!

V.S.P. Length 18 inches; tail 10 inches. Fur fulvous brown beneath, brown near the summit with black tips; that of the tail longer, coarser, and almost black. In summer the fur

loses its brilliancy, and changes to a paler orange with little lustre. The throat and breast have various inconstant markings of yellowish white; feet slightly palmated at the base of the toes; toes 5 with black hooked nails.

M. Canadensis. Pean or Fisher martin.
M. Pennantii of Erxlebein and Baird!
M. melanonyncha. Bodds!
M. piscator of various authors!

v.s.p. Length of body 23 inches; of tail 16 inches. Fur shining black at the tips, yellowish brown more inferiorly, and grey brown at base; throat, abdomen and legs, blackish brown; an inconstant white mark on breast and between the hind legs; tail long, bushy and black; ears brownish with white margins, pale anteriorly and blackish posteriorly; chin and nose tipped with brown; claws hooked and strong.

Sub genus Mephitis.

Sub gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{4}{5}\frac{4}{5}$. Differs from mustela in having the upper tubercular molar very large, broad and long, and the inferior carnivorous with two tubercles on its inner side; toes separated, nails long; heel a little raised in walking; feet hairy; tail long and bushy or wanting.

M. Americana. Chinche or Skunk.
Virerra mephitis of Gmelin!
Chinche of Buffon.
Enfant du diable of Charlevoix.
Mephitis mephiteca. Baird!

v.s.p. Length 10 inches; tail 7 inches, the long hair at extremity of tail nearly one-half the said length. Fur black, shining on the whole body, except on the back, where two broad white lines advance and meet over the neck. A white line also reaches from the forehead to the tip of nose. Hair of the tail long and bushy, and with the exception of the tip is black; legs comparatively short, but very muscular; claws on the fore feet very strong and hooked; toes not palmated. An anal follicle contained a very fætid secreted fluid, which by a muscular apparatus the animal is enabled to eject to a considerable distance when pursued or in danger.

Sub genus Lutra.

Sub gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{5}{6}\frac{5}{6} = 38$. Three false molars on each jaw; the lower greater carnivorous

tooth with two points on its outer side; head compressed, large; tongue demi-asperate; tail long, flattened horizontally, tapering; feet palmated, nails crooked.

L. Canadensis. Otter.
L. Braziliensis of Harlam!
Mustela Hudsonica of Lacepede!
Mustela Lutra Braziliensis of Gmelin!

V.S.P. Length of body 3¼ feet; tail 1½ feet. Fur brown or fawn colour, glossy, of two sorts, internally of waved and shining brown, with long hairs brownish and black tipped. Summer pelage almost black; winter pelage a reddish brown; chin and throat dusky white; neck and head long; ears short and approximate; snout blunt; legs short; teats ventral; on each side of anus a small aperture leading to a sac containing a fætid secretion. An animal long confounded with the European species, but pointed out by Captain Sabine as much larger, and differing in other more essential respects.

2ND SUBDIVISION OF CARNIVORA.

Genus Canis.

Gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}$, molars $\frac{8}{7}\frac{8}{7} = 40$. Three false molars above, four below, and two tubercuious teeth behind the carnivora. The large superior carnivorous tooth has a small tubercle on its inner side; posterior portion of the inferior one altogether tuberculous; muzzle variably elongate; tongue soft; ears variably erect; fore feet 5-dactyle; hind feet 4-dactyle; teats inguinal and ventral.

C. lupus. Wolf.
Canis Occidentalis, Var. Griseo—Albus. Baird!

V.S.P. Length 5½ feet including tail; of tail 1 foot 5 in.; of ear 3½ inches. Fur reddish brown or pale, intermixed with white hairs. The colour of the fur, moreover, varies considerably. Tail bushy, pendant; ears erect, acuminate; legs long and very muscular; head moderately long and round; hair on the neck very long, and stands out like a fringe around the head; teats inguinal and ventral; eyes oblique, irides yellow; feet very thick; toes strong; claws long and curved.

C. fulvus. Red fox.
Vulpes fulvus, Var. fulvus. Baird!

V.S.P. Length of body 2 feet; of tail 16 inches. Summer pelage ferruginous on head, back and sides, less brilliant towards

the tail; chin whitish; throat and neck dark grey, continued along the anterior part of the belly in a narrow stripe; abdomen pale reddish; anterior part of fore, hind legs and feet black; tail blacker than body, especially at the tip, bushy; at the tip a few white hairs are discernible. Winter pelage; fur more dense and glossy, and not varying much in colour; eyes oblique, irides yellow; pupil oblong; muzzle elongate; ears erect, acuminate; claws strong, nails hooked; body denoting great agility.

C. cinereo-argentatus. Silver grey or Kit fox.
Vulpes Fulvus. Var. Argentatus. Baird!

v.s.p. Length of body about 21 inches; of tail 14 inches; height of back 13 inches. Upper lip beyond the whiskers whitish, the rest of the dorsal aspect grizzled; a brown hue predominates on the crown and occiput; sides of neck, shoulders and flanks of a dull reddish orange; lower jaw white, tinged with blackish brown towards its tip and along the edges; chest reddish orange; belly, throat and inner surface of extremities white; upper surface of the feet white; tail woolly, tapering, yellowish grey superiorly, intermixed with black and white hairs; under surface brownish orange, tipped with black.

3rd Subdivision of Carnivora.

Genus Felis.

Gen. char. Incisors $\frac{6}{6}$, canines $\frac{1}{1}$, molars $\frac{3}{3}\frac{3}{3}$ to $\frac{4}{3}\frac{4}{3}$ = 28 to 30. Two false molars superiorly and two inferiorly. Superior, carnivorous trilobed aud carinate internally; inferior bilobed trenchant and non carinate; a small tubercular tooth above without anything to correspond to it below; head short and round; ears acuminate; fore feet 5-dactyle, hind feet 4-dactyle, with long sharp retractile claws, usually sheathed.

F. concolor. American lion, Couguar or Puma.
F. discolor of Cuvier!
F. concolor et discolor. Temminck!

v.s.p. Length from tip of nose to the tip of the tail 90 inches; of tail 30 inches; of ears 2¼ inches; space between the orbits 3½ inches; greatest height 24 inches. Pelage brownish yellow, with occasional patches of a deeper shade; back deeper coloured than the sides; belly pale red; thorax, insides of thighs and legs, a pale white; lower jaw and throat entirely white; ears white internally, blackish externally; external lobule reddish

grey; whiskers white; end of the tail black; both sexes coloured alike. The dimensions given above are taken from a specimen in the museum of the Natural History Society of Montreal.

F. Canadensis. Canada lynx; Loup cervier.
F. borealis of Temminck!
F. lynx of Linnæus!
Lynx Canadensis. Baird!

V.S.P. Length of body and tail 39 inches; of tail 4 inches. Winter pelage a grey made up of white and black hairs, of a blueish grey at the base. Summer pelage short, brown at the base, and red at the tips with brownish spots. Posterior margin of ears black, anterior white, terminated by a tuft of black hairs two inches long. From the base of the ear to the angle of the jaw the hairs are very long, and give the animal a whiskered appearance; tail first grey, terminated by black; head thick and round; ears short, erect and pricked.

3RD TRIBE OF CARNIVORA.

Amphibia.

Genus Phoca.

Gen. char. Incisors $\frac{6}{4}$ or $\frac{6}{2}$ or $\frac{4}{4}$, canines $\frac{1}{1}\frac{1}{1}$, molars $\frac{5}{5}\frac{5}{5}$ to $\frac{6}{5}\frac{6}{5}$ to $\frac{6}{6}\frac{6}{6} = 30 = 32 = 34 = 36 = 38$. Molars all trenchant or conical; feet 5 dactyle; fore feet enveloped in the body as far as the tarsus; hind feet as far as the heel; between the latter a short tail; eyes large; nostrils closing voluntarily; head round; external ears wanting; four abdominal mammæ.

P. vitulina. Common seal.
Vitulus oceani. Rond.

V.S.P. Length of body and tail 39 inches; of tail 4 inches. Fur yellowish grey, variously spotted black, darker on head and back, paler on the abdomen; extremity of snout flat and broad; posterior part of head large and round, without any bony projections; upper lip moveable, extensible, furnished with thick strong whiskers; over the eyes a few bristles similar to whiskers; fore limbs short; feet palmated; toes with thick long black nails, longer on the hind than on the fore feet.

ORD. V. RODENTIA.

Genus Sciurus.—Sub genus Sciurus.

Sub gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{5}{4}\frac{5}{4} = 22$. Superior incisors flat and cuneiform; lower ones compressed la-

terally; molars tubercular; fore feet 4-dactyle, with a rudimentary thumb in shape of a tubercle; hind feet 5-dactyle; body and tail long; 2 pectoral and 6 ventral mammæ.

S. striatus. Ground squirrel: Chip-monk.
S. Lysteri of Ray!
S. Carolinensis of Brisson!
Tamias striatus. Baird!

v.s.p. Length of head and body 6 inches; of tail 4 inches. Incisors deep, brown and furrowed; lower ones twice as long as the upper; molars equal in size, surrounded by a thin plate of enamel, acquiring a black crust. General colour of the head and upper part of the body reddish brown, the hairs grey; within eyelids white with a black streak at each angle; on the cheek a brown line, gradually increasing in breadth, reaches to the ears, brown without, grey within; on the back 5 longitudinal black bands bordered posteriorly with red, all terminating on the rump. A white line separates the two lateral ones; abdomen and inside of the thighs pale; tail red at the base with an edging of black.

S. Hudsonius. Red squirrel.
S. vulgaris, var. E. of Erxlebein.
S. vulgaris of Linnæus.

v.s.p. Length of head and body 8 inches and 6 lines; of tail 6½ inches. Incisors strong, much compressed, convex anteriorly, deep orange coloured, nearly as long as the lower ones ridges of enamel on the molars less elevated than in the former species; distance between the orbits 7 lines; eyes large, prominent; frontal bone flat; nose obtuse; whiskers black, longer than the head; ears subrotund, pencilled at the tips. On each side of nose a light brown spot, divided by a narrow black stripe. Between the ears a beautiful bright glossy chesnut commences, and continues down the back, becoming lighter on the sides; eyelids white; throat, chest, and inside of legs, dirty white. In summer when the pelage is short, a black line, well defined, separates the abdominal white from the lateral chesnut. This stripe is lost in winter when the fur is long and thick. Fore feet 4-dactyle with the rudiment of a thumb covered by an obtuse thin nail closely applied; 3rd toe longest, 2nd next in length, 1st and 4th shortest and arise more posteriorly; claws compressed, slightly curved, chesnut coloured; scrotum in spring large and pendulous; tail

reddish brown, bushy, susceptible of a distichous arrangement with light brown tips, inferiorly black and then greyish. A great many of the lateral hairs of the tail have alternate black and brown rings, three of the former intersected by two of the latter.

S. niger. Black squirrel.

V.S.P. Length of head and body 13 inches; of tail 13 inches. Fur over the whole body black, at the base greyish black; on the cheeks and throat brownish black; tail long, hairs without down; feet hairy; claws curved and much compressed, a rudimentary thumb armed with a rounded nail closely adhering to it. A fine specimen shot spring 1838, on the Montreal mountain.

S. Carolinensis. Grey squirrel.

V.S.P. Length the same as the last, but the tail much longer and more bushy. General colour grey composed of black, brown, yellowish and white hairs. In some specimens the colour assumes a golden hue especially about the head and along the sides, all the inferior parts of a lighter hue verging to white; on the anterior part of the fore and superior parts of the hind feet, the colour changes to a red, which, however the animal may vary in its general colour, is uniform and permanent. I suspect that these two are near varieties of each other, as they are desbribed under the same name by Baird, in his catalogue of N. A. Mammals in the Museum of the Smithsonian Institute. I doubt, however, if he is correct.

Sub genus Pteromys.

Sub. gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{5}{4}\frac{5}{4} = 22$. The dental system has the generic characters of the last; head short and broad; eyes large and prominent; fore feet 4-dactyle, hind feet 5-dactyle; bony appendages to the feet supporting a furred lateral membrane serving as a parachute.

P. volucella. Flying squirrel.

Sciurus volucella of Linnæus, Gmelin, Pallas and Sabine.

V.S.P. Length of body to tail 5 inches 7 lines; of tail 4 inches; extended alar length 6 inches 3 lines; between orbits 7 lines; from occiput to nose 1 inch 3 lines. Fur on the back black internally, tipped with a very light brown, around the ears assuming a darker hue; sides of nose, abdomen, and inferior surface of the parachute white, occasionally yellowish on the abdo-

men; parachute fringed with white; tail light yellowish brown, distichous beneath, the fur dense; eyes large, black; incisors orange coloured, compressed; fur of the whole body exceedingly soft, in fact almost silky.

Genus Mus.—Sub genus Arctomys.

Sub. gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{5}{4}\frac{5}{4} = 22$. Incisors strong, anterior surface rounded; molars with ridges and blunt tubercles; head large; eyes large; no cheek pouches; ears short; body thick and heavy; paws strong; fore feet 4-dactyle with a rudimentary thumb; hind feet 5 dactyle; nails strong and compressed; tail short.

A. monax. Wood chuck or Ground hog.
Mus monax of Linnæus!
Glis fuscus.
Marmota Bahamensis of Brisson?
Marmota Americana of Gmelin!

V.S.P. Length of body 17 inches; of tail 8 inches. Fur long rusty brown with grey tips; face paler, of a blueish ash colour; inferiorly grey but lighter; ears short, broad, having a cropped appearance, much imbedded in the fur; tail about half the length of the body, dark brown and bushy towards the extremity.

A. empetra. Quebec marmot.
Mus empetra of Pallas!
Glis Canadensis of Erxlebein!

V.S.P. Length of body 17 to 20 inches; of tail 7 inches. Dorsal fur dark at the base, yellowish in the middle, black near the tips, and then tipped with grey, giving the animal a hoary appearance, the grey tips disappearing towards the tail; sides of the upper lip, point of chin, cheeks and sides of neck, of a soiled reddish white colour, gradually mixing with the dark colour of the head; throat, breast, belly, fore and hind feet of a reddish orange or chestnut without mixture; hair on the tail dusky throughout, longer on the back, and darker towards the tip; tail rather flat, rounded at the tip; legs short and muscular; toes with long sharp claws, those of the four feet being longest and most curved.

Sub genus Mus.

Sub gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{3}{3}\frac{3}{3} = 16$. Molars with tubercles; ears oblong or round, nearly naked;

no ear pouches; fore feet 4-dactyle, a wart with an obtuse nail in place of a thumb; hind feet 5-dactyle; tail long, naked and scaly.

M. decumanus. Common rat.
M. sylvestris of Brisson!
M. Norvegicus of Idem!

V.S.M. Length about 9 inches; colour light brown above, greyish white beneath; tail nearly as long as the body; feet naked, dirty flesh colour; tail scaly with stiff scattered hairs.*

M. musculus. Common mouse.
M. sorex of Brisson!
M. domesticus vulgaris of Ray!

V. S. M. Length about $3\frac{1}{2}$ inches; tail about the same length. Fur dusky, grey above, ash coloured beneath; fore feet 4-dactyle, with a rudimentary thumb, clawless; hind feet 5-dactyle, naked.

M. agrarius. Common field mouse.
M. leucopus of Rafinesque!
M. sylvaticus of Forster!
Hesperomys leucopus. Baird!

V.S.P. Length of head and body 3 inches, 7 lines; of tail 2 inches, 3 lines; of ears 2 lines. Colour mixed, dusky and ferruginous, along the back, with yellowish or reddish-brown sides; cheeks lighter almost rufous; upper lip, a space on each side of the mouth, chin, throat and belly, with the inner surface of the extremities white; tail not scaly, hairs short, appressed, streaked with black along the dorsum, all the other surface white; head large and long; ears large, erect and membraneous; snout obtuse, and sparingly covered with short appressed hairs; eyes moderately large; whiskers long, black and white. Supposed by Tennant to be a variety of the European field mouse.

Sub genus Gerbillus.

Sub gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{3\,2}{3\,3} = 16$. Molars tuberculous; first with three, second with two, and third with one tubercle. Ears smaller than in the last sub genus; fore

* Another species, the *Mus rattus*, has been also killed in Montreal, undoubtedly an introduced species. The author has never seen but one specimen of it, which was a stuffed one in the possession of the Museum of McGill College, and which was trapped in a merchant's store in this city. It differs from the former only in the colour of its pelage which is blackish.

legs short, 4-dactyle and a rudimentary thumb; hind legs long; 5-dactyle with nails; tail long hairy.

G. Canadensis. Jumping mouse.
Dipus Canadensis of Davies!
Dipus Americanus of Barlow!
Mus Canadensis of Pennant!
Jaculus Hudsonius? Baird!

V.S.P. Length about the same as common mouse; head, back, and upper parts of the body reddish brown verging to yellow; under parts, as well as the insides of the extremities cream colour; a yellow streak commences below the nostrils, running along the head and superior and inferior sides of the fore limbs, and thence running along the body terminates at the thighs; tail much longer than the body; tapering, ciliated throughout, and terminating with a fine pencil of hairs; slate brown above, cream colour below; fore feet short, 4-dactyle with sharp nails; hind legs long especially from the heel to the toes, 5 dactyle; head long, lower jaw projecting beyond the upper. Ears small, oval, whiskers long.

Genus. Arvicola.
Sub genus. Fiber.

Sub gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{3}{3}\frac{3}{3}=16$. Molars with flat corners and scaly transverse zigzag lamina; Fore feet 4-dactyle with rudimentary thumbs; hind feet 5-dactyle, edged with stiff and close hairs, and in swimming like the membrane of palmated feet. Tail long, laterally compressed, granular.

F. zibethicus. Muskrat.
Castor zibethicus of Linnæus.
Mus zibethicus of Gmelin.
Ondathra zibithicus of Say.

V.S.P. Length of head and body 14 inches, of tail $8\frac{3}{4}$ inches; Fur dark umber brown in the upper part of the head, shoulders, ears and back; the down is dark grey, the tips alone being edged with brown; sides, breast, fore front of belly and cheeks of a lighter brown hue, while the chin and posterior part of the belly are ash grey; nose thick and blunt; ears small; toes full, the place of web supplied by stiff hairs, which in the hind feet, turn inwards; tail compressed laterally, thin at the edges, covered with scubs and minute stiff appressed hairs of a dusky brown colour, thicker in middle than at the root, and from the middle tapers gradually to an obtuse tip.

Sub genus Arvicola.

Sub gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{3}{3}\frac{3}{3}$=16. Molars with flat crowns ,and irregular plates of enamel; front toes with nails; tail round, hairy, nearly as long as the body.

A. Xanthognatus. Meadow mouse.

A. gapperi? Baird!

v.p.s. Length of head and body, 5½ inches to 8 inches, of tail 2 inches; Incisors pale yellow exteriorly, brown ones subrotund and rather larger. Molars (upper) with three grooves; ears circular; whiskers long; fore feet 4 dactyle with rudimentary thumbs as callosities; claws small; hind feet 5-dactyle; fur in upper parts of body reddish yellow; the hairs below the yellow tips, shining grey or black; sides of head fulvous; under parts of body silvery blueish grey, darkening into blackish grey on the shoulders; a blackish brown stripe runs along the nose; tail brownish black above and white beneath.

Genus Castor.

Gen. char. Incisors $\frac{2}{2}$, canines $\frac{0}{0}$, molars $\frac{4}{4}\frac{4}{4}$= 20. Molars with flat crowns and sinerous, complicated ridges of enamel, one on the inner edge and three on the outer edge of the upper teeth; feet 5-dactyle; front toes short; hind ones longer and pulmated; tail long oval, flat and scaly; an anal pouch filled with an unctuous strong smelling secretion.

C. fiber. The Beaver.

C. Canadensis. Baird!

v.s.p. Length of head and body variable, of a fully grown one, generally 40 or 45 inches, of the tail 11½ inches; fur dense, consisting of an inner greyish black down and a longer coarse hair of a chesnut colour more or less verging to black; nose obtuse; eyes small; ears short, thick and rounded, and susceptible of closure at the will of the animal, by a verticle apposition of the auricle; toes, fore feet free; of hind feet with large callous soles and the toes palmated; the 2d toe with two nails, the inferior of which is rounded with a cutting edge; the inner toe has a less perfect double nail, the rest have simple nails; tail linguaform, with angular oval soft scales, and hairs sparingly interspersed in their intestices; for a short distance from the body it is covered with hair.

Genus Hystrix.

Gen. char. Incisors $\frac{2}{2}$, canines none, molars $\frac{4}{4}\frac{4}{4}$ = 20. Molars with flat tops, and a ridge of enamel; head short and strong with

a thick muzzle; tongue scaly; fore feet 4-dactyle and a rudimentary thumb; hind feet 5-dactyle; body covered with spines intermixed with the hair; tail more or less long, in some foreign species prehensile.

H. dorsata. Porcupine.
H. pilosus of Catesby!
Cavia Hudsonius of Rlim!
H. Hudsonius of Brisson!
Erithrezon dorsatum of Cuvier!
Erethizon dorsatus. Baird!

V.S.P. Length of head and body 30 inches; of tail 8 inches; fur over body above and beneath blackish brown externally intermixed superiorly with white hairs and spinous quills, which are spindle-shaped and very sharp, brown, and at other times tipped with white; the upper lip is covered with a yellowish brown fur assuming a deeper tint on the forehead and sides of the head; tail brown, with a fine white hair on the tip; the hairs which cover the upper surface of the feet, curve downwards near the soles, and being worn by constant friction on the ground, form a thick marginal brush, which fits the animal for walking on the snow; eyes lateral, small and round; ears much concealed by the fur, in many instances barely perceptible. This animal forms the type of the Hystrix tribe of M. F. Cuvier. A specimen in the Museum of the Natural History Society of Montreal measures:

From the tip of the nose to the tip of the tail, 36 inches.
Length of the tail including fur..... 7 "
Distance between the eyes..... 2½ "
Greatest height from ground including fur... 12 "

Genus Lepus.

Gen. char. Incisors $\frac{4}{2}$, canines wanting, molars $\frac{6\,6}{5\,5} = 28$. Upper incisors in pairs; two cuneiform, with a longitudinal groove anteriorly, the other two smaller; lower ones square; molars with flat crowns and transverse laminæ of enamel; ears and eyes large; fore feet 5-dactyle; hind feet 4-dactyle. Fore legs short, hind legs long; hind feet with slightly arched nails; tail short, reclinate or erect; mammæ 6 to 18; cæcum large.

L. Americanus. American hare.
L. Hudsonicus of Pallas!

V.S.P. Length 20 inches; tail including fur 2½ inches. Sumer pelage: blackish grey at the roots, and yellowish brown at the

tips; sides of the muzzle sprinkled with white; under jaw grey; abdomen and thorax white; sides dull yellowish brown; tail white beneath and yellowish brown above. Winter pelage: blackish grey internally changing to brownish which fades to white at the tips, giving the animal a more white appearance, which is only interrupted at the margins of the ears, where the interior black of the ear becomes perceptible; the hair is twice as long in winter, as it is in summer. Weight of a full grown one about six pounds.

ORD. VII. PACHYDERMATA.

None wild.

ORD. VIII. RUMINANTIA.

Genus Cervus.

Gen. char. Incisors $\frac{0}{8}$, canines $\frac{0}{0}$, or $\frac{1}{0}\frac{1}{0}$, molars $\frac{6}{6}\frac{6}{6}$ = 32 to 44. Canines when present, bent back and compressed; head long terminated by a moveable snout or upper lip; eyes large, pupils elongate transversely; a lachrymal sinus in most species; ears large and pointed; tongue soft; horns solid and deciduous, more or less branched, wanting in females except in one species; 4 inguinal mammæ.

C. alces. Moose deer.
Alce Americanus of Jardine and Beard!

V.S.P. Pelage light brown over the shoulders; hairs internally grey changing to white tipped with brown on the shoulders, back and sides of neck; grey internally tipped with black, on the sides, upper part of the forelegs and cheeks; forehead, muzzle, internal surface of the legs, lower part of the fore and hind legs except at the tarsus, and the posterior part of the abdomen of a dirty white or grey colour; ears greyish white with a shorter fur than that on the body, the hairs here being $\frac{3}{4}$ of an inch long, while on the mane it is 4 inches, on the flanks 2 inches and gradually becomes longer as it approaches the abdomen; fur on the tail short the longest hairs being scarcely 2 inches; hairs on the upper part of the body alternately white, grey, black and brown; the shafts assuming a zigzag appearance internally and downy near their insertion into the skin. Irides hazel, pupils elongate transversely; muzzle long and very moveable projecting considerably over the lower jaw. From the intermaxillary space, hangs a tuft of black hairs 9½ inches long, attached to a process of the skin; tarsi of the

fore and hind feet dark brown. Described from a specimen in the Museum of the Nat. History Society of Montreal, of which the following are the dimensions:

	F.	Inc.
Length from tip of snout to commencement of the tail	9	6½
do of tail, including fur		5½
do of ears		9¼
do of fore legs	3	0
do of hind legs	3	6
do of head from occiput to tip of snout	2	4½
Height from shoulders to ground with fur of mane.	5	9¼
Distance between the orbits		9

A much larger and finer specimen of this animal is in the possession of James Douglas, M.D., of Quebec, who has furnished the author with the following measurements of it. It was killed about 3 miles from that city in March, 1855.

	F.	Inc.
Length from tip of snout to tip of tail excluding the fur,	9	11
Do. of tail with fur,	0	6¾
Do. from occiput to snout,	3	1
Do. of fore leg along its inner surface,	3	11½
Do. of hind leg along its inner surface,	4	2
Do. of ear,	0	11¾
Do. of mane,	0	4
Do. of the intermaxillary tuft with the fur,	0	11
Height from shoulder to the ground including fur,	7	1½
Distance between the orbits,	0	10¼

The white hairs of this animal are extensively used by the Indians in the fabrication of their ornaments. They possessed the knowledge of dyeing them in the most gaudy colours, long before the settlement of this country by the French, and indicated a degree of effect in using them truly astonishing, and far above what would be expected from savage tribes.

C. Virginianus. Common or Red deer.

Length from the snout to the tail 5 feet, 8½ inches; tail including fur 5 inches; from the occiput to the snout 9¼ inches; ears 5¼ inches; height from the ground to the shoulders 3 feet, 2 inches. Pelage, upper and lateral parts of the body, neck, head, and ears, anterior and exterior surfaces of the extremities and tail, of a fawn colour, produced by hairs grey at the insertion,

changing to brown, then to yellow, and lastly tipped with blackish brown. Around the eyes, and sides of the nose, the fawn assumes a lighter tint; the intermaxillary space pure white, expanding into a white circular spot which covers the upper part of the throat; abdomen, and upper internal surfaces of the hind legs white; irides deep hazel; antlers incurved, branched from their internal upper surface; tail tufted, composed of white and brown hairs; back part of the knee-joints of the hind legs deep brown.

Ord. IX. Cetaceæ.

Fam. II. Ordinary whales.—*Tribe I. Delphinus.*

Genus Delphinus.

Gen. char. Teeth canine shaped, compressed and notched on their cutting margins, from none to 200; jaws more or less elongated; spiracle luneiform, an adipose dorsal fin with an occasional longitudinal fold of skin; tail horizontally flattened and furcate.

Sub genus Delphinapterus.

Sub gen. char. Without dorsal fins; head oblique; muzzle not elongate; teeth ranging from 9 to 42 throughout.

D. Leucas. Beluga or White Grampus.
D. albicans of Fabr!

v.s.p. Length from extremity of the tail to extremity of the snout 12 feet, 5 inches; of tail 1 foot, 6 inches; breadth of the tail 2 feet, 9½ inches; length of pectoral fins 1 foot, 4 inches; distance between the eyes over the head 1 foot, 11½ inches; greatest circumference about 9 feet; head externally convex; eyes small, black, situated 5 inches above and behind the commissure of the mouth; spiracle large, luneiform, 2½ × 1¼ inches; three fins, two pectoral and a caudal or tail. There is no dorsal fin, but a slight fleshy eminence supplies its place. Colour pure white; cuticle of a mucous or gelatinous nature, nearly half an inch in thickness. The specimen from which the foregoing description is taken, was killed opposite the city of Montreal in the spring of 1836, and is at present a conspicuous object in the Museum of the Natural History Society of this city. The author has had no opportunity of examining its dental or osseous system

END OF THE CLASS MAMMALIA AS OBSERVED IN THE DISTRICT OF MONTREAL.

ARTICLE XXIII—*On some of the Rocks and Fossils occurring near Phillipsburgh, Canada East.* By E. BILLINGS, F.G.S., Geological Survey of Canada.

1. MAGNESIAN LIMESTONE AND UNDERLYING SLATE.

In the neighbourhood of Phillipsburgh, on the eastern side of Missisquoi Bay, (which forms the northern extremity of Lake Champlain,) there is an extensive exposure of limestone occupying an area of about nine miles in length by two miles in width, arranged in a series of long irregularly parallel ridges, presenting low broken escarpments on their western faces, and gentle slopes on the eastern. The direction of these ridges is for the greater part nearly north and south, and the dip of the strata in general towards the east, at an angle of from 10° to 30°; but in some places for short distances it is from 30° to 80°. On the western side of this rocky tract, next to the bay, the strata are composed principally of magnesian limestone, often arenaceous, and in places traversed by veins and filled with irregular nodules of white quartz. Interstratified with this there are some beds of a nearly pure limestone, very compact and crystalline in texture, and usually white, or white clouded with various shades of grey. There are also occasionally to be met with, beds of limited extent, or rather lenticular masses of a hard white, or yellowish white sandstone, intercalated between the strata of limestone. It is difficult to ascertain precisely the thickness of these rocks, but it cannot be much less than 400 feet. They constitute the lower half of the series of limestones exposed in this vicinity, and along the shore of the bay south of Phillipsburgh, they rest upon a formation of hard slates, of a dark grey or blackish colour, with numerous seams of white calcareous spar. These slates dip towards the east, at an angle of from 30° to 50°, while the limestones which lie upon them have a dip of from 10° to 30° in nearly the same direction. Near the wharf, just below the old block-house, the slates constitute the lower 20 feet of the cliff, but about half a mile south, the limestone comes down to the water's edge. Further along the slates appear again at the base of the cliff, with the limestones above them. At the Province line, one mile and three quarters south of the wharf, the limestones once more reach the water, but the slates after a short interval are again exposed in the flat point on the north side of the mouth of the Rock river.

Although I have searched a good deal for fossils I have not found any either in the slates or magnesian limestones.

2. Blue thin-bedded and Nodular Limestones.

Lying to the east of the magnesian limestones, and above them, is a formation of greyish or dark blueish, sometimes almost black limestone, with some beds of white marble, of limited extent at the base. The darker coloured limestones, which constitute nearly the whole of the mass, consist of beds of from three inches to three or four feet in thickness. Usually the thicker beds seem to be composed of a number of thin layers, with irregular thin seams of shale between. Many of them thus present a nodular appearance. In this deposit there are occasional magnesian beds interstratified. Some of the strata are silicious, and where exposed to the action of the atmosphere, lose their lime, the residue forming a light red friable mass, in which the forms of the fossils are well preserved, either as casts of the interior or exterior. The thickness of these limestones has not yet been ascertained, but it is probably not less than 400 feet. The strata are a good deal disturbed by faults, and much further examination will be required before it can be determined with certainty, how often the same strata are repeated in the different ridges. On a recent visit to this locality with Sir W. E. Logan, we found in these rocks about forty species of fossils, which shew that this part of this series of limestones is the equivalent of the upper part of the Calciferous sandrock. Of these fossils I shall now proceed to give an account.

Plantæ.—Several species of fucoids occur on the surfaces of some of the strata. They resemble those of the Calciferous sandrock.

Zoophyta.—One specimen was found which resembles *Stenopora fibrosa*, and in the higher beds, an obscure fossil very like *Tetradium fibratum*. These fossils are so badly preserved that I do not consider them identified. No trace of any other coral was observed.

Echinodermata.—There are here the columns of three or four species of Crinoids. The detached plates of a Cystidean which is either *Palæocystites tenuiradiatus*, (Hall, sp.) so abundant in the Chazy limestone, or a closely allied species—is common.

Bryozoa.—In the highest beds several specimens were observed which resemble *Stromatopora rugosa*, (Hall, sp.) but it

is impossible to say positively whether or not they belong to that species. The Calciferous sandrock in some places is full of concretions, which being composed of concentric layers, present on weathered surfaces an appearance almost exactly like that of *S. rugosa*, and therefore it may be that the specimens in question have nothing organic in their character. No other indications of Bryozoa were seen.

BRACHIOPODA.—*Camerella calcifera* is the most abundant species. There are five species of *Orthis* all undescribed; one much resembles *O. parva*, (Pander,) and another is very like the small variety of *O. calligramma*, figured in SILURIA, 3rd ed., p. 53, fig. 12. All of these species occur in the limestones at Point Levi, and one *C. calcifera* is found also in the Calciferous sandrock at St. Timothy and Edwardsburgh. No other Brachiopoda were found.

LAMELLIBRANCHIATA.—No species of this order were found.

GASTEROPODA.—The most abundant species are *Maclurea matutina*, (Hall,) *Ophileta sordida*, (Hall, sp.) *O. levata* and *O. complanata*, (Vanuxem.) I am under the impression that the three latter constitute but one species. In the same beds we find numerous examples agreeing with all the figures given by Hall and Vanuxem, and it appears to me that *O. levata* is simply two or three of the inner whorls of *O. complanata;* and that *O. sordida* is the same seen in section in the rock. We traced these fossils through a thickness of 270 feet in a continuous section. They are more abundant in the upper than in the lower strata of the section. Associated with the above are *Ecculiomphalus Canadensis, E. intortus* and *E. spiralis;* five species of *Pleurotomaria;* three of *Murchisonia;* two of *Holopea* and two of *Capulus.** One of the species of *Holopea* appears to be *H. dilucula*, (Hall.) Both of them and also *E. Canadensis* and *E. intortus* occur in the limestone at Point Levi. These fossils abound in several ridges of limestone about a mile east of Phillipsburgh, north of the road leading to Frelighsburgh. *Maclurea magna* or a closely allied species, occurs in immense numbers in several exposures of limestone five or six miles further north in

* In my paper on the Point Levi fossils in this Journal, vol. 5, p. 301, I referred several species of this tribe to the genus *Patella*. But since then I see that Barrande places similar species in *Capulus*. "See Fauna primordiale dans la chaine cantabrique." Bul. Geo. Soc., France, 2nd series, vol. 17, p. 516.

Stanbridge. The rocks of these localities appear to be higher in the series than those near Phillipsburgh, and may represent some portion of the Chazy.

CEPHALOPODA.—*Orthoceras*, 7; *Cyrtoceras*, 3; *Nautilus*, 2. These are all undetermined but they have the aspect of the Cephalopoda of the Calciferous sandrock. Some of the Orthoceratites are slightly curved and have the septa very closely arranged.

CRUSTACEA.—*Bathyurus Saffordi*, *B. Cordai*, *Amphion Salteri Menocephalus globosus?* and a species of *Asaphus* are the only trilobites observed. The most abundant of these is *B. Saffordi* which is also the dominant form at Point Levi. When I described this species (this Journal Vol. 5, p. 320,) it was impossible to determine which of the several forms of pygidium so common at Point Levi belonged to the glabella to which I gave the name. But in the vicinity of Phillipsburgh there are several localities where the pygidium figured below is common, and where no other species of the genus has been found. The only glabellæ associated with it are those of *B. Saffordi*, *M. globosus*, and *A. Salteri*. Only one specimen of *B. Cordai* consisting of an imperfect glabella was collected, but at a locality where no fragments of *B. Saffordi* were observed. It seems therefore almost certain that this pygidium and glabella belong to the same species.

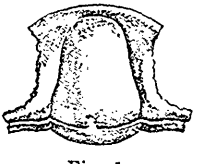

Fig. 1.

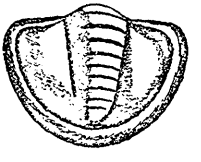

Fig. 2.

Fig. 1.—Glabella of *B. Saffordi*.
2.—Pygidium of the same.

The lateral and posterior margins of the pygidium of *B. Saffondi* are uniformly curved so as to form a regular semioval, the proportional length and breadth of which vary somewhat but in general, the former is three-fourths of the latter. The anterior angles are rounded. The axis is convex, conical, or subcylindrical, and varying from one fourth to one third the whole width of the pygidium at the anterior margin. It has nine segments, but in most specimens the last three are very indistinctly defined. It terminates abruptly in a rounded point at one line and a half from

the posterior margin. The side lobes of the pygidium are without ribs, but a deep rounded groove runs all round at one line from the margin.

This pygidium was first discovered by Mr. Hunt at Point Levi and for several years was the only fossil known to us in the limestones of that locality. Afterwards the late John Head, Esq., and Sir W. E. Logan found other specimens of it at the same locality. This led to further researches, and at length Mr. Richardson and Mr. Bell discovered the rich fauna which has given us a clue to the Geological age of the Quebec group. At Point Levi *B. Saffordi* is the most abundant and characteristic fossil of the Limestone which I have designated, No. 2, in the paper above cited. It is common at Phillipsburgh, but not so abundant as at Point Levi.

B. Cordai.—Of this species I found one specimen on Lot No. 1 of the Township of St. Armand, in the hill west of the road to Phillipsburgh, close to the Province line. On comparing this species with *B. conicus* from the Calciferous sandrock at St. Timothy, I am strongly inclined to consider them identical, the only difference being that the surface of the latter is tubercled and of the former smooth.

Menocephalus globosus? Two ill-preserved glabellæ were found which resemble this species.

On comparing the whole collection of the Phillipsburgh fossils with those at Point Levi, the general aspect is the same, and I believe that at least one half of the species are common to the two localities, but owing to their state of preservation much further examination will be required to decide this question with certainty.

In the following table I shall designate the rock in which the *Dikellocephalus*, &c., occurs at Point Levi No. I, and include all the others of that locality under No. 2. The Phillipsburgh rocks I shall also divide into two groups; the magnesian limestones No. 1, and the upper blue limestones No. 2. In this arrangement I wish it to be understood that although I consider No. 2 of Phillipsburgh as the equivalent of No. 2 at Point Levi, yet the groups No. 1 of the two localities I do not identify. It is possible that they may be the same, but the question cannot be decided with certainty without fossils:—

Table showing the Fossils common to the limestones of Phillipsburgh and Point Levi.

		Phillipsburgh.		Point Levi.	
		No. 1.	No. 2.	No. 1.	No. 2
1	Camerella calcifera.....		×	×	×
2	Orthis parva?.....		×		×
3	" "		×		×
4	" "		×		×
5	" "		×		×
6	" "		×		×
7	Holopea dilucula.....		×		×
8	" "		×		×
9	Ecculiomphalus Canadensis....		×		×
10	" intortus.....		×		×
11	Bathyurus Saffordi		×		×
12	" Cordai		×		×
13	Menocephalus globosus?		×	×	×

The above table shows that the upper limestones at Phillipsburgh must lie on the same geological horizon, very nearly, as that of limestone No. 2 of Point Lévi. I am strongly under the impression that eight or ten of the other Phillipsburgh species occur at Point Levi, but it is difficult to identify species of *Pleurotomaria* and *Orthoceras* without good specimens.

In the palæontology of New York, Prof. Hall notices 13 species as occurring in the Calciferous sandrock of that State. Of these, three are fucoids and one (*Orthoceras laqueatum*) has no locality. *Turbo obscura* and *Pleurotomaria turgida* appear to be one. With the above deductions there are only eight *Mollusca*, and of these the following occur at Phillipsburgh, *Maclurea matutina, Ophileta sordida, O. levata, O. complanata,* and probably *Holopea dilucula.* There are several specimens of *Orthoceras*, with the septa closely arranged as in *O. primigenium.* These species are stated to occur in the higher part of the rock, in the State of New York, and therefore it seems probable that No. 2 at Phillipsburgh represents the upper part of the Calciferous sandrock as developed in the Mohawk valley.

3. DESCRIPTION OF SOME OF THE NEW SPECIES OF FOSSILS REFERRED TO IN THE FOREGOING PAPER.

Genus CAMERELLA. (Billings).

CAMERELLA.—(Billings.) *Canadian Naturalist and Geologist*, Vol. 4, p. 301. August, 1859.

TRIPLESIA.—(Hall.) *Twelfth Annual Report of the Regents of the University of New York*, p. 44, October or November, 1859.

In August, 1859, I published this genus in the Canadian Naturalist and Geologist and described three species under it *C. longirostra*, *C. Panderi*, and *C. Volborthi;* the latter two from the Black River and the former from the Chazy limestone. Shortly afterwards Prof. Hall proposed the name *Triplesia* for it, but he did not describe any of the internal characters. He dated his genus back to 1858, although it was not published until October or November, 1859. The twelfth Annual Report above cited, in which the genus *Triplesia* was first made public, is stated (on the cover) to have been "made to the Assembly, March 15, 1859." The only other date on the cover is "Albany, 1859." The first six pages of the report are occupied by the business matters of the Regents relating to the affairs of the University. Then follows a title-page to the paleontological portion of which the following is a copy, "*Contributions to the Palæontology of New York; being some of the results of investigations made during the years* 1855-56-57 *and* 58." At the foot of the page is the following note. "*The following notices and descriptions of new genera, with other investigations have been communicated, in part or entirely, at different times to the Albany Institute; to the Reports of the Regents of the University on the State Collections of Natural History, for the years* 1856 *and* 1858*; to the American Association for the Advancement of Science, and are already printed in the third volume of the palæontology of the State of New York.* No other date of publication is given either on the cover or title-page. The 3rd volume of Palæontology of New York was not published until 1860. Upon examining the other Reports and proceedings referred to, I am satisfied that the genus *Triplesia* was not published in 1858. At all events the date given by Prof. Hall must be regarded as doubtful and can have no authority until he shows in what work he published the genus in 1858. As to the time of the publication of the Twelfth Annual Report, the following are the facts, as nearly as I can ascertain them.

Some time previously to the 1st of July, 1859, the first 18 pages of the palæontological part were printed, and made up into a pamphlet. A copy was sent to the editors of Silliman's Journal and was noticed by them in their July number, at p. 149. I saw this notice and wrote to a friend in Albany to send me a copy. He could not get one as only a few had been made up, apparently for private distribution. The printer however gave him some loose sheets as far as page 18, which had been corrected for proof and thrown aside after the pamphlet was published. I received them in the beginning of the month of August. I afterwards, in September, received the pamphlet. At that time, i.e. in September, only 18 pages had been issued. The remainder, containing a description of *Triplesia*, must have been published some time during the Autumn of 1859. The note on page 62 could only have been written after the meeting of the American Association, in August, as it contains information that was then first made known. I feel satisfied therefore that the genus *Camerlla* was published several weeks before the genus *Triplesia*, and besides, as Prof. Hall did not notice any of the internal characters, his description can have no authority.

In the Twelfth Annual Report the reader will find several other genera thus dated.

Page 24, "GENUS NUCLEOSPIRA. (Hall 1857)"
" 27, "GENUS TREMATOSPIRA. (Hall 1857)"
" 32, "GENUS LEPTOCOELIA. (Hall 1856)"
" 35, "GENUS EATONIA. (Hall 1856)"

I think naturalists have a right to ask, in what works were the descriptions of these genera published at the dates indicated? And if they were not published at the times stated, for what purpose were these dates given? The same questions may be put with respect to the genera *Rhynchospira*, *Tropidoleptus*, and *Rensslœria* which were first described in the same work.

The genus *Camerella* appears to belong to the family RHYNCONELLIDÆ, the species differing from the ordinary forms of *Rhynconella* by having the surface, in general, either not ribbed at all, or with only a few obscure plications not extending to the beak. The interior differs in having the dental plates of the ventral valve converging so as to form a small triangular or oval chamber of variable dimensions as in *Pentamerus*. The species known up to the present time are the following:

POTSDAM SANDSTONE. One species undescribed discovered by Dr. Shumard in Texas.

CALCIFEROUS SANDROCK. Two Species, *C. calcifera* and another large undescribed species of which I have some fragments.

CHAZY LIMESTONE. Two species, *C. longirostra* and *C. varians*. This Journal, Vol 4.

BLACK RIVER. Two species. *C. Panderi* and *C. Volborthi*. This Journal, Vol. 4.

TRENTON. Three species. *C. extans*, *C. nucleata*, and *C. cuspidata*. These three were described by Prof. Hall in Vol. 1, Pal. N. Y., under the genus *Atrypa*.

Of the t n species known in America seven occur below the Trenton Limestone. The Texas species is particularly interesting on account of its association with primordial trilobites. The following are the fossils which are found with it in the same beds. This list is copied from Barrande's elaborate memoirs on the Primordial Zone and Taconic system in the Bulletin of the Geological Society of France.* It was prepared for him by Dr. Shumard.

" *Agnostus*, very similar to *Agn. Orion*. Billings.
" *Conocephalites*.
" *Lonchocephalus* (*Bathyurus*) *armatus?* Billings.
" *Arionellus*. Two species very distinct, of which one resembles a form that occurs in the third magnesian limestone of Missouri.
" *Discina*.—One small species.
" *Orthis Coloradoensis*. Shumard.
" ——— *Sps. indet.*"

The above list so far as it goes exhibits an association of organic types similar to that which occurs in the limestones at Point Levi. In no country in any part of the world has such an assemblage been discovered above the Primordial Zone, or at least above the very base of the Lower Silurian, and the genus *Camerella* is therefore one of the most ancient of the brachiopodous forms of life.

CAMERELLA CALCIFERA, N. sp.

Description—This species varies from four to nine lines in width. The proportional length varies from a little less to a little

* *Documents anciens et nouveaux sur la faune primordiale et le Systéme Taconique en Amerique*, par M. J. Barrande. Bul. Soc. Fr., 2nd Series, Vol. 18, p. 203.

more than the width; the difference being caused by the variable form of the front margin which is sometimes concave or nearly straight, as represented by the figures *a* and *b*, (below) while often the middle portion is either convex or projects so as to form a small rounded lobe. The ventral valve is either moderately or strongly convex; the beak pointed and slightly elevated above the hinge line, with a small area beneath it; the hinge line somewhat straight, its length about half the width of the shell; sides rounded; the front margin either concave, straight, or convex, sometimes with a small projecting lobe in the middle; the mesial sinus is usually one-third the width of the shell, evenly rounded in the bottom, and becoming obsolete before reaching the beak. The dorsal valve is more uniformly convex than the ventral; the mesial fold rounded and usually disappearing at about half the length of the shell. The surface has usually a smooth appearance, but on many specimens from ten to twenty concentric sublamellose ridges of growth are visible.

Fig. 3.

Fig. 3.—*Camerella calcifera*; *a*, ventral valve; *b*, dorsal; *c*, interior of ventral valve, shewing the small chamber beneath the beak.

Affinities of this species.—*Camerella extans* (Emmons) has the hinge line wider and the mesial lobe defined to the beak. *C. nucleata* (*Atrypa nucleus*) is most closely allied to this species, but is in general more strongly trilobed, and, according to Prof. Hall, has the beak of the ventral valve incurved over that of the dorsal. In our species it is elevated in a manner similar to that of the beak of an *Orthis*. Notwithstanding these differences these three species are all closely related and may yet be united.

It is to be borne in mind that this species varies greatly in size and in the contour of the front margin. The mesial fold on the dorsal and the sinus in the ventral valve are sometimes nearly obsolete, but in general are well developed for half the length of the shell. Out of about 100 specimens which I have examined there are three in which the sinus extends nearly to the beak, but in all the others it dies out about the middle of the shell.

Although the individuals of this species are numerous, I have not succeeded in getting a specimen with the valves united.

Locality and formation.—This species occurs in the Calciferous sandrock at St. Timothy on the St. Lawrence above Beauharnois,—in the Township of Edwardstown, between Beauharnois and Lake Champlain,—abundantly at Phillipsburgh, and also in the limestones of the Quebec group at Point Levi.

ECCULIOMPHALUS CANADENSIS, N. sp.

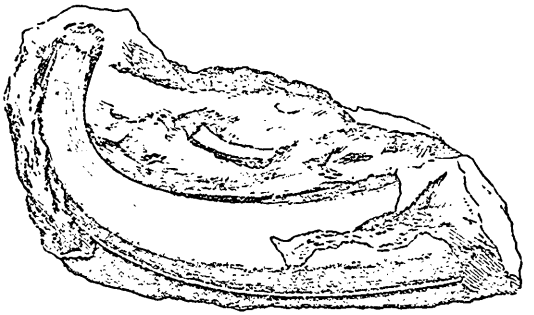

Fig. 4.

Fig. 4.—*Ecculiomphalus Canadensis.*

Description.—This species consists of a simple curved tube usually about three inches in length. The larger extremity for about two inches is nearly straight, and the cross section nearly circular. The remainder, to the point, curved so as to make half a whorl of an inch across, or a little less. In this part the tube is not cylindrical but flattened laterally. In most of the specimens the sides are more sharply rounded than the dorsal or ventral aspects. In none that I have seen is the shell preserved, so that the surface characters remain unknown. Some of the fragments shew that the shell near the smaller end is greatly thickened.

Length from two to three inches; diameter at the aperture from six to nine lines.

Locality and formation.—Ormstown, in the Seigniory of Beauharnois, and Phillipsburgh in the Calciferous sandrock. Also in the limestones of the Quebec group at Point Levi.

ECCULIOMPHALUS INTORTUS. N. SP.

Description.—This species consists of a simple conical tube, so coiled as to make two whorls within a circle of one inch and a half in diameter. At the aperture the cross section of the tube is nearly circular, and five lines in diameter in a specimen which

measures one inch and a half across the whole coil. The inner or apical whorl is usually about half an inch across. The remainder being not so sharply curved, completes only a second whorl at a diameter of one inch and a half. Most of the specimens that I have seen consist of only one whorl and a half, but we have some imperfect ones of two whorls. In the casts of the interior an obtuse carination is sometimes seen on one side. The surface of the shell appears to be smooth, but owing to the peculiar state of preservation of these fossils, this point cannot yet be determined with certainty.

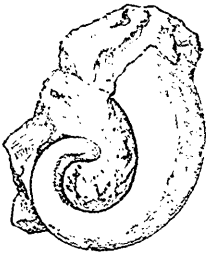

Fig. 5.

Fig. 5.—*Ecculiomphalus intortus.* A specimen imperfect at both extremities.

Locality and formation.—In the calciferous sandrock in the Township of Edwardstown and at Phillipsburgh. Also in the limestone of the Quebec group, Point Levi.

ECCULIOMPHALUS SPIRALIS. N. SP.

Description.—This species resembles a large *Pleurotomaria* with two whorls disjoined their whole length and distant from each other throughout about half an inch. The cross section of the tube is oval being somewhat flattened vertically the upper side depressed convex and the lower obtusely carinated. The two whorls make a spiral coil from three to four inches across. The inner whorl is from one inch to one inch and a-half across. The aperture is from three-fourths of an inch to one inch wide measured in the plane of the coil and almost one third less in depth. The surface of the shell, a small portion only of which is preserved on one specimen, is marked by sharp elevated sub-imbricating transverse lines of growth about five in two lines.

The inner whorl is elevated a little above the outer forming a depressed spire.

Locality and formation.—In the upper limestone at Phillipsburgh.

AMPHION SALTERI. N. SP.

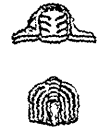

Fig. 6.

Fig. 6.—Head and tail of *Amphion Salteri.*

Description.—Head about three lines in length and five lines in width at the base. Glabella convex, oblong, one-third the width of head, with straight sides, front obtusely rounded and slightly narrower than the bease; neck furrow extending all across; three pairs of glabella furrows inclining slightly backwards; their inner extremities separated by about one-third the width of the glabella. The margin in front of the glabella is scarcely half a line in width. The fixed cheeks are separated from the glabella by a deep groove on each side. The eye appears to be opposite the second lobe of the glabella from the neck furrow and distant about three fourths of a line from the furrow which separates the cheek from the glabella. The fixed cheeks appear to be covered with small tubercles.

The pygidium has the front margin rounded and the posterior somewhat straight. The axis is conical and strongly convex with five or six segments, well defined. The pleuræ of the pygidium are five on each side and in their posterior half or two-thirds nearly parallel with the axis and then curve inwards to join the axial segments. Length of pygidium about three lines; greatest width at about one-third the length three lines at which width (nearly) it continues to the posterior margin.

Cheeks and Thorax unknown.

Affinities.—The tail of this species very closely resembles that of *A. Canadensis* but the glabella at once shews it to be distinct as all three pairs of glabellar furrows are in the sides while in *A. Canadensis* the front pair are placed in the front margin. There is no other described species to which this is closely allied.

The head and tail have not been seen in connection, but they are often found in the same slabs of stone, and as there is not associated with them any other pygidium to which the head could

be referred it seems highly probable that they belong to each other.

Locality and Formation.—Phillipsburgh, Calciferous Sandrock.

4. Grey and Red Sandstones.

On the eastern side of the limestones at Phillipsburgh there is a ridge of grey sandstone which usually weathers to a light reddish or yellowish colour. This ridge terminates about two miles north of the road to Freligsburgh. It then appears to be overlaid first by the magnesian limestone and above this the blue limestone. The immediate line of junction of the magnesian rock with the sandstone was not observed. This ridge runs in a southerly direction into Vermont. No fossils were found in it in its prolongation into Canada, but hearing that the Rev. J. B. Perry and Dr. G. M. Hall, of Swanton had discovered trilobites in it, I called upon them and they kindly accompanied me to the locality. The place is about two miles south of the Province line and one mile east of the Highgate Springs. The rock is here a deep red sandstone, the typical red sandrock formation of Vermont. We collected numerous specimens of the head of a small species of *Conocephalites*. No other fossils except a small *Theca* were observed. It thus seems clear that this rock is not the Medina sandstone but a formation somewhere near the Potsdam sandstone.

On looking over the back numbers of Sillimans Journal I find that the resemblance of this trilobite to *Conocephalites* was recognised by Prof. C. B. Adams in 1848, but he did not attach to it any importance as indicating the age of the formation. In fact the geological position of *Conocephalites* was not then generally known; Barrande's "*Notice préliminaire*" in which the characters of the Promordial Zone were first clearly pointed out had been then only lately published (in 1846). As everything relating to the question of the age of these rocks is of interest I shall quote Prof. Adams paper in full. It seems necessary first to explain that Dr. Emmons contends that the red sandrock on the top of Snake Mountain is the Calciferous sandrock and that the slate beneath it is his Taconic slate. He says that a great fault runs through the mountain which throws the rocks down on the West side so that the top of the Utica slate lies below, or at a lower geographical level than the Calciferous.

"*On the Taconic Rocks*; by Prof. C. B. ADAMS.—The north part of Addison county, Vermont, possesses peculiar advantages for the study of the so-called Taconic rocks, since here they pass from a highly metamorphic to a slightly metamorphic condition and have been much less disturbed. Some of the typical Taconic rocks disappear, or more probably pass gradually into rocks of the Lower Silurian system.

"One of the most conspicuous of the rocks of this region, is a red sandrock, which Dr. Emmons regards as at or near the base of the New York system, but which overlies the Champlain Division, in the order of red sandrock, Hudson river shales, Utica slate, Trenton limestone, and La Motte limestone.

"A section was exhibited of Snake mountain, in which these rocks appear by an uplift with their relative position unaltered. The two lower formations are identified by their appropriate fossils, which occur abundantly; the Utica slate by its position and lithological characters; the Hudson river shales by the same characters, and by their upper member, which is an argillaceous limestone containing the stinted forms of *Chætetes lycoperdon* which are usual in this the last period of the existence of the species. The red sandrock lies upon the last named rock in actual contact, with a moderate easterly dip. The upper part of this section is repeated in the line of the strike in several other localities, but one only, Buck mountain, three miles north, has sufficient elevation and steepness to exhibit the lower part of the series.

"The assertion which had been made, that there is a line of fracture high up the side of the mountain, above the Trenton limestone, was shown to be entirely unsupported by any facts. Not only is there no evidence that such a line of fracture has brought up the shales from beneath the Trenton limestone, but the fossils in the upper member of the shales prove that the present is their original relative position. But these shales are the Taconic slates of the Taconic system.

"From position, therefore, it is inferred that the red sandrock if more recent than any of the Champlain Division. Its fossils afford less demonstrative evidence. With the exception of *Fucoids* they are rare, having been been found only at Highgate, where fragments of the shields of trilobites, having some resemblance of Conocephalus, occur very abundantly, and atrypa hemispherica (?) very rarely. These fossils, especially the latter, if correctly

identified, indicate the period of the Medina sandstone and Clinton group, regarding these two rocks as belonging to one period.

"It was also shown by a section from Lake Champlain to the Green Mountains through Ferrisburgh and Monkton, that the Taconic quartz rock is probably a metamorphic equivalent of the above named red sandrock. In this section there is a gradual change in the lithological characters from the red sandrock to the quartz rock; the difference in the lithological characters, however, is only such as must have been the effect of igneous agency in the eastern part of the section, and the order of succession of the calcareous over the quartzose members is identical in both rocks. But since a small part of the section, on the opposite sides of which the change of characters is most conspicuous, is concealed by drift, the identity of the Taconic quartz rock with the Medina sandstone was not positively affirmed.

"A section from Buck Mountain through Waltham into New Haven was exhibited, which rendered it somewhat probable that the Stockbridge limestone of the Taconic system is the equivalent of the calcareous rocks which overlie the red sandrock, rather than of the lower limestones of the Champlain Division, as has been commonly supposed.

"In reply to Dr. Emmons, [an abstract of whose remarks on the Taconic system we have not received,] it was stated by Prof. Adams that he (Dr. E.) had misunderstood the description of the calcareous rock over the Hudson river shales, which was not affirmed to be the Trenton limestone, but an upper member of the Hudson River shales, as proved by the contained fossils in connection with the position. The remarks of Dr. E. being based on this misconception of the statements actually made, could not of course affect the conclusion respecting the age of the rocks of Snake mountain." *Silliman's Journal*, 2nd Series Vol. 5, p. 108.

The section at Snake Mountain has been, it appears, examined by Prof. Hitchcock and Prof. W. B. Rogers and they have both arrived at the conclusion that there is no dislocation passing through the hill, as Emmonds contends, but that there is an unbroken succession in conformable sequence of all the rocks of the New York series, from the Trenton to the Medina inclusive. On this most important section which brings Palæontology and Physical Geology into a direct antagonism with each other, the following are Prof. Roger's remarks, as they appear in the proceedings of the Boston Natural History Society, March 7, 1860.

"Mr. C. H. Hitchcock exhibited a geological map of Vermont, and explained the principal features of the complicated geology of that State.

"The two most interesting points in this connection were, that there is no foundation for what Mr. Emmons called his Taconic system, (a mixture of the Silurian and Devonian,) and that the Dorset limestone (his Stockbridge limestone) is newer than the lower Silurian, and is probably upper Silurian or Devonian.

"Prof. W.B. Rogers remarked upon the importance of the investigations referred to by Mr. Hitchcock, and spoke of the difficulty which the geologist has to encounter in attempting to ascertain the precise sequence of the rocks in a region where, as in the greater part of Vermont, perplexing structural features, metamorphic influences, and an extreme paucity of fossils combine to embarrass his enquiries. It is not therefore matter of surprise that, in spite of repeated explorations, some important problems in the geology of the State should still remain unresolved.

"As regards the belt of formations on the western side of the State, extending along the shore of Lake Champlain, the abundance of fossils and the almost undisturbed position of the strata have rendered their investigation comparatively easy, so that these formations were early identified with the lower members of the paleozoic series, from the Potsdam sandstone to the Hudson River group inclusive. Immediately eastward of this narrow strip is another belt of variable breadth, extending through more than half the length of the State, and passing northward into Canada. This consists of reddish sandstone and shales, and reddish, white, and gray limestones, which, from lithological peculiarities and the absence of distinct fossils, were much less easily referred to their proper geological position. Indeed it is only within a few years that this remarkable group of strata has been generally recognized as belonging to the period of the Oneida and Medina rocks, to which Mr. Hitchcock now refers them.

"As connected with the history of this investigation, Prof. Rogers felt some satisfaction in stating that in a paper entitled "Notes on the Geological Structure of Western Vermont, &c.," communicated by him to the American Association at Albany in 1851, the manuscript of which he now submitted, he gave a detailed account of numerous sections and longitudinal tracings made during preceding seasons, and in express terms announced the conclusion that

the rocks in question were referable to the Levant, or in other words the Medina period. As, however, the chief interest of the discussions arising on the occasion had reference to the supposed Taconic system of Prof. Emmons, to which Prof. Rogers's observations had been largely directed, his statement of the age of the red rocks and associated limestones excited comparatively little attention at the time, although he believes it was the first distinct announcement of the conclusion regarding the geology of this belt which is now generally received. He however thinks that Prof. Hall mentioned at the time having arrived at a similar result. As this paper was not published in the Transactions of the Association, but only mentioned by its title, Prof. Rogers asked to be allowed to insert in the Proceedings of the Natural History Society an extract setting forth the conclusion and the arguments on which it was founded. The extract, beginning with an account of the rocks on the eastern slope of the Snake and Buck Mountains, is as follows :—

"The general geological position of the red rocks here spoken of is clearly seen by following either of the sections from the western base of the Snake and Buck Mountain across the trough or valley above described. Here we ascend through the various divisions of the Matinal series from the Trenton to the top of the Hudson River group as here defined, each marked by characteristic fossils, and all maintaining a nearly uniform eastern dip ; and above the latter we find a series of red and greenish and grey sandstones and shales of great thickness, succeeded, where the exposures are unbroken, by arenaceous and argillaceous reddish and gray limestones, alternating with beds of sandstone similar to that beneath.

"Stratigraphically considered, this series of beds occupies the position of the Medina group of New York, or its equivalent the Levant series of Pennsylvania and Virginia. The sandstones and shales bear a close resemblance to those of the latter, not only in color, but in the profusion of fucoid-like markings which they display on some of the parting surfaces. The series of reddish and gray limestones which rest upon these massive arenaceous beds form an interesting feature in the geology of Vermont. Their alternation with layers of sandstone and shale, and their frequently reddish tint, would lead us to regard them as a continuation of the lower mass under somewhat new formative conditions. In the prolongation of this belt of sandstones and limestones towards the north, as at Winooski Falls, near Burlington, the latter mass is seen to consist in great part of a pinkish white fine-grained limestone

which towards the base contains layers of reddish limestone interstratified with red sandstone,—marking the transition from the arenaceous to the calcareous form of deposit.

"In none of the localities of this calcareous mass which I have examined, from the flank of the Snake Mountain to near the Canada line, have I found any well-marked organic remains. This fact of itself strongly favors the idea of its being but a peculiar development of the upper portion of the Medina group. Nor can it be objected to this that metamorphic action may have caused its present destitution of fossils. Through nearly the whole of the series of exposures extending due north toward the Canada line, it presents a gentle eastern dip, conforming to the subjacent fossiliferous beds of Matinal limestone and slate, from which it is separated only by the sandstones above described. From this we infer that it must have been as little exposed as these fossiliferous beds to agencies capable of obliterating its included fossils, and that therefore it has never been in any considerable degree a fossiliferous mass.

"We are further strengthened in the opinion that this calcareous group, *with the subjacent sandstone, belongs to the Medina period* by the consideration that the Clinton group, with which it might otherwise be compared, is almost everywhere an eminently fossiliferous one. From Alabama to northern New York, it is marked by an abundance of fossils. According to Mr. Logan, strata of this age are found in the vicinity of Lake Memphremagog, and, although there surrounded by metamorphic masses, they include a number of fossils in good preservation.

"On the whole, therefore, I think that the limestone and subjacent sandstone of which we are now treating must be regarded as one formation, and may with the highest probability be referred to the period of the Levant rocks or the Medina group of New York."

A careful re-examination of Snake Mountain is much required, for if the section it presents has been correctly interpreted then we must admit that palæontology is at fault, but if the displacement contended for by Emmons really does exist then the principles of the science will remain as before, unerring guides for us in our researches after truth.

MISCELLANEOUS.

THE EARTHQUAKE OF JULY 12, 1861

This was apparently more limited in its range, at least within Canada, than that of Oct. 1860. We have notices of it only from Montreal, Ottawa, Prescott, Ogdensburgh, Brockville, St. Andrews and St. Johns. It was more violent at Ottawa than elsewhere, shattering walls and throwing down chimneys. It occurred in all the above places about 9 o'clock, p. m. It appears, from collating the statements of several observers, that it was preceded by a rumbling noise, which was followed by a series of slight vibrations, terminating in a sudden shock. At Prescott, three shocks are said to have been experienced. Unless it extended into the Hudson's Bay territories, from which no accounts have been received, the theatre of the vibration was limited to the central district of Canada, surrounding the confluence of the Ottawa and St. Lawrence. J. W. D.

GEOLOGICAL SOCIETY OF LONDON.

In late numbers of the "Abstracts of Proceedings of the Geological Society of London," we find the following notices of papers relating to North American Geology:

April 10, 1861.—"On the Geology of the Country between Lake Superior and the Pacific Ocean (between 48° and 55° parallels of latitude), explored by the Government Exploring Expedition under the command of Captain J. Palliser (1857–60)." By James Hector, M.D. Communicated by Sir R. I. Murchison, V. P. G. S.

This paper gave the geological results of three years' exploration of the British Territories in North America along the frontier-line of the United States, and westward from Lake Superior to the Pacific Ocean.

It began by showing that the central portion of North America is a great triangular plateau, bounded by the Rocky Mountains, Alleghanies, and Laurentian axis, stretching from Canada to the Arctic Ocean, and divided into two slopes by a watershed that nearly follows the political boundary-line, and throws the drainage to the Gulf of Mexico and the Arctic Ocean. The northern part of this plateau has a slope from the Rocky Mountains to the eastern or Laurentian axis, of six feet in the mile, but is broken

by steppes, which exhibit lines of ancient denudation at three different levels; the lowest is of fresh-water origin; the next belongs to the Drift-deposits, and the highest is the great Prairie-level of undenuded Cretaceous strata. This plateau has once been complete to the eastern axis, but is now incomplete along its eastern edge, the soft strata having been removed in the region of Lake Winipeg.

The eastern axis sends off a spur that encircles the west shore of Lake Superior, and is composed of metamorphic rocks and granite of the Laurentian Series. To the west of this follows a belt where the floor of the plateau is exposed, consisting of Lower Silurian and Devonian rocks. On these rest Cretaceous strata, which prevail all the way to the Rocky Mountains, overlaid here and there by detached tertiary basins.

The Rocky Mountains are composed of Carboniferous and Devonian limestones, with massive quartzites and conglomerates, followed to the west by a granitic tract which occupies the bottom of the great valley between the Rocky and the Cascade Mountains. The Cascade chain is volcanic, but the volcanos are now inactive; to the west of it, along the Pacific coast, Cretaceous and Tertiary strata prevail. The description of these rocks was given with considerable detail on account of their containing a lignite, which for the first time have been determined to be of Cretaceous age. This lignite, which is of a very superior quality, has been worked for some years past by the Hudson Bay Company, and is in great demand for the steam-navy of the Pacific station, and for the manufacture of gas. Extensive lignite-deposits in the Prairie were also alluded to; and, like those above-mentioned, were considered to be of Cretaceous age; but, besides these, there are also lignites of the Tertiary period.

The general conclusion was that the existence of a supply of fuel in the Islands of Formosa and Japan, in Vancouver's Island, in the Cretaceous strata of the western shores of the Pacific, but principally within the British territory, and in the plains along the Saskatchewan, will exercise a most important influence in considering the practicability of a route to our Eastern possessions through the Canadas, the Prairies, and British Columbia.

"On Elevations and Depressions of the Earth in North America." By Dr. A. Gesner, F. G. S.

After some observations on the differences between volcanic uplifts of the land and the slow upward and downward shiftings

produced by changes in the position of great parallel areas during long periods of time, the author proceeds to enumerate evidences of local elevation and subsidence that he has observed along the coast from the Northern part of Labrador to New Jersey.

In the south-eastern part of New Jersey, at Nantucket, Martha's Vineyard, and Portland, submergence of the land is proceeding, locally at the rate of probably four feet in sixty years. In New Brunswick, at St. Johns the land has been elevated; at the Great Manan Island and the Great Tantamar Marsh there has been subsidence. At Bathurst and on the opposite coast of Lower Canada the land seems to be rising. In Nova Scotia, near the Bay of Fundy and Mines Basin there is subsidence; on the southern side, however, there are signs of elevation. The sea rapidly encroaches upon Louisberg in Cape Breton; and in Prince Edward's Island, also, at Cascumpec, submergence of the land is taking place.

June 5, 1861.—"On an erect Sigillaria from the South Joggins, Nova Scotia." By Dr. J. W. Dawson, F.G.S.

This specimen, presenting the external markings of leaf-scars and ribs with more than usual clearness and with some instructive peculiarities, has afforded to the author the type of a new species, *Sigillaria Brownii*. Observations on the probable style of growth, on the structure, and on the classification of *Sigillariæ*, were also given in this paper, together with a *résumé* of the observations previously published regarding *Sigillaria* by Brongniart, Corda, and others.

"On a Carpolite from the Coal-formation of Cape Breton." By Dr. J. W. Dawson, F.G.S.

Numerous *Trigonocarpa* belonging to a new species (*Trigonocarpum Hookeri*) occur in a thin calcareous layer in the coal-measures near Port Hood, Cape Breton. The author thinks it highly probable that though some *Trigonocarpa* may have belonged to Conifers, yet in this case they were the seeds of *Sigillaria*.

BOTANICAL SOCIETY OF CANADA.

Sixth meeting. Kingston, 12th April, 1861. Very Rev. Principal Leitch, President, in the chair.

The following candidates were balloted for and duly elected *Fellows*:—Hon. William Sheppard, D.C.L., of Fairymead, Drummondville, Lower Canada; J. Bruce, Hamilton, C. W.

The following were admitted as *Corresponding Members*:—John Richardson, Montreal; P. L. Simmonds, King's College, London, England; John Lowe, M.D., M.R.C.S. England, King's Lynn.

Donations to the library were announced from Mr. Stanton and Prof. Lawson. Letters were read from Dr. Greville, Edinburgh, and Mr. J. T. Syme, F.L.S., London. Interesting collections of specimens were exhibited from Mrs. Noel, and Dr. W. E. Dickson, Kingston. Mr. T. Sullivan presented a peculiar pilose polyporus, and Mr. A. T. Drummond, B.A., exhibited a number of dyes prepared from native lichens.

The Secretary announced the presentation to the Society by Mr. B. Billings, a Fellow, of a large and very valuable collection of plants, chiefly from the neighbourhood of Prescott. The Society's thanks were voted to Mr. Billings for his valuable donation.

The following papers were read:—

1. Remarks on the Silk obtained from Lettuce-fed Silk Worms. By Miss Gildersleeve.
2. Further observations on Silk Culture. By Mrs. Lawson.
3. Extracts from Letters relative to Silk and the native fibre-yielding Insects of Canada. By John Duff.
4. On Fungi, their relation to disease. By John Lowe, M. D., M.R.C.S. England, F.B.S.E., Surgeon to the West Norfolk and Lynn Hospital. [British American Journal, vol. II., p. 193.]
5. On the Secretion of Saccharine Matter in the Floral Organs of Plants, and on the Economy of Bees; with the results of investigations on the Sexual Development of Bees. By the Very Rev. Principal Leitch, President. Part II.

Seventh Meeting, 14th June, 1861. Rev. Prof. Mowat, M.A., afterwards Rev. Prof. Williamson, LL.D., Vice-President, in the chair.

The following *Subscribers* were admitted:—Miss Fisher, Newmarket; Rev. H. E. Plees, Carrying Place; John G. Giles, M.D., Farmersville; Rev. Mr. Borthwick, M.A., Ottawa; W. Carter Deans, M.D., Trenton; W. Weir, M.D.; H. D. Lord, Ladlowville, Tompkins Co., New York; Edward C. Fox, of Baliol College, Oxford, Trenton, C. W.; Samuel H. Fee, Kingston.

The following donations to the Society's Library and Herbarium, were announced.

1. Fragmenta Phytographiæ Australiæ, vol. I, from the au-

thor, Dr. Mueller, Botanist to the Colony of Victoria. Hon. M. B.S.C.

2. Memoir on the Pre-carboniferous Flora, from the author, Principal Dawson, Montreal, Hon. M.B.S.C.

3. Several popular works on Botany, from F. Stanton, 1st Royals, F.B.S.C.

4. Lichens, a large and beautiful collection, from Mr. B. Billings, F.B S.C., Prescott.

5. Seeds from Mr. Horage, Erfurt, and Mr. Bruce, Hamilton.

Professor Lawson exhibited under the microscope, several species of Spirogyra in a beautiful state of conjugation, from the pond in Queen's College grounds.

The following papers were read:—

1. On the Geographical Distribution of the Coniferæ in Canada. By the Hon. William Sheppard, D. C. L., of Fairymead, Drummondville, Lower Canada.
2. Description of the Curculio, its mode of destroying Fruit, and the various means employed to check its progress. By Thomas Briggs, Jr.
3. Remarks on the species of Oak, their history, habits, and uses. By Miss Crooks, Hamilton, C. W.
4. List of the Lichens of the neighbourhood of Prescott, C. W. By B. Billings, jun.

Field meeting, 17th June, 1861. The members met at the Crystal Palace, Kingston, and proceeded a few miles beyond Collins' Bay, visiting the woods and swamps along the Bath Road. Many interesting plants, including ferns, orchids, carices, mosses, hepaticæ, lichens, algæ, &c., were collected, of which a list will be printed in the Society's Annals.

G. L.

NEW MINERAL.

Prof. How of King's College, Windsor, N. S., publishes in Silliman, the description of a new Boracic Acid Mineral from the Gypsum of Nova Scotia, for which he proposes the name "Cryptomorphate." It is found along with the Natro-boro-calcite, previously observed by him in the Gypsum qarries at Windsor.

"The mineral to which I would now draw attention was found in the same quarry as the preceding, at a distance of about 100

yards and at about 20 feet lower level, and also associated with Glauber-salt, which, it is worthy of notice, is generally met with here, according to the quarrymen, in narrow seams at the line of junction of the "hard plaster," (Anhydrite) with the soft "plaster," (Gypsum). I detected it in the form of an opaque white substance without lustre, and, to the naked eye, devoid of crystalline structure, in cakes and somewhat rounded masses varying in size from that of a small pea to that of a bean; these masses lay between gypsum and crystals of Glauber-salt, taking shape from the crystals of the latter on the side next to them, and when detached from them leaving their faces, as it were, etched, and sometimes the crystals were penetrated to a considerable depth by the imbedded borate. The mineral is very soft, (H = 1) but coherent, tasteless, slightly tough between the teeth, fuses readily B.B. to a clear bead, insoluble in water, soluble in HCl. As found, or very soon after being brought home, it lost by exposure to air, Water = 18·36 per cent,
and the air dry substances gave the following results on analysis; the water was determined by ignition, the lime, magnesia and sulphuric acid in one portion of the ignited residue, and the soda in another, after its treatment with fluor-spar and sulphuric acid for separation of boracic acid, which was, of course, estimated by deficiency:

	I.	II.
Lime,	14·21	——
Soda,	7·25	——
Sulphuric acid,	3·98	——
Magnesia	0·62	——
Water,	19·96	20·78
Boracic acid,	53·98	——
	100·00	

The quantity of mineral obtained did not permit me to make more than one analysis, and retain a little as a specimen for identification, but these results as well as the characters already mentioned, and the crystalline structure to which I shall presently advert, are, I think, sufficient to show that it is specifically distinct from Natro boro-calcite (see analyses quoted.) On the assumption that the magnesia and sulphuric acid are accidental, and that the latter is combined with the former and with a quantity of soda equivalent to that of the acid not required by the magnesia, I have calculated the preceding results (I) after making

these deductions, and at the same time taking away the amount of water necessary to render the $MgOSO_3 = MgOSO_3 + 7$ aq.: (the hydrated sulphate of soda would of course become anhydrous on exposure to dry air); the results then become;

		Oxygen.	Ratio.	Calculation.		
Lime,	15·55	= 4·44	3·08	3CaO	84	15·64
Soda,	5·61	= 1·44	1·90	NaO	31	5·77
Water,	19·72	=17·52	12·16	12HO	108	20·11
Boracic acid,	59·10	=40·77	28·10	$9BO_3$	314·1	58·48
	99·98				537·1	100·00

corresponding to the formula,

$$NaO, 3CaO, B9O_3 + 12HO.$$"

The late Prof. Robb remarks as follows on its crystalline form:—

"In spite of your odd formula, the mineral, just as I got it, untouched and unwashed, is perfectly crystalline in every particle. A good power is required, but with a magnifying power of about 350 diameters there is no difficulty, the form comes out as sharp as possible. The crystals are excessively thin translucent tables or plates. They have a rhombic outline and the angles probably = 80° or more, owing to their excessive thinness I could not say whether they could be called right or oblique rhombic prisms. I suspect the latter from analogy. By care the 'Tiza' (Natro-boro-calcite) can be shown to consist of very fine prisms, sharp, angular and long, but too fine for me to state their form. The diameter was less than ·00118 of an English inch. The long prismatic needles of the Tiza are in great contrast to the broad tables of the recent mineral in your last letter; of that the plates are about ·0048 of an inch from side to side, but some are a little larger, others a little smaller. In some you see regular cleavage, that is, a small rhomb chipped out of one side. As far as form goes therefore it would seem to be a distinct and definite species. I presume it was formed in a dry place for the angles were quite sharp. The connection between these borates and sulphate of lime and sulphate of soda is very curious."

Prof. How thus notices its bearing on the question of the mode of formation of gypsum:—

"The truth of the last sentence in Prof. Robb's letter is very apparent. In my former paper on the subject I adverted to the existence of Natro-boro-calcite in the Gypsum here as confirming

Dawson's theory of the origin of the rock from volcanic waters acting on the carbonate of lime; it is interesting to observe that Bechi found* the same mineral, with other borates, in the lagoons of Tuscany. The hydrated conditions of both the borates found in the rock here and of the associated Glauber-salt, shows the action of water, but that of ordinary sea-water would not account for the presence of boracic acid. As regards the soda, the sulphate and borate of lime were probably the substances originally present, and chlorid of sodium in water being introduced might remove part of the calcium as chlorid, and furnish borate and sulphate of soda; it is confirmatory of this view that a small quantity of rock-salt in crystalline grains has lately been found in the Gypsum."

Prof. How has also recognised the mineral *Gyrolite* associated with Apophyllite in the trap of Nova Scotia.

"STEEPS" FOR SEEDS.

Of the many "steeps" that have been recommended to facilitate the germination of seeds, the most intelligible is that of caustic potash, or carbonate of potash, applied by M. André Seroy to seeds naturally protected by fatty or oily pulp. He reports that the seeds of Hollies, Magnolias, Yews, and the like, which often do remain in the ground for a couple of years, come up readily after treatment with potash and subsequent rubbing with sand.

BLANCHING OF FLOWERS.

It it well known that light is as necessary to plants as a due supply of heat and moisture. The effects of its absence are often singular. We know that plants grown in darkness do not exhibit their usual healthy green color, light being required for the development of chlorophyll. Advantage is taken of this circumstance in the blanching of salads and vegetables, and the same process is now being applied to flowers. It appears that in Paris there is a great demand for white lilacs for ladies' bouquets in winter, and as the common white lilac does not force well, the purple "Lilas de Morly" is used. The flowers of this variety, when made to expand at a high temperature, in total darkness, are of a pure white; those of the Persian lilac will not whiten.

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* Dana's Min., 4th Ed., 394, 395.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF JUNE, 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.	RAIN.	SNOW.	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.	p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.		Mean amount of, in tenths.	Amount of, in inches.	Amount of, in inches.	6 a. m.	2 p. m.	10 p. m.
1	30.042	29.995	29.905	54.6	79.9	65.6	.335	.567	.413	.80	.37	.66	S. W.	S. W.	S. W.	88.44	3.0	.....	.....	Clear.	Cum. 2 Solar Halo.	Cirr. 2. Lunar Halo.
2	032	938	800	55.7	81.2	67.0	.349	.547	.450	.81	.52	.67	N. E. by E.	N. E. by E.	S. E.	139.50	3.0	.....	.....	Cirr. Str. 4.	Ligt Cirr. 2 SolarHalo	Cirr. Str. 8.
3	29.474	311	564	60.1	77.0	63.7	.449	.695	.510	.85	.75	.88	S. S. E.	W. S. W.	W. N. W.	333.70	3.5	2.333	.....	Rain.	C. C. Str. 8.	" 8.
4	850	717	921	49.0	65.8	53.8	.278	.436	.367	.81	.80	.88	N. N. W.	W. S. W.	N.	218.70	2.0	.....	.....	Clear.	Light Cirr. 4.	Clear.
5	30.117	30.063	30.126	48.4	72.3	59.0	.260	.340	.387	.78	.45	.79	S. S. E.	S. E. by E.	S. E. by E.	85.30	2.0	.....	.....	"	Clear.	Cirr. Str. 6.
6	041	29.993	29.937	52.3	67.7	57.6	.334	.418	.343	.86	.62	.72	S. S. E.	S. E.	S. E.	169.30	2.0	.....	.....	C. C. Str. 10.	C. C. Str. 8.	C. C. Str. 8.
7	29.904	870	800	59.6	72.8	70.6	.433	.450	.586	.85	.48	.80	E. S. E.	S. by E.	S. S. E.	28.00	2.5	0.100	.....	Cu. Str. 8.	Cirr. 4.	Clear.
8	862	772	893	58.7	80.4	63.0	.452	.567	.435	.94	.57	.86	S. E.	S. by E.	S. by W.	5.70	2.0	.....	.....	Clear.	Clear.	Cu. Str. 8.
9	768	785	892	67.0	89.8	74.9	.556	.990	.673	.84	.71	.79	S. S. E.	S. W.	S. W.	54.90	2.0	.....	.....	"	"	" 4.
10	843	770	630	70.9	95.8	76.7	.621	.949	.614	.85	.78	.68	S. by W.	S. by W.	S. S. W.	35.70	2.0	.....	.....	"	"	Clear.
11	625	472	402	70.1	94.9	75.5	.516	.814	.597	.70	.54	.71	S. W.	S. S. W.	S. W. by W.	10.20	1.5	.....	.....	"	"	Cirr. 4.
12	435	472	632	69.5	79.2	60.8	.628	.581	.333	.88	.60	.63	W. S. W.	W. S. W.	N. by W.	211.10	2.5	.....	.....	Cu. Str. 10.	Cu. Str. 4.	Clear.
13	788	755	790	56.2	63.0	51.0	.342	.229	.270	.78	.41	.72	W.	W.	W.	253.50	3.0	Inapp.	.....	Nim. 10.	" 4.	Cu. Str. 4.
14	822	755	750	58.0	68.5	54.0	.337	.343	.341	.70	.49	.83	W. S. W.	W. S. W.	S. W. by S.	306.80	2.5	.....	.....	Clear.	C. C. Str. 6.	Nim. 10.
15	500	363	434	56.1	64.2	58.1	.420	.464	.452	.94	.77	.94	E. S. E.	N. E. by E.	S. W.	72.40	4.0	0.989	.....	Rain.	Rain.	Cu. Str. 8. Lightning.
16	477	567	790	56.6	73.0	52.0	.391	.383	.264	.87	.48	.69	N. N. E.	N. N. E.	N. by E.	264.90	2.5	0.700	.....	Nim. 10.	Clear.	Clear.
17	833	866	842	58.1	69.5	56.5	.255	.437	.357	.53	.63	.78	S. E. by E.	S. E.	S. S. W.	118.00	1.5	.....	.....	Clear.	"	"
18	791	814	869	50.2	64.7	57.6	.328	.427	.372	.89	.71	.78	S. W.	S. W.	S. W.	132.00	1.0	.....	.....	"	"	"
19	689	576	697	60.4	80.9	63.2	.433	.599	.510	.85	.50	.88	S. by W.	S. S. W.	W. S. W.	157.80	2.5	0.236	.....	C. C. Str. 10.	C. C. Str. 4.	C. C. Str. 4. Distant Thunder.
20	662	747	811	58.4	64.1	58.3	.372	.433	.394	.78	.73	.82	W. by N.	W. S. W.	W. S. W.	230.39	2.5	.....	.....	Nim. 10.	" 8.	Clear.
21	675	546	562	60.9	61.2	59.1	.419	.442	.439	.80	.8.	.88	S. S. W.	S. S. E.	S. E. by E.	26.20	2.5	Inapp.	.....	Heavy dew.	Cirr. 10.	Cu. Str. 10.
22	674	564	555	59.3	62.4	69.0	.462	.399	.564	.91	.72	.79	W. by S.	W. by S.	S. S. W.	222.50	2.0	.....	.....	C. C. Str. 9.	Cu. Str. 4.	" 8.
23	420	428	640	67.6	67.2	51.0	.591	.556	.302	.89	.84	.82	W. S. W.	W. by S.	W. by S.	393.70	3.0	0.010	.....	" 4.	" 8.	" 8.
24	616	735	850	43.2	69.6	57.0	.209	.336	.302	.75	.47	.66	W. by N.	W. by N.	W. N. W.	200.60	2.5	.....	.....	Clear.	Cirr. 2.	Clear.
25	842	772	700	55.0	87.9	68.7	.328	.921	.571	.77	.71	.82	S. W. by W.	S. S. W.	S. S. W.	66.30	2.0	.....	.....	Cu. Str. 8.	Clear.	"
26	583	584	614	68.4	77.0	65.9	.612	.685	.444	.90	.75	.71	S. S. W.	W.	W.	275.10	3.5	0.200	.....	" 8.	Cu. Str. 9.	Cu. Str. 8.
27	720	715	751	64.2	73.6	64.3	.471	.504	.464	.81	.61	.77	W. by N.	W. by N.	W. by N.	156.70	3.0	.....	.....	Clear.	Clear.	" 4.
28	660	565	782	61.2	69.7	66.0	.383	.490	.509	.71	.68	.81	W. S. W.	S.	W. S. W.	218.70	2.0	0.300	.....	"	Nim. 9.	Clear.
29	733	704	706	60.1	78.2	62.4	.376	.450	.422	.73	.67	.75	S. W. by S.	W. S. W.	W. S. W.	177.80	2.0	.....	.....	"	Cirr. 4.	" Aurora Borealis.
30	568	684	661	64.6	78.7	61.0	.444	.583	.419	.75	.62	.80	W. by S.	W. S. W.	S. E.	177.10	1.0	.....	.....	C. C. Str. 8.	Cu. Str. 10.	Cu. Str. 8. Comet first seen.
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....

REPORT FOR THE MONTH OF JULY, 1861.

1 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.	RAIN.	SNOW.	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.		Mean amount of	Amount of, in inches.	Amount of, in inches.	6 a. m.	2. p. m.	10 p. m.
1	29.701	29.742	29.763	56.6	71.4	59.4	.385	.509	.358	.84	.68	.73	S. S. E.	S. S. E.	N. E. by E.	439.20	2.0	0.170	.....	Cu. Str. 10.	C. C. Str. 4.	Cirr. Str. 8.
2	701	670	675	54.5	58.3	56.9	.383	.394	.429	.90	.82	.91	N. E. by E.	N. N. E.	N. E. by E.	495.00	3.0	3.210	.....	Rain.	Rain.	Rain.
3	729	845	831	61.0	76.0	65.0	.449	.652	.516	.85	.73	.84	N. N. E.	S. S. W.	S. S. E.	218.22	2.0	0.300	.....	Cu. Str. 10.	Cu. Str. 10.	Clear. Comet visible.
4	862	874	895	61.0	85.1	66.3	.433	.577	.470	.85	.49	.73	S. W.	S. S. W.	S. S. W.	211.60	1.0	.....	.....	Clear.	Clear.	" " "
5	840	770	794	71.8	91.0	72.0	.566	.894	.601	.74	.64	.78	S. S. W.	S. S. W.	S.	92.60	1.0	.....	.....	"	"	" " "
6	781	713	800	70.0	93.5	75.0	.557	.793	.507	.77	.50	.71	S.	S. S. E.	S. by W.	77.80	1.0	.....	.....	"	"	" " "
7	838	775	722	72.4	89.6	77.0	.681	.793	.765	.81	.63	.84	S. by W.	S. W.	S. W.	121.10	1.5	.....	.....	Cirr. Cum. 6.	C. C. Str. 4.	Rain.
8	683	783	550	74.0	89.7	66.5	.686	.714	.529	.83	.52	.82	S. S. W.	S. S. W.	S. E.	177.00	2.0	.....	.....	C. C. Str. 6.	Cirr. 4.	Nim. 10.
9	475	511	400	70.2	81.0	67.7	.557	.717	.584	.77	.70	.87	S. S. W.	S. S. W.	W. N. W.	70.84	2.0	1.310	.....	Cu. Str. 8.	C. C. Str. 4.	Cu. Str. 4.
10	470	574	702	67.0	76.0	65.1	.529	.652	.549	.82	.73	.80	E. S. E.	N. E.	N. N. E.	84.00	1.0	.....	.....	C. C. Str. 4.	Clear.	Clear.
11	590	528	577	51.3	57.4	57.0	.341	.400	.385	.89	.84	.84	N. E. by E.	N. E. by E.	E. by S.	427.50	2.5	0.863	.....	Rain.	Cu. Str. 4.	" Aurora Borealis.
12	633	599	731	54.1	62.1	55.2	.362	.376	.376	.87	.69	.87	S. S. W.	S. W.	W. by S.	208.60	2.5	.....	.....	C. Cum. 4.	" 8.	Str. 2. " "
13	882	976	937	58.5	77.6	58.0	.429	.457	.423	.91	.49	.88	S. W.	S. W.	N. E. by E.	55.40	3.0	0.074	.....	" 4.	" 8.	Clear. " "
14	30.037	869	902	56.4	72.4	60.1	.385	.483	.456	.84	.61	.88	N. E. by E.	E. S. E.	E. S. E.	58.30	2.0	.....	.....	C. C. Str. 6.	C. C. Str. 4.	C. C. Str. 4.
15	29.776	709	714	56.1	62.3	60.0	.420	.523	.469	.94	.94	.94	N. E. by E.	S. W. by S.	S. W. by S.	94.20	2.5	0.696	.....	Rain.	Rain.	Rain.
16	656	603	668	63.2	69.9	60.3	.510	.577	.456	.88	.85	.88	S.	S. S. W	S. by W.	166.10	2.5	0.603	.....	C. C. Str. 10.	"	Cu. Str. 4.
17	688	705	854	53.2	73.2	59.0	.321	.416	.416	.80	.52	.85	W. S. W.	S. W.	S. S. W.	150.60	1.0	.....	.....	Clear.	C. C. Str. 4.	Clear.
18	752	718	688	61.1	83.3	70.4	.390	.505	.516	.74	.51	.90	S. S. W.	S. S. W.	E. S. E.	99.90	1.0	.....	.....	Cirr. Str 2.	" 4.	Cirr. 10. Distant lightning.
19	396	582	583	64.0	70.4	65.2	.497	.530	.542	.83	.69	.87	W. S. W.	W. S. W.	N. E. by E.	79.30	1.5	1.126	.....	Cu. Str. 10.	" 4.	Cu. Str. 10.
20	422	405	470	63.0	74.1	60.0	.503	.442	.456	.86	.55	.83	E.	N. W.	W. by S.	67.10	2.0	0.576	.....	Rain.	Cu. Str. 9.	" 4.
21	575	588	622	30.1	72.6	58.5	.426	.483	.387	.82	.61	.79	W. by N.	W. by N.	W. by N.	364.00	2.0	0.131	.....	"	" 4.	Clear.
22	600	612	760	60.0	66.0	57.0	.345	.353	.385	.68	.56	.84	S. W.	W.	W.	230.40	1.0	.....	.....	Clear.	C. C. Str. 8.	Cu. Str. 4.
23	762	782	853	60.0	72.1	61.5	.433	.455	.466	.85	.56	.85	E. by N.	N. N. E.	W. S. W.	75.00	1.0	.....	.....	Cu. Str. 4.	Cu. Str. 10.	C. C. Str. 10.
24	921	869	976	56.7	77.2	61.7	.385	.534	.436	.84	.59	.80	W. S. W.	S. W. by W.	S. S. E.	6.20	1.0	.....	.....	C. C. Str. 10.	C. C. Str. 4.	Clear.
25	930	942	980	57.6	74.2	65.8	.349	.436	.509	.74	.53	.81	S.	S. S. E.	S. S. E.	0.70	1.5	.....	.....	Clear.	Cu Str. 4.	" Aurora Borealis.
26	904	904	875	66.1	84.1	69.1	.542	.590	.530	.87	.61	.77	S. by E.	S. S. E.	S. S. E.	0.50	1.5	.....	.....	"	Clear.	Cu. Str. 2.
27	835	832	833	71.9	78.0	71.0	.537	.671	.688	.71	.71	.92	S. S. E.	N. W.	E. S. E.	53.60	2.5	0.200	.....	Cu. Str. 10.	C. C. Str. 6.	Rain.
28	891	735	712	69.0	85.0	71.3	.571	.691	.615	.82	.57	.88	S. S. E.	S. S. E.	S. S. E.	50.80	1.0	.....	.....	Clear.	" 4.	C. C. Str. 2.
29	688	760	833	69.0	79.0	69.4	.642	.907	.880	.92	.93	.56	S.	S. S. E.	S. S. E.	204.70	2.0	0.163	.....	Rain.	Cu. Str. 6.	Cu. Str. 4.
30	748	722	755	70.4	83.9	69.0	.631	.903	.526	.85	.63	.77	S. S. W.	S. S. W.	S.	87.20	1.0	.....	.....	C. C. Str. 8.	C. C. Str. 4.	Clear.
31	844	800	736	67.6	79.7	68.2	.584	.724	.584	.87	.72	.87	S. by E.	S. by W.	S. S. E.	76.40	1.5	0.706	.....	Rain.	" 8.	Str. 4.

REMARKS FOR JUNE, 1860.

Barometer..... Highest, the 5th day, 30'128 inches.
Lowest, the 3rd day, 29.311 "
Monthly Mean, 29.720 "
" Range, 0.815 "

Thermometer... Highest, the 9th day, 99°7.
Lowest, the 17th day, 40°1.
Monthly Mean, 65°83.
Monthly Range, 59°6.

Greatest intensity of the Sun's rays, 104°8.
Lowest point of Terrestrial radiation,—33°4.
Amount of evaporation, 3·73 inches.
Mean of Humidity, .735.

Rain fell on 10 days, amounting to 4.863 inches; it was raining 56 hours and 18 minutes, and was accompanied by thunder on 3 days.
Most prevalent wind, the W. S. W.
Least prevalent wind, the N.
Most windy day the 23rd day, mean miles per hour, 12.23.
Least windy day the 8th day, mean miles per hour, 0.23.
Solar Haloes visible on 2 days.
Lunar Halo visible on 1 night.
Aurora Borealis visible on 1 night.
The Electrical state of the Atmosphere has indicated moderate intensity.

REMARKS FOR JULY, 1861.

Barometer..... Highest, the 14th day, 30.037 inches.
Lowest, the 9th day, 29.400 "
Monthly Mean, 29.734 "
Monthly Range, 0.637 "

Thermometer. Highest, the 6th day, 99°2.
Lowest, the 23rd day,—47°4.
Monthly Mean, 67°68.
Monthly Range, 51°8.

Greatest intensity of the Sun's rays, 104°1.
Lowest point of terrestrial radiation,—47°0.
Mean of humidity, ·765.
Amount of Evaporation, 2·72 inches.
Rain fell on 14 days, amounting to 10'188 inches, it was raining 79 hours, 49 minutes, and was accompanied by thunder on 4 days.
Most prevalent wind, S. E. by E.
Least prevalent wind, E.
Most windy day, the 2nd day; mean miles per hour, 20.60.
Least windy day, the 26th day; mean miles per hour, 0.02.
Aurora Borealis visible on 4 nights.
Comet visible.
Earthquake felt here at 9.03. p. m. 11th day.
Tornado in Montreal 9th day.
The Electrical state of the Atmosphere has indicated moderate intensity.

CONTENTS OF NUMBER III.

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

"The adoption by Mr. CHAPPUIS of the principle of the daylight reflector to the stereoscope was noticed by us in the *Athenæum* for Nov. 7th, 1857. We there made some suggestions for further improvements, with a recommendation to Mr. CHAPPUIS to 'try them.' That gentleman has not done so; but Messrs. SMITH & BECK have not only carried out, they have gone beyond our suggestions,—and from a toy the stereoscope has progressed to an object belonging to science. A few words will enable our readers to understand the improvements that have been made in this justly popular instrument. 1st. By the introduction of achromatic lenses the optical part is greatly improved, thereby increasing the definition and correcting the colour which single lenses invariably show on the margin of the objects. These errors in the unachromatic stereoscope frequently destroy the delicacy of the image altogether.—2nd. By the application of lenses of such a focal length, and placed at such a distance apart as that all shall see without fatigue, which is not the case with those hitherto contrived. But with these improvements in the optical part of the instrument arose the need of greater delicacy in the mechanical contrivances for observing to the best advantage; this led—3rd. To an arrangement whereby any one having the sight of both eyes could see the effect.—4th. A thoroughly steady and substantial stand adapted for a person seated at a table, and allowing of any alteration of position. 5th. A method for holding the slides so that they can be placed and replaced easily and without danger.—6th. Means have been adopted for varying the illumination at pleasure, causing a great variety of very beautiful effects of light and shade, from the cool tints of moonlight to the ruddy glow of the morning sun. And, lastly, a compact case to keep the whole from dust, injury, or exposure. The result is a perfection beyond which it is hardly possible to carry the stereoscope. This perfection is admirably exhibited in the stereoscopic views of the Moon, taken on glass by Mr. HOWLETT, from the negatives obtained by Mr. WARREN DE LA RUE with his equatoreal reflecting telescope of 13 inches aperture and 10 feet focal length. The stereoscopic effect is obtained by combining two views of the moon, taken at different epochs nearly in the same phase, but when the disc is in two different conditions of libration."

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