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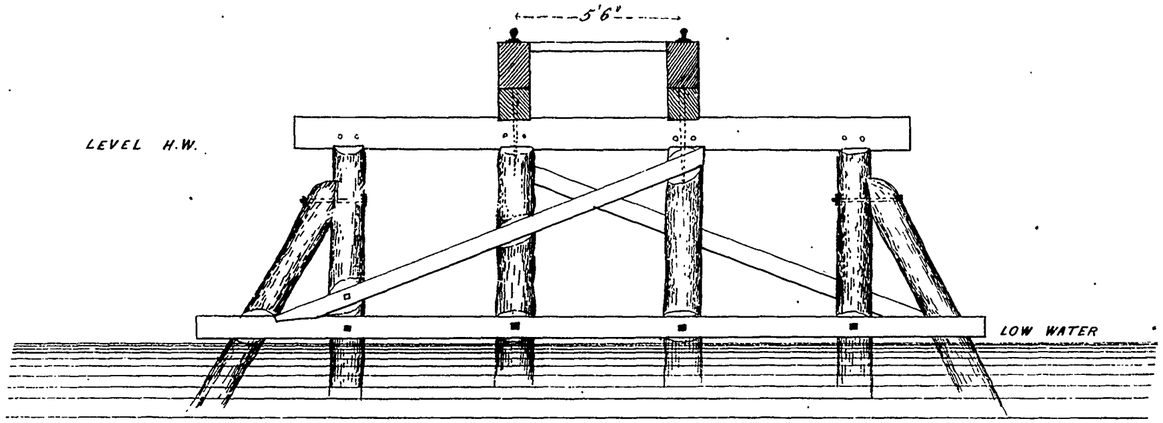
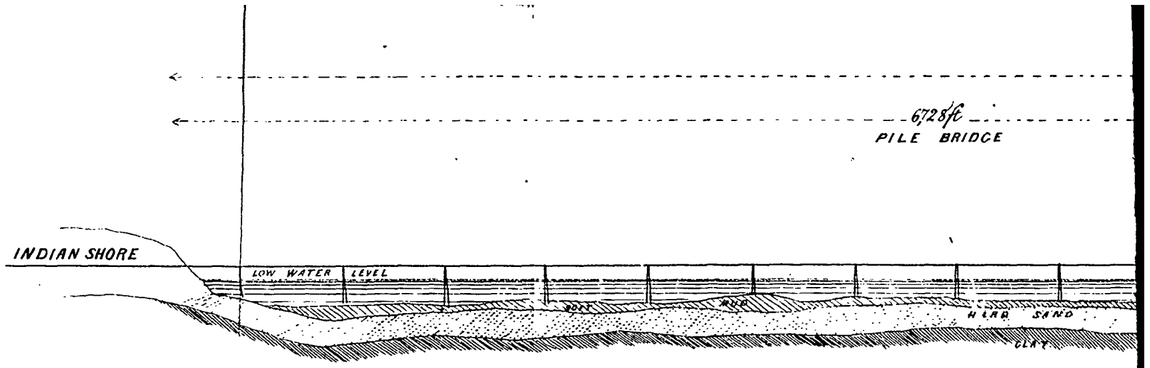
Nº3.

CROSS SECTION PILE BRIDGE





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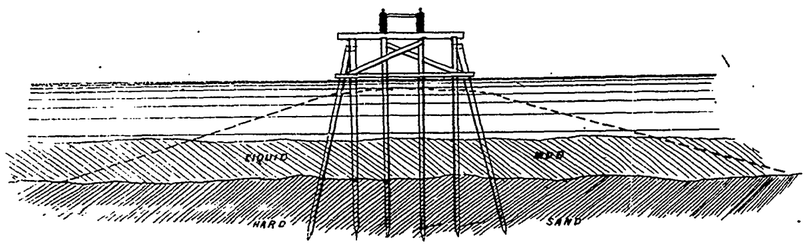
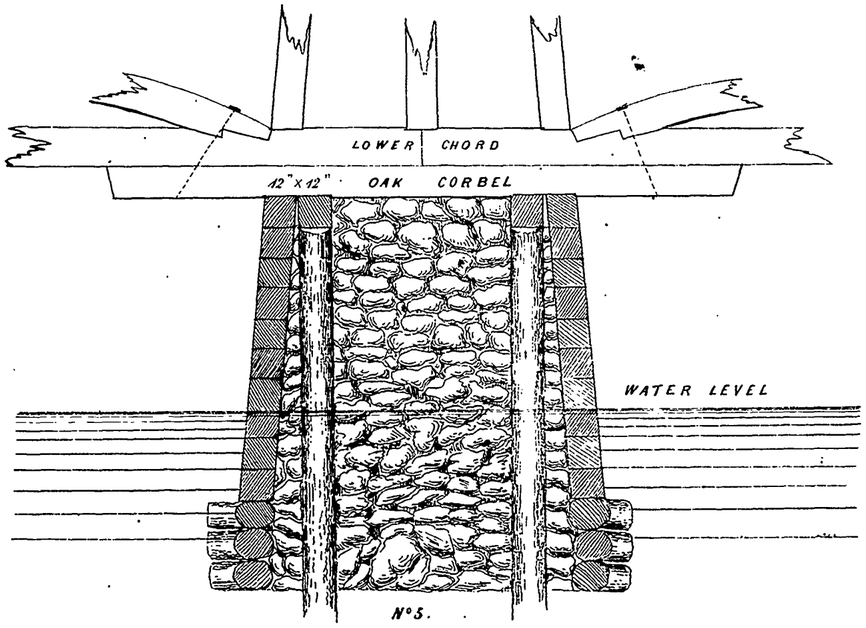


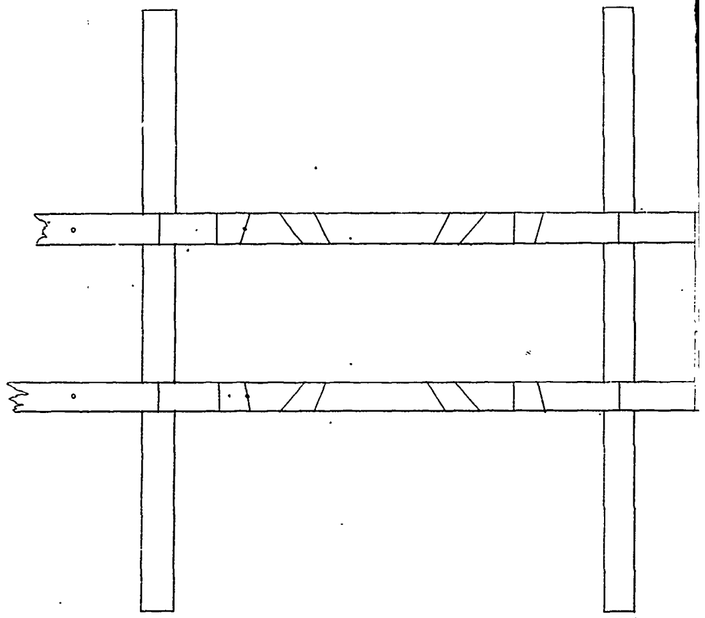
CROSS SECTION OF PILE BRIDGE

after being filled to one foot of low Water with earth



Nº5.

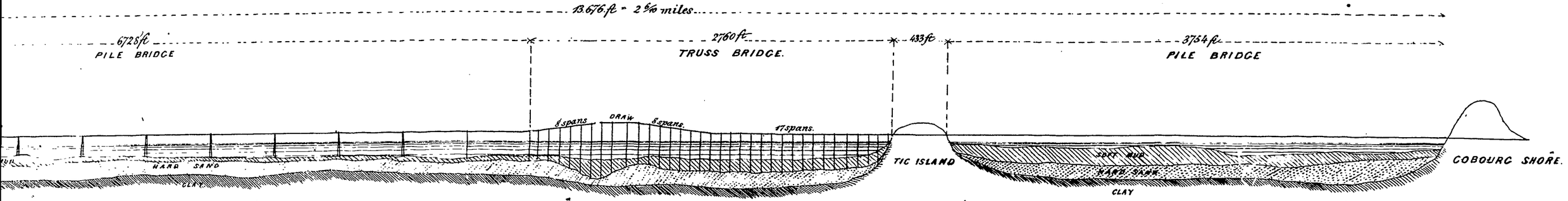
LONGITUDINAL SECTION OF PIER



Nº4

PLAN OF PILE

C-116 350



No 1.

SECTION OF RICE LAKE

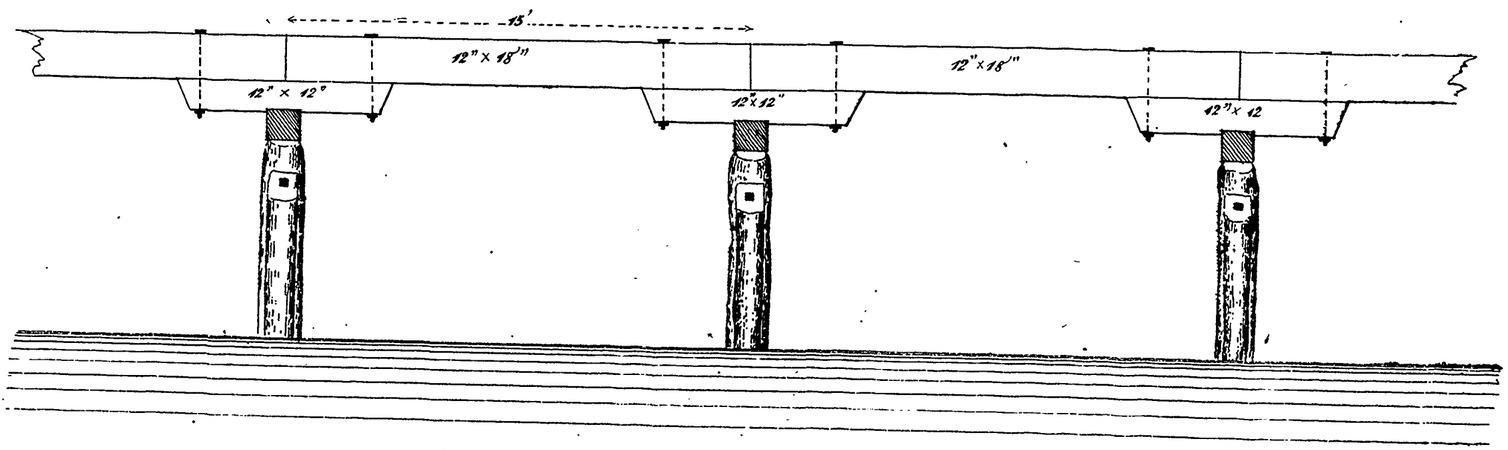
SCALE HORIZONTAL 600 feet to one Inch
VERTICAL 60 " " " "

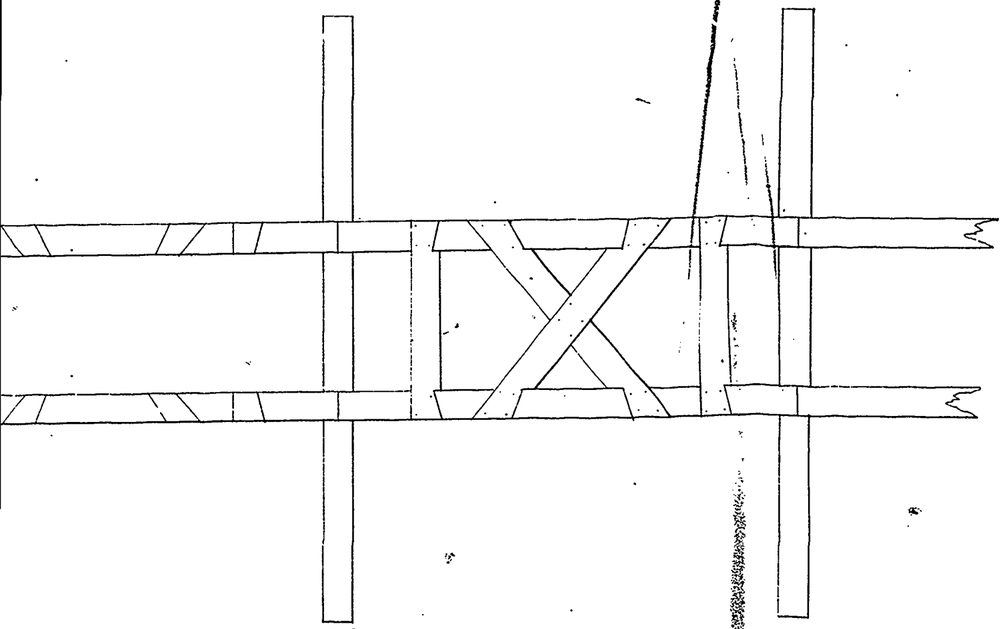
Drawings of
RICE LAKE RAILWAY BRIDGE,
to accompany a Paper
by T.C. Clarke C.E.

for the "Canadian Journal"

No 2.

ELEVATION PILE BRIDGE.





No 4

PLAN OF PILE BRIDGE

The Canadian Journal.

TORONTO, JUNE, 1855.

On the Action of the Ice upon the Bridge at Rice Lake.

By T. C. Clarke, C.E.

(*Communicated to the Canadian Institute, April 21st*, 1855.

The bridge of the Cobourg and Peterboro' Railway over the Rice Lake, in the county of Northumberland, is perhaps the largest Railway bridge on this continent, and one of the largest in the world,—its total length being a trifle over two miles and a half. The Railway crosses from the Cobourg shore to Tic Island by a pile bridge of 3,754 feet in length. Here it curves a little, the deflection being 2½°. From Tic Island to the north side of the main channel, a distance of 2,760 feet, there is a succession of wooden cribs 10′×20′ in size, sunk eighty feet from centres, filled with stone, and carrying a superstructure of that class of bridges known as "Burr's Truss."

In the channel, there is a pivot draw on a turntable, supported by a pier 20′×40′ in size, and giving two openings of fifty feet each. The bridge raised on an incline from each end towards the draw, and the spans immediately next it, give a clear headway of twelve feet, to afford a passage for the cabins built upon the rafts which come down the Lake.

From the end of the truss bridge to the Indian village shore, a distance of 6,728 feet, is a pile bridge, similar to the other, except that it is strengthened every five hundred feet by a crib 10′×20′ in size, loaded with stone. The cross section of Rice Lake accompanying this paper, shows these dimensions of the bridge.

The bottom of Rice Lake is black mud, in a semi-liquid state, and capable of affording no support to piles. This sometimes reaches nearly to the top of the water, and sometimes there is a depth of ten to fifteen feet of water before reaching it. It affords nutriment to the wild rice (Zizania aquatica. L.), from which the Lake takes its name, and which grows in large patches in such luxuriance that it is difficult to paddle a canoe through it. Under this black mud there is a stratum of very hard and compact sand, overlaying the clay.

The depth of water and mud averaged from the low water level, shown in the section, is about fourteen feet south of Tic Island, and sixteen feet between the Truss bridge and the Indian shore. The total rise and fall of the Lake is six and a half feet.

The piles are driven through the sand and a little into the clay, in some instances; generally, however, they are driven an average of ten feet into the sand, which was a difficult process; the pile not going more than two inches at a blow, from rams weighing 18 cwt., falling through forty feet leaders, after it had begun to penetrate this sand.

It will be observed that from Tic Island to the channel, where was evidently the ancient bed of the river, it is deeper than the rest of the Lake, being an average of twenty-eight feet from low water mark In the channel it is thirty-six feet from low water mark, and forty-two and a half feet from high water mark to the hard bottom. This depth rendered an ordinary pile bridge impracticable, and accordingly the truss bridge, resting on crib piers, as before mentioned, was designed to carry the Railway over this part of the Lake.

The mode of construction was as follows:—Four long piles were driven and capped, to bear the vertical pressure of the bridge until the cribs could sink to their bearings. They also served as guides for the cribs, which were built around them, 10′×20′ in size at top, and battening 2″ in 12″ at the ends, and 1″ in 12″ at the sides. They were made of square timber above, and round below water. They were sunk to their places through the ice in winter, and then loaded with bowlders, collected along the shores.

The construction of the pile bridge will be seen from inspection of the accompanying drawings. The piles, of which the centre pair were white oak, the outside pair and the spur piles in some cases pine or tamarac, were driven, and capped with pine caps 12×12. The spur piles were driven with a leaning machine, so that their tops stood about four feet from the others. They were then drawn up by strong tackle, and secured with 1″ round bolts. The corbels are fastened to the caps and piles by 1″ square rag bolts three and a half feet long. They are notched an inch on the caps. The stringers of pine, 12″×18″, are secured to the corbels by 1″ round screw bolts. Ties of 3″ oak plank connect the stringers together on top.

The quantities of materials in this bridge are as follows:

184,000 lineal feet of piling.
138,000 " " round timber in cribs.
644,000 feet B. M. square " "
1,932,000 " " " " in bridge.
250,000 lbs. iron in bridge.
20,000 yards stone in cribs.

The total cost of the bridge has been not far from $175,000.

It remains now to describe the effect which the ice has already had upon this structure, and to consider what are its future prospects of stability and permanency.

It was predicted by many persons, previous to commencing this undertaking, that no structure could possibly be built which could resist the power of the ice in Rice Lake,—which forms to the thickness of two and a half feet; expands with such force as to "buckle" up into high ridges, from the heat of the noonday sun; and contracting again in the cold nights, cracks and splits with a noise like that of artillery, and with a tremendous power which, as they declared, no artificial structure could resist. Moreover, they said, after the ice has "taken," the lake rises some two or three feet, and the ice, being frozen to the piles, must inevitably drag them all out.

To these evil forebodings it was replied that it was not supposed that a pile bridge could sustain the thrust of the ice for any length of time; it might be disturbed and thrown out of line and level, but notwithstanding it could serve to carry the trains across the lake until such time as it could be filled up with a solid embankment. It was not expected that it would last for ever; but if it lasted long enough to form a means of communication across the Lake until it was filled up from dirt waggons, that would be a great advantage,—sufficiently important to justify the cost of the bridge. To be sure, if the Company had plenty of time, and unlimited means, it would be better to fill the Lake up as they went along, leaving only a passage for the waters; but, in their circumstances, this was entirely impossible, for it would have required such a large immediate outlay, with so remote a prospect of remuneration, that the project would have been killed.

The bridge was accordingly built, and the result has thus far justified the anticipations of its projectors; while, on the other hand, the prognostications of those who feared danger from the ice have been partially realized. The bridge has been much twisted and shaken, but although its straightness and regularity have been destroyed, it still stands in its place, fully equal to the task of carrying unusually heavy engines over in safety.

If the filling in of the Lake is hurried on with as fast as possible, it can be completed before next winter, and then there will be no danger to be apprehended for a long time to come.

The manner in which the ice has affected the bridge is somewhat singular. As was predicted, there has been evidently a raising of the entire field of ice since its formation. The effect of this during the winter of 1853–4 was to draw out a few piles, near the Indian shore, which had been imperfectly driven, and to raise the whole, north of the truss bridge, some six or eight inches, except where it was held down by the cribs, sunk every five hundred feet. This gave it rather an undulating surface, and they were obliged to raise and block up the stringers at these low points. It is proposed to prevent this raising of the ice, by putting flash-boards on the dam at Crook's Rapids, at the lower end of Rice Lake, and raising it some two or three feet before the ice takes. As more water flows into the Lake it would be necessary to gradually take off the boards, and thus keep it at the same level.

When there is no snow on the ice, the heat of the sun in the middle of the day expands it, and it moves slowly, carrying the bridge with it. When night comes on and the temperature falls, it contracts again, and cracks and splits in a surprising manner.

One of these cracks took place at a very acute angle across the bridge, throwing one portion up stream about eighteen inches, and the other down as much.

The worst injury that the bridge has received was about the 1st of January of this year. The weather was particularly trying, the days being warm and the nights very frosty; and this, it must be observed, is the only kind of weather in which the bridge takes injury,—uniformly cold or warm weather not affecting it.

On this occasion there appeared to be an expansion of the ice from the channel towards each shore, and the effect was irresistible. The pile bridge north was thrown towards the Indian shore; but owing to the number of cribs in it, it moved but little. The truss-bridge was pushed towards Tic Island, so that the last span slid four feet upon the solid abutment. South of Tic Island, the pile bridge was crowded over toward the Cobourg shore,—so much, that at the place where it parted, near the island, the stringers were drawn apart nearly seven feet, so that they fell from the corbels. The piles were leaned over, and where the thrust met the resistance of the shore, it crushed up the solid 12″×18″ stringers, and turned them into splinters, and bent the iron rails double. This has all been since repaired, and the trains are now crossing regularly.

From inspection of the drawing, No. 6., accompanying, it will be seen that nearly three-fourths of the length of the piles are unsupported, and only one-fourth of them is in the solid ground. When the thrust of the ice comes at the water-line, it exerts a very powerful leverage, and it is not strange that the bridge should yield.

The dotted line in fig. 6 shows the outline of the embankment which it is proposed to make. This, it will be seen, will support the piles very much, and render it almost impossible that they should be moved. In course of time, as the piles decay, it will be found necessary to fill it up to the level of the track. The embankment must then be protected from washing away by a slope wall of loose stones and brush. Another very ingenious method of protecting it has been proposed, which would be less expensive than a slope wall. This is, to drive piles some twenty feet from the bridge in rows parallel to it on each side, cut them off below the depth to which the ice forms, and chain to them a succession of spars forming a boom along the embankment on each side, and twenty feet from it. It is believed that this would render the water calm enough inside of it to prevent washing away the bank.

The material on the south side of the Lake is admirably adapted for filling, being a tough species of clay, or rather hard pan, which, when thrown into the water, consolidates, and packs around the piles, instead of washing away. A few hundred feet of embankment was made of this material in the summer of 1853, and has stood perfectly well ever since.

The Rice Lake Bridge was designed and built under the immediate superintendance of Ira Spalding, Esq., and reflects great credit on that gentleman's skill and judgment as an Engineer. The contractor was Mr. Zimmerman, whose well known energy was severely taxed to supply so large an amount of materials, and carry on the work to successful completion, in spite of sickness and scarcity of workmen, in the comparatively short space of eighteen months.

THOS. C. CLARKE.

Port Hope, April 2nd, 1855.

Report of the Select Committee on the Geological Survey of Canada.—Minutes of Evidence.

In continuation* of the "Report of the Select Committee" appointed by Parliament to inquire into the condition of the Geological Survey of Canada, we proceed to furnish an abstract of the Minutes of Evidence which accompanied the Report. The importance which the Committee have very properly attached to this great undertaking is thrown into relief, not so much by the information elicited from witnesses respecting the actual results of the Survey, as by the proofs of a marked and highly complimentary attention, which the labors of Mr. Logan and his staff have met with among European and American Geologists and practical men.

The first witness examined was Professor Hall, of Albany, the author, among other valuable works, of the "Geology of the First District of the State of New York," and of those magnificent volumes devoted to the Palæontology of the entire State. Mr. Hall submitted in evidence that he had had an opportunity of knowing much of the progress of the Canada Geological Survey from its commencement, and entertained a very high opinion of the character and value of the work which has been accomplished, as well as of its importance to the Province, both in its Scientific and Economical relations.

In reply to the question, "What in your opinion would be the best manner of placing the information and materials that have been collected on the Canadian Survey before the public?" Mr. Hall considered it advisable to publish in one or more volumes an account of the Geology of the Province, which may be a revision and a condensation of the Reports of Progress, with such illustrations by Geological Sections, Maps, Fossils, &c., as may be required for the proper elucidation of the subject. Accompanying this volume should be a Geological Map of the Province on a scale sufficiently large to represent all the Geological formations in their entire extent, each formation being distinguished by a different color. This map might also be accompanied with a small Pamphlet, describing briefly the character and extent of the Formations as represented on the map by different colors. It would be very desirable to have copies of the complete work and the map so distributed that it would be accessible for reference to every

* See "*Canadian Journal*," Vol. III., p. 234.

person in the Province. In addition to this means of placing *before the public the information already obtained, he strongly* recommended that the Museum already commenced should be advanced as rapidly as consistent with the other duties of the Geologist. The object in this collection should be the formation of a Museum of Economic and Scientific Geology, where specimens of all the Mineral products of the Province should have a place; and where those of Economic interest should be presented in a proper arrangement, not only in their natural state, but also in their wrought or manufactured condition.—This Museum should be open to the public. This plan would render available at an early period a great part of the information and materials already collected by the survey. The publication of the results of the Survey, as the materials accumulated, was recommended,—since by such a course the Canadian Survey will receive due credit for such discoveries, and confer a benefit upon science by their speedy publication; whereas by leaving the publication till a later period, *the same discoveries* may be made and published elsewhere.

A sound basis of scientific investigation is of the highest importance in leading to practical results. Mr. Hall said that he conceived that no practical or economic results of great value are likely to arise except those based upon scientific investigations. The great lead-bearing formation of the States of Wisconsin, Illinois, and Iowa was instanced. For many years a serious misapprehension existed in regard to the true position of the lead-bearing rock; and only so late as 1850 was it determined, by a proper examination of its organic remains, that instead of its being in the Niagara group, as formerly supposed, it belongs to a much lower series of rocks, viz., a Lower Silurian Limestone. This erroneous impression gave rise to fruitless searches for Lead ore in the Niagara limestone, which this late information will discourage. There are at this time multitudes of practical miners, who know at once, by the occurrence of certain Fossils, the presence of the Lead-bearing rock, and who would never think of searching for Lead ore in any rock where these Fossils do not exist.

During fifty years previous to the commencement of the Survey in the State of New York, not less than one million dollars had been expended in abortive search for coal, where a well-informed Geologist would have at once pronounced the undertaking useless, and certain to prove a failure.

With reference to the Mineral wealth of Canada, Mr. Hall stated that "from a knowledge of the great Geological features of Canada, derived chiefly from the Reports of Mr. Logan, as well as from some cursory observations of my own, I infer that the Country is rich in all those Mineral products (with the exception probably of coal,) which lie at the foundation of modern progress and civilization. Without enumeration, I need only refer to the list of Economic Materials given in the Geological Report of 1849-50, and to the display of mineral products in the Canadian department of the Grand Industrial Exhibition of London in 1851. I might mention, however, the immense area of the Geological formation composing the Laurentine mountains on the north of the St. Lawrence, having a length of one thousand miles by a breadth of one hundred miles, in which occur deposits of magnetic Iron Ore, the most extensive and valuable in the known world. This ore, so famous in Sweden for the manufacture of steel, is associated in the same formation with specular Iron Ore, Galena, Plumbago, indications of Corundum, and other mineral products. Succeeding this, you have a large area of Copper bearing rocks of the Lake Superior region, in which both Copper and Silver occur. You have also some forty or fifty thousand square miles of country on the south of the St. Lawrence, composed of Metamorphic rocks of a later age. Ten thousand square miles of this area have been shown to contain Gold, and the entire formation abounds in Magnetic and Specular Iron Ores, Chromic Iron, Copper Ore, Serpentine, Marble, Soapstone, Roofing Slates, and many other economic products. In the other formations, comprising half the entire area of Canada, are abundance of Limestones and other building stones, Clays, Ochres, Bog Iron Ores, Asphalt, Gypsum, &c., &c.

"Compared with the neighbouring States, Canada stands before any one of the United States, except those containing coal; but taking all the States upon her borders together, the comparison in everything, except coal, is very nearly equal, if we compare equal areas of country."

The next witness examined was Professor E. J. Chapman, of University College, Toronto.

Ques.—"*Have you ever been practically engaged in any* Geological Surveys? *Ans.*—"Yes, in several; *principally for Railway and Water Companies.* I have also taken part in Mining Surveys; and I may mention, as lending more weight to my evidence on this occasion, that I am the author of several works on Mineralogy, and of a considerable number of published papers on Mineralogy, Mineral Chemistry, and Geology, many of which have been translated into foreign scientific Journals." *We may, perhaps, be permitted to question* whether the implied comparison between a Geological Survey for "Railway and Water Companies," and the Geological Survey of Canada—a vast country containing 300,000 square miles—is either philosophical or just; a doubt which is far from being dispelled by the perusal of the question and answer subjoined, in which "waterways," "millstreams," and "dumbwells" are brought forward as illustrations to sustain the prosecution of an inquiry which, though it may cost the country fifty thousand pounds, will at the same time add immeasurably to its wealth and its science.

Can you give instances from your own experience in such surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest? *Ans.* Many instances of this kind are well known to Geologists, some have come under my own observation; when a railway crosses a stream in England, the law compels the Company to make the water-way sufficiently large to prevent the land around from being flooded during times of heavy rain, or from the melting of the snow. It is very frequently inconvenient to the Engineer to make the water-ways larger than is absolutely necessary; and the usual method of procedure is to measure the nearest existing water-ways, ascertaining at the same time from persons living near the spot, if these be of sufficient size to admit at all times the flow of water through them. When engaged some years ago in this kind of work, I was surprised to find the water-ways over a small stream quite insufficient to prevent flooding, when from another stream in the same locality with smaller water-ways, no flooding took place; the physical aspect of the country exhibiting no cause for the difference in question, but rather tending the other way. On examining the district geologically, however, the problem was explained at once. The hills and higher ground along the one stream were capped with stiff impermeable clay; along the other, with gravel. All the rain which fell upon the clay, apart from that taken up by vegetation, ran off into the stream; whilst the greater part of the rainfall upon the gravel was absorbed by the porous nature of the soil. *Now had a geological survey of such a district been made before the erection of bridges, it would have shewn that the water-ways over the one stream must have been very much larger than those over the other, if flooding were to be avoided.*

Another case, much of the same kind, came under my notice more lately, whilst prosecuting some Geological inquiries in Hertfordshire. A miller inquired of me why the stream on which his mill was situated, after having been at one time sufficient to drive eight pairs of stones, had gradually become unable to drive more than three pairs; thus

greatly deteriorating the value of his property. The surrounding country was clay overlying porous chalk. On examining into the matter, I found that an extended system of drainage, by means of the so-called "dumb wells," had come into operation in the district during the preceding three or four years, and had thus gradually affected the water power of the stream. These dumb wells are pits dug through the clay into the absorbent chalk, and afterwards filled up with rounded stones or other matters admitting the free passage of water. Drains being led into these, the greater part of the rain-fall is carried into them, and so down into the underlying porous rock. *Whenever therefore a Geological investigation of a district points out the existence of permeable beds, lying at an accessible depth beneath stiff clay lands, and good surface drainage is not readily obtainable, recourse may be had to the method just described.*

We cannot consider these "instances of scientific results acquiring practical importance" very flattering to our Geological Survey, or likely to win for it a cheerful support and encouragement from the practical men of Canada.

With reference, indeed, to the first illustration, it does not seem to be very improbable that an hour's inspection of the water marks on the banks and in the valley of the streamlet would have furnished the information to be deduced from "a Geological Survey of such a district before the erection of bridges;" such, we apprehend, is the modest plan which would have been adopted in Canada; and as to the existence of available 'permeable beds,' the first well sunk in a district must lead to their discovery. Hundreds of mill-streams in this country are annually failing in their supply of water, and at the same time freshets are becoming more sudden and destructive, yet no one would venture to advocate the expediency of sustaining a geological survey with a view to arrive at the explanation of these frequent and easily interpreted occurrences. Mr. Chapman, however, was asked to give instances from his "own experience in such Surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest," and with commendable candour he limited his instances to those which had come under his independent observation; not that the illustrations advanced can be said to be possessed of much scientific value to the geological world, however important they may have appeared to a Hertfordshire miller; yet, experience is always worth consulting, whether won in the difficult pursuit of truth at the bottom of "dumb wells," or acquired by the patient study of the water shed of a refractory streamlet.

Ques.—"Have you had an opportunity of ascertaining the progress that has been made in the Geological Survey of this Province; and what is your opinion of that progress?" *Ans.* "I have devoted several days to a very careful examination of the work already performed, and the materials collected under Mr. Logan's direction, and I can only express my wonder that so much should have been done; considering more especially the small means hitherto at Mr. Logan's disposal, the want of Topographical Maps, and other difficulties incidental to a new country." No one would suppose that a just appreciation of the value of the results already obtained by the Survey, could be derived from an inspection even during broad-day light of the minerals collected, as they may have been obtained from localities commercially inaccessible; but, when they "lie in a great measure, buried in packing-cases in the vaults and sheds of the Survey Office,"* the difficulty is proportionately increased. It is only by a study of the published reports of the work already done, that correct impressions can be obtained of the real value of the Survey. We confess, therefore, to some degree of surprise at finding Mr. Chapman state in the continuation of his evidence, that "several of Mr. Logan's valuable reports, moreover, are out of print, and *I have been quite unable to obtain copies of them.*" This explains at once the error alluded to in the May number of this Journal respecting the discovery of the tracks of a crustacean in the Potsdam Sandstone, the inference being that Mr. C. was not familiar with the contents of the Reports of which he had been unable to procure copies.

Mr. Chapman is asked by the Committee to state some of the new Scientific Truths which have been derived from the Survey, and he enumerated among others the following:—"Another very interesting discovery is that of the crustacean tracks on the Potsdam Sandstone. The celebrated discussion to which this has given rise in England has attracted the attention of scientific men all over Europe to the results of the Survey." Had Mr. Chapman enjoyed the opportunity of studying Mr. Logan's admirable Report for 1851 and '52 he would have known the name and designation of the real discoverer; or had he met with the fourth edition (1852) of Sir Charles Lyell's Manual of Elementary Geology he would have found the following circumstantial notice of the "tracks," with the date of the discovery, and thus avoided leading the Committee into error on a subject familiar to every amateur geologist in Canada:—

"*Tracks of a Lower Silurian Reptile in Canada.*"—In the year 1847 Mr. Robert Abraham announced in the *Montreal Gazette*, of which he was editor, that the track of a fresh water tortoise had been observed on the surface of a stratum of sandstone in a quarry opened on the banks of the St. Lawrence at Beauharnois in Upper Canada. The inhabitants of the parish being perfectly familiar with the track of the amphibious mud-turtles or terrapins of their country, assured Mr. Abraham that the fossil impressions closely resembled those left by the recent species on sand or mud. Having satisfied himself of the truth of their report, he was struck with the novelty and geological interest of the phenomenon. Imagining this rock to be the lowest member of the old red sandstone, he was aware that no traces had as yet been found of a reptile in strata of such high antiquity. He was soon informed by Mr. Logan, at that time engaged in the Geological Survey of Canada, that the white sandstone above Montreal was really much older than the "Old Red" or Devonian. It had in fact been ascertained many years before, by the State Surveyors of New York (who called it the "Potsdam Sandstone"), to lie at the base of the whole Silurian series." * * * Early in the year 1851, Mr. Logan laid before the Geological Society of London a slab of this sandstone from Beauharnois, containing no less than twenty-eight foot prints of the fore and hind feet of a quadruped, and six casts in plaster of Paris, exhibiting a continuation of the same trail. * * * Numerous other trails have since been observed (1850, '51), in various localities in Canada, all in the same very ancient fossiliferous rock; and Mr. Logan, who has visited the spots, will shortly publish a description of the phenomenon." We may here remark that Professor Owen first inferred (1851) that the tracks were those of a fresh water or estuary tortoise. Agassiz supposed that they were crustacean, in which view Professor Owen coincided in 1853. (See Journal of the Geological Society August, 1853.)

Mr. Chapman being requested to state to the Committee some of the advantages derived from the Survey by the discovery of materials of economic application, replied:—"With regard to economic discoveries, I may state generally that the survey has brought to light the existence of beds of workable

* See Report of Committee.

Peat, before, I believe, unknown in Canada, or at least undescribed, of slate of excellent quality, of limestone bands, where limestone was supposed to be absent, and of lithographic stone, serpentine, soapstone, white brick clay, and other valuable materials, previously altogether unknown or undiscovered along the localities indicated by the survey. * * * * The proof of the non-existence of coal over the greater part, if not the whole of Canada, is entirely due to the survey." Why did not Mr. C. enumerate the Copper region of Lake Superior and Huron, the vast deposits of gypsum in western Canada, the enormous areas of magnetic, bog and specular ores of iron some sixty miles north of Lake Huron, also in the valley of the Ottawa and the valley of the St. Lawrence? Why not mention the great ranges of building stone, as well as 'serpentine'? beautiful ochres and admirable sandstones for glass-making as well as 'soapstone'? Marble, manganese, and refractory sandstone as well as 'white brick clay'? and would it not have been as well to have hinted at plumbago, phosphate of lime, flagstones and shell marl, as "the bringing to light the existence of workable beds of peat"?

We most cordially agree with Professor Chapman in his recommendation, that at least from 10,000 to 20,000 copies of the Reports should be struck off and distributed among "the schools, mechanics' Institutes and other similar establishments throughout the Province;" and may we not add, among the Professors of Mineralogy in our Colleges!

W. E. Logan, Esq., Director of the Geological Survey of Canada, gave a short statement of what he had accomplished up to the present time, which we give below:—

It will be observed by a reference to the Reports of Geological Progress published, that the districts examined are as follows:

The Canadian coast and Islands of Lake Superior, and two rivers on the north shore for distances of forty and sixty miles up. Here there has been shewn to exist an important copper region.

The Canadian coast and islands on the north shore of Lake Huron with distances of from twenty to seventy miles up four of its principal tributaries. Along the coast the copper-bearing rocks have been shewn to continue to some distance eastward of Lacloche.

The coast of Lake Huron from the mouth of the Severn round by Matchedash Bay, and Cabots Head to Lake St. Clair; that of Lake Erie from the vicinity of Chatham to the exit, and the upper part of Lake Ontario; with most of the country included in the perimeter formed by these coasts and a line from Toronto to Lake Simcoe. In this have been shewn great ranges of valuable building stone, of gypsum, and hydraulic and common limestone, with extended areas of white and red brick clay, bog iron ore, asphalt and mineral oil; while the structure, proved by the ascertained distribution of the formations, shews that there can be no workable coal beds in a part of the country, where even practised observers, without due caution, would be liable to mistakes that might lead to great loss of capital.

The country in a general line between Lake Simcoe and Kingston along the junction of the fossiliferous and unfossiliferous rocks: in the former of which are shewn the existence of a great range of valuable building stone, as well as hydraulic and common limestone, with lithographic stone: and in the latter enormous deposits of magnetic iron ore with whetstones, plumbago, crystalline lime-stone and other materials; while the drift displays great areas of white and red brick clays, in some places covered by extensive tracts of excellent peat and shell marl.

The country between the St. Lawrence and the Ottawa, south of a line from the vicinity of Kingston to Pembroke, comprising a surface of about 10,000 square miles, where in addition to great areas of peat and shell marl, and clay fitted for common bricks and pottery, with bog iron ore and ochre, great ranges of building stone, hydraulic and common limestone, and white sandstone fitted for the purpose of glass making, in the fossiliferous rocks: and magnetic and specular ores of iron, lead ore, and some copper ore, plumbago, phosphate of lime, great and extensive beds of crystalline limestone, sometimes giving good marble, barytes and traces of corundum have been found in the ins fosiliferous.

The Ottawa from its mouth near Montreal to the head of Lake Temiscamany, a distance of 400 miles, with many of its tributaries on the south bank for distances of from twenty to forty miles up. The economic materials in this are similar to those in the previous area and in equal abundance.

The north side of the St. Lawrence from Montreal to Cape Tourmente, as far back as the junction of the fossiliferous and unfossiliferous rocks, comprising an area of 3000 square miles, in which have been found clay fit for common bricks and pottery in great quantity, accessible in almost every part; bog iron ore in large abundance, a profusion of iron and manganese, ochres of various beautiful tints, tripoli or infusorial earth, refractory sandstone admirably adapted for furnace hearths, white sandstone fit for glass making, ranges of excellent building stone extending the whole distance, marble, and limestone fit for burning.

The south side of the St. Lawrence and the Eastern Townships from St. Regis to Etchemin River, a surface of about 15,000 square miles, a large portion of which is occupied by a mineral region of great importance, found to hold inexhaustible supplies of roofing slate and of beautifully variegated calcareous, and magnesian marbles, the latter resulting from a band of serpentine which has been traced for 135 miles, soapstone in great abundance, dolomite, magnesite, chromic iron, whetstones, extensive intrusive masses of most beautiful granite, magnetic iron ore, occasional indications of silver-bearing lead ore, copper ore and gold, while in the less mineralized part are good arenaceous and calcareous building stone, flagstone, white sand, stone for glass making, common brick and pottery clay, bog iron ore, peat, shell marl, and other materials.

The country between the Etchemin River, and Temiscouata portage road, in which many of the same materials as in the previous area will be found, but cannot yet be pointed out in a connected manner, the exploration having been only partial.

The coast of the Gaspe Peninsula from the Metis road by Cape Gaspe and Isle Percee to the mouth of the Maisapedia River, a distance of about 805 miles, with several sections across the Peninsula from the St Lawrence to Bay Chaleurs: the chief object of the exploration of this district was to determine the northern limit of the great eastern coal field of North America, spread out in the sister colonies; and as the carboniferous area lies unconformably on the inferior rocks, to ascertain whether any outlying patches might exist in the Peninsula. None such, however, have yet been discovered.

A large and valuable collection of specimens has been made to illustrate the economic materials, the minerals, rocks and fossils of the districts examined. This is preserved at the office of the Survey; and now that a suitable building has been placed by the Government at the disposal of the Survey, a commencement had been made to a classification and arrangement of the materials into two divisions, one to display the character and application of the useful materials, and the other the science of the whole subject.

The true bearing of geological facts, as parts of a whole, being unintelligible without the exhibition of their relative geographical positions, and so large a portion of Canada being still unsurveyed topographically, it has been necessary to measure accurately extensive lines of exploration, and the maps resulting have proved of great value to the Crown Land Office. From this collateral work is derived a large part of what is known of the interior of the Gaspé Peninsula, where six streams have been measured: the Matane, the Chat, the St. Ann, the St. John, the Bonaventure and Great Cascapedia. It has shewn the courses of the Kamamistiquia and Michipicoten rivers on Lake Superior, of the Thessalon, the Mississague, the Spanish and French rivers, on Lake Huron; in addition to 150 miles of the Ottawa and the whole length of the Mattawa. From it has resulted the improved delineation of the forms and distribution of a great chain of lakes in the rear of Kingston, and last year the course of the Muscoco from Lake Huron to its source, of the Petewawe from its source to its mouth; of the Bonnechere from its junction with the Ottawa to one of its sources; of the York branch of the Madawaska, with a sketch of the relations of various streams, from the tributary just mentioned to Balsam lake, the whole distance in these explorations and admeasurements being 500 miles.

Chemical analyses have been made of all the metallic ores, and such other useful minerals as required it, the number of which has been very great, and in addition of upwards of fifty valuable mineral springs, of a great collection of soils from both divisions of the Province, and of new mineral species.

The means placed by the government at Mr. Logan's disposal were £1,500 in the first instance, then £2,000 per annum for five years from March, 1845; £2,000 per annum for five years from July, 1850; and £1,000 for fitting up the Museum, making a sum total of £22,500 for the whole expenses of the Survey during a period of eleven years. The Survey of the State of New York cost half a million dollars. From want of a liberal grant Mr. Logan has been compelled to supply at his own expense nearly all the scientific books indispensible for the proper prosecution of the Survey, and all the more costly instruments required both for topographical surveying and chemical analysis, and has in various other ways met the deficiencies of the government appropriation from his private exchequer. While enumerating these difficulties he is not unmindful of his friends. He reminds the Committee that the present increased value of all the necessaries of life press severely on those associated with him in the investigation. The physical difficulties of the Survey have been both numerous and constant; besides those incident to travelling in canoes up shallow rivers, and travelling on foot through the forest, the endless measurements and remeasurements arising from the want of a good topographical map of the country have been a serious labour in themselves, and retarded in a very great degree the progress of the geologists. "Boundary lines that on paper are represented as straight go staggering through the bush in zigzags that would surprise an Indian hunter."

The work of the Survey is too extensive for the staff employed on it. All the general office work falls on Mr. Logan; he keeps a set of books by double entry, detailing every penny expended on the Survey and the purpose to which it is applied. Formerly he was accustomed to write with his own hands four manuscript copies of his report, often amounting to more than 100 printed pages. The present staff consists of a director, (Mr. Logan) an assistant geologist, (Mr. Murray) a chemist and mineralogist, (Mr. Hunt) an explorer, (Mr. Richardson) and a messenger. The staff now proposed by the Committee is mentioned in their report. (See May No. of *Canadian Journal*.) Mr. Logan renders public thanks to Mr. Abraham, Dr. Wilson, the Rev. Mr. Bell, Mr. Billings and Mr. Sheriff Dickson for the valuable information they have from time to time communicated to him. "An excellent vein of geological knowledge seems to run up the Ottawa." Specimens of minerals and rocks have been occasionally sent to the Crown Land Office from provincial surveyors for transmission to Mr. Logan but have not yet reached the office of the Survey. The packages having been opened, and probably handled by several persons, the labels may have been misplaced, and thus a doubt becomes attached to the whole of them which destroys their value. This advantageous method of obtaining, without expense or trouble, much valuable information respecting the geographical distribution of various rocks, has hitherto been of no avail through the want of method and co-operation on the part of the authorities of the Crown Land Office.

Illustrations of the practical value of the Survey are occurring every day. The information contained in the reports has led to the establishment of the iron works of Forsyth & Co. at Bytown. These gentlemen (from Pittsburgh) express their thanks to Mr. Logan for his information in leading to and assisting their present enterprise. Mr. Keefer ascertained at once by an inspection of the geological map where he was to obtain his materials for the Kingston and Toronto railroad. Mr. Gzowski, in the reports of the St. Lawrence and Atlantic Railroad Company, has publicly thanked the Survey for similar information. The Gaspé *Coal* and Fishing Company suddenly melted into thin air, upon the expression of Mr. Logan's opinion, that *Coal* was not to be found in Gaspé. The question of coal in Canada West was again agitated in the spring of 1854, and "in so serious a manner as might have led to futile but expensive borings in bituminous shale, (at Collingwood), and affected the value of property in its vicinity, had I not fortunately in the beginning of the year communicated to the Canadian Institute at Toronto a paper on the Physical Structure of the Western District of Upper Canada, with a geological map of nearly two-thirds of the Upper Province. These comprehended the whole subject, and the publication of them in August last in the Journal of the Institute has, I should think, settled the question in the minds of all sensible men."

Villagers and isolated settlers have frequently been astonished and delighted at finding themselves actually standing a few feet above that indispensable necessary of life—common limestone. Many instances have occurred to the officers of the Survey of settlers journeying miles for limestone when it lay just beneath their log shanties. An enterprising farmer once said to Mr. Logan, "Now, if you will find limestone near this, I'll give you five dollars." His astonishment was unbounded when Mr. Logan replied, "Why my good friend, you are standing on limestone."

Side by side with what in comparison may be termed the minor instances of the practical results of the Survey, we have most important generalizations, which apply to millions of acres in the Laurentian region of Canada. The rocks of the Laurentian mountains consist largely of lime feldspars, and produce upon disintegration an exceedingly fertile soil. "The vallies underlaid by these rocks have always constituted in my mind the main hope for the Laurentian country in an agricultural point of view; but the discovery of important ranges, largely composed of lime feldspars, greatly extends the prospect of advantage. These rocks have been met with in several localities, from Abercombie to the Sault à-la-Puce in Chateau Richer; and as the Laurentian series in which they occur reaches from Labrador to Lake Huron, they are a subject of real importance to both sections of the Province." The director of the Geological Survey of England has been reminded by Mr. Logan, that if the ancient phosphatic shells were found in any part of the *Lingula* beds in England in the same abundance that calcareous shells are in *calcareous rocks, the farmers of England would have to thank* Canada for pointing out another source of this mineral manure.

Among the instances of new facts established by the Survey of a scientific character, Mr. Logan enumerated:

1st. The Laurentian series of rocks constitutes a mountainous region from Labrador to the Arctic Ocean. The first fossiliferous rocks on the south side of it belong to the Lower Silurian series. This series, we have shewn, is wanting on the north, the first fossiliferous rocks there met with being of the Upper Silurian age. The inference is that the north side was above water during the Lower Silurian period, while the south was beneath it, and the Laurentian series, for many thousand miles, would thus appear to have been the limit of a Lower Silurian Sea—a great fact in palæozoic geography.

2d. The want of conformity in what I have called the eastern area of Canada, between the Lower and Upper Silurian rocks, and between the Devonian and the Carboniferous, with the fact that the successive disturbances in them all run in lines having parallel directions, has enabled us to shew, that a uniform set of forces producing the undulations have been in operation, from the time of the first traces of organic existence on the face of the globe, until the termination of the Carboniferous era,—a great fact in geological dynamics. A paper on these subjects was read by me before the British Association at Ipswhich in 1851, and it was considered of sufficient importance to obtain the recommendation of the geological committee, that it should be

printed in full in the reports of the Association, the papers in general being printed in abstract only.

3d. We have ascertained that certain fossil and recent shells, instead of carbonate, are composed of phosphate of lime, by which has been broken down a heretofore supposed distinction between the skeletons of vertebrate and invertebrate animals. Professor Agassiz and other naturalists appear to think that very important results will flow from the discovery.

4th. The age of the gold-bearing rocks in North America has heretofore been considered anterior to the fossiliferous, but our investigations from Gaspé to Vermont shew them to belong to the Silurian epoch.

5th. Many mineral species have been analysed and several new ones discovered by Mr. Hunt, and his results have all been adopted by Dana, acknowledged in Europe and America to be one of the first authorities, and by all the various European mineralogists.

Mr. Logan frequently alludes to the discoveries of the accomplished chemist to the Survey, Mr. Hunt, but as we propose soon to advert to the evidence of that gentleman we shall forbear to dwell here upon the results of his valuable and most interesting investigations.

The next witness examined was the Reverend Andrew Bell, of L'Orignal, a gentleman who has devoted much time to the prosecution of geological enquiry in Canada for many years past, and whose opportunities of testing the accuracy of the Survey have been extensive and prolonged. Mr. Bell considers the information contained in the Reports to be "exceedingly accurate," and the amount of information obtained in regard to the country explored "has been very great." "The Survey has already brought to light facts sufficient to show that the mineral wealth of Canada is enormous, affording materials for the useful and profitable application of labour, skill and capital to an almost unbounded extent, and of course all tending towards the future and progressive prosperity of the Province." We are glad to have the opportunity of recording Mr. Bell's testimony that there is a growing taste for geological studies in this country and an appreciation of the advantages to be gained from them.

"Nothing is plainer to me from my own experience, than the fact that there is a gradual breaking down of the prejudices which have been entertained in regard to Geology; and amongst the whole circle of my friends and acquaintances throughout the Province, I have marked a growing desire for information in regard to it, as well as a growing conviction, that there is a definite and orderly arrangement of the rocks, and that it is only in certain rocks that certain useful minerals are to be obtained,—in short that it is science, that points the way. This is especially the case among the young men of the generation fast coming into public life; I see it in the increased love there is for Geological reading generally; I see it in the incipient collections of fossils and minerals, I occasionally meet with through the country, and I see it in the frequent visits I receive for the purpose of seeing and studying my own collection."

The Reverend Mr. Horan, Professor of Geology and Mineralogy in the Seminary of Quebec, expressed the opinion that the Survey has had extremely important results in a scientific point of view, and has proved beneficial in its economic application.

Count de Rottermund of Quebec, examined.—Count de Rottermund differs from Mr. Logan and Mr. Murray in some of the theoretical conclusions at which those gentlemen have arrived; and as to the results of Mr. Hunt's department of the Survey, the Count does not think them worth "any serious attention." It is quite unnecessary to make any further comment upon Count de Rottermund's evidence.

We now proceed to notice as fully as our space will permit Mr. Hunt's replies to the questions put by the Committee. With reference to the important scientific and economic results which have been developed by the Canadian Geological Survey Mr. Hunt enumerates among others the following:—

I may in the first place allude to the investigations of the altered or metamorphic rocks, which are found in Lower Canada on the South side of the St. Lawrence. These rocks are a prolongation of the Green Mountains, and form the north eastern extremity of the Great Appallachian Chain, itself the most important Geographical and Geological feature of Eastern North America. The crystalline rocks, which are economically of great consequence from their mines of iron, chrome, lead, copper and gold, and their beds of fine marbles, serpentines, soapstones, slates, &c., had been regarded by the American Geologists as primary strata, that is to say, more ancient than those oldest secondary rocks, in which are found the first vestiges of organic life. Although some few had ventured the opinion that they were really more recent strata in an altered state, the facts in support of such a novel proposition had not been brought forward, and the opinion of their primary character was still generally received.

It was reserved for Mr. Logan in his researches in the Eastern Townships of Canada in 1847 and 1848, to show that the Geology of that region furnished the key to a correct understanding of the age and Geological structure of the whole Appallachian Chain, and to demonstrate by a most minute and laborious investigation, that these so called primary rocks were really no other than the Silurian strata of the St. Lawrence valley in an altered condition. He has traced the gradual changes by which these fossiliferous sandstones and shales become the gneissoid, micaceous, and chloritic strata of the Green Mountains. In the course of this investigation, the results of the chemical examination of the unaltered strata were brought to bear upon the great question, and we were enable to shew that the chromium, the titanium, and the iron, whose compounds in a crystalline form were regarded as characteristic of some of these altered rocks, exist already in an amorphous condition in the unaltered strata.

As one result of this investigation may also be mentioned the determination of the true nature and origin of the serpentine of this formation. Serpentine is a magnesian mineral, which the highest authorities in the science have hitherto regarded as in all cases of igneous origin, and an intrusive rock like trap or granite. We have shown that in the Appallachian Chain, it is really a stratified rock of aqueous origin, and have actually assigned its true place in the Silurian strata. Our researches have moreover shown that the magnesia, which enters into the composition of the serpentine and its associated dolomites and talcose slates, was not introduced subsequently to the decomposition of the rocks, as is supposed in the theory of von Buch, hitherto generally adopted, but that it formed a part of the original sedimentary deposit. This conclusion I regard as an important step towards a more simple and rational theory of mineral metamorphism, than the one hitherto received.

The establishment of the metamorphic nature and the true age of the crystalline rocks of Eastern North America, from the Gulf of the St. Lawrence to the Gulf of Mexico, is the more important from the grand exemplification which it affords of the metamorphic theory. Hitherto, although the existence of such changes was considered probable, the cases in which the fact of alteration had been proved were but few, and confined to limited areas. Portions of the Alps of Savoy and Switzerland, and the marbles of Carrara in Italy, had been shown to be altered secondary strata, but most Geologists have hitherto been unwilling to accept the bold generalizations of Lyell, and extend a similar view to wide spread areas. The results of our Survey, which have shown the truth of this view as applied to a great portion of the Western Continent, have now placed the theory on an assured basis.

Another interesting investigation has been that of the Laurentides. This mountainous region, stretching from the Gulf west to Lake Huron, is composed of the oldest known rocks, not only of North America, but of the globe. On this continent, they are so far as yet known confined to British America, except a prolongation into northern New York, and perhaps some exposures west of the Mississippi, while in the old world they have been recognized only in Scandinavia, Finland and northern Russia, and perhaps in the north of Scotland. These rocks have never hitherto been carefully investigated, and a partial examination in the state of New York, had led an American Geologist to regard them as of igneous origin, and to look upon the crystalline limestones and hypersthene rocks, with their associated iron ores, as alike intrusive. The researches of our Survey have shown that these antique portions of the earth's crust are, not less than the rocks of the Eastern Townships, metamorphic sedimentary deposits, and indicate the existence at the remote epoch of their formation, of Physical and Chemical conditions similar to those, which have accompanied all the succeeding Geological periods.

Mineralogically, the investigation of the so-called hypersthene rocks

of this formation, with their peculiar calcareous triclinic feldspars, is of eminent scientific interest, while the fact, that the famous iron mines of Sweden, Russia, and those of Lake Champlain in the United States, belong to this series of rocks, gives them a great economic importance. The immense deposits of iron ore at Marmora, Madoc, South Sherbrooke, South Crosby, McNab, Hall, and elsewhere in the same region are contained in this formation. It is interesting as illustrating the connection between the geology and the agricultural capabilities of a district, to observe that wherever in the region of these Laurentian rocks the calcareous feldspars, above alluded to, are met with, their decay gives a fertile soil, strongly contrasting with the barrenness of those districts, where the more silicious portion of the formation prevail.

In speaking of the economic results of the Survey, the examinations of our mineral waters must not be forgotten. From their medicinal value mineral springs often become centres of attraction and of population; Bath and Harrowgate in England, the famous watering places of Germany, and those of Virginia and Saratoga in the United States among others, owe their importance to mineral springs. Canada abounds in mineral waters of almost every kind, and their investigation has occupied much of my time during several years. The Annual Report of Progress of the Geological Survey for 1853, contains a list of fifty-six springs, with references to the pages of that, and of previous reports, in which the analysis may be found. The number of mineral waters, whose composition is thus made known, is greater than that of all the others yet described in America, and the published results will show that, probably nowhere but in France and Germany, have the examinations been made with the same degree of minuteness as in Canada. A great proportion of the waters have been analyzed quantitatively.

Among the most remarkable of our mineral springs thus made known, are those which contain large portions of iodine and bromine salts, and others holding in solution salts of the rare bases baryta and strontia, which had hitherto been detected only in a few springs in Germany. We may also mention the numerous alkaline waters, remarkable for the great proportion of carbonate of soda which they contain, along with silicate, phosphate and borate of soda, or borax. This rare salt hitherto unknown in the waters of North America has been found in several springs in Lower Canada. The waters of Tuscarora, Chippawa, and St. David's in Upper Canada, remarkable for containing large quantities of free sulphuric acid, with sulphuretted hydrogen and sulphates of alumina, iron, and lime, may also be mentioned, and the sulphur spring of Charlotteville, near Simcoe, C. W., surpassing in the amount of sulphuretted hydrogen the famous Harrowgate waters, is also worthy of especial notice, for it is destined at some future time to become an important watering-place. The results of these analyses have made known to the medical profession the Chemical composition of all these various waters, and will enable the enlightened physician to prescribe them with discrimination in the various forms of disease.

The study of these different springs has at the same time been made with especial reference of their geological position, and many curious and important relations between their soluble mineral contents, and the composition of the sedimentary rocks, have been shown, throwing light at the same time upon the theory of the formation of mineral waters, and the chemistry of the strata through which they flow."

It was one of the objects of the Committee to ascertain how far the Geological Survey of Canada had been appreciated by distinguished scientific men abroad; and here we may incidentally remark, that no one who peruses the evidence of which we have given an abstract, can fail to notice the kindly feeling which appears to exist among the officers of the Survey, and especially between those whose position and labours have at this juncture been most prominently brought before the public. Mr. Hunt, with much taste, makes the following quotation from a well known and able pen in the *London Quarterly Review* for October, 1854, which is the only one, out of many, which we have room to insert. "In Canada, especially, there has been proceeding for some years one of the most extensive and important Geological Surveys now going on in the world. The enthusiasm and disinterestedness of a thoroughly qualified and judicious observer, Mr. Logan, whose name will ever stand high in the roll of the votaries of his favourite science, have conferred upon this great work a wide spread fame." Mr. Logan tells the Committee that he (Mr. Logan) is "by profession a Miner and a Metallurgist," and almost in the same breath, while not forgetting to enumerate the well deserved encomiums of distinguished scientific men abroad upon the general results of the Survey, points to Mr. Hunt's valuable contributions to the *London Philosophical Magazine*, as well as other scientific publications, and to the *American Journal of Science;* to his analysis of mineral species and his various results with regard to them—adopted by Dana,—to the works of Gerhardt and Laurent by whom he is quoted, and to his communications to the American Association.

Coleoptera Collected in Canada.*

By William Couper, Toronto.

For Authorities and synonyms see Melsheimer's Catalogue, &c.

LEBIA

? VITTATA Fabr.—*Mels. Cat.* Antennæ black, about twice the length of thorax; head red: eyes black; thorax red, orbicular: margin very narrow; elytra black, with a bright yellow longitudinal stripe on the centre of each, and another on the margin; truncate behind; body beneath and thighs red; tibiæ and tarsi black. Length 2 lines.

This little rarity was taken about one mile north of Toronto in the summer of 1848; since then I have not seen another. It is evidently a variety.

SCARITES

SUBTERRANEUS.—*Mels. Cat.* Antennæ reddish, 11-articulate, the two basal joints longest; jaws curved, nearly the length of head, grooved on top, each armed with an inside lance-like tooth near the base; head grooved on both sides; thorax smooth, polished, with a slight transverse protuberance on front, and a fine longitudinal groove on the disc; elytra with eight smooth striæ, and three slightly impressed punctures on each—one on front and two behind; forelegs palmate; shanks toothed; body and legs with a few hairs. Toronto peninsula, May, not common. Length 7 lines.

AMARA

VULGARIS Lin.—*Mels. Cat.* Antennæ dark brown, villous; head and thorax black, polished; elytra black, highly polished, and slightly tinged with copper-coloured bronze; body beneath and legs black. Toronto, common. Length 5 lines.

AGONDERUS

? LINEOLA Fabr.—*Mels. Cat.* Antennæ light brown, and very short; head reddish-yellow, with a black transverse fascia on top; thorax reddish yellow, on which there are two black spots; elytra yellow, striate, with two longitudinal black lines on each side of suture; body beneath and legs pale. Toronto peninsula, very rare. Length 3½ lines.

Evidently an allied species.

NECRODES

SURINAMENSIS.—*Mels. Cat.* Antennæ clavate, perfoliate; head and thorax black, the latter orbicular and polished; scutellum triangular, finely punctured; elytra black, minutely punctured, with three longitudinal raised lines on each, and slightly depressed behind: each with a yellow transverse notched fascia, which in some specimens appear in the form of three dots; hind thighs toothed. Toronto and Manitoulin, common. Vary in length from ½ to nearly 1 inch.

THANATOPHILUS

CAUDATUS.—*Mels. Cat.; tuberculata* Germ. Antennæ clavate, perfoliate: head and thorax densely covered with short

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* Continued from page 212.

yellowish hairs, elytra dark grey, and, on each, four rows of tubercles longitudinally arranged; obtuse at the apex. Toronto, common. Length 5 lines.

Taken by Richardson at Fort Simpson, lat. 62° N.

PAEDERUS

RIPARIUS.—*Mels. Cat.* Head, elytra, and tip of abdomen steel-blue; thorax and anterior part of abdomen bright orange. Toronto, common. Length 2 lines.

DINEUTES—CYCLINES

AMERICANUS Lin.—*Mels. Cat.* Black. Apex of each elytron armed with a short tooth; mouth with setæ; a row of very short hairs on the anterior femoræ; four posterior legs short, thin, and transparent. Toronto, not common. Length 5 lines.

BYRRHUS

VARIUS.—*Mels. Cat.*; *trivittatus*, Melr. Head and thorax tinged with dark copper bronze; elytra dark brown, finely striate, on which are three longitudinal green lines, interrupted by small black spots. Toronto, very common. Length 2¼ lines.

HISTER

ABBREVIATUS.—*Mels. Cat.* Black. Jaws as long as head; thorax smooth, each side with a fine marginal groove; elytra abbreviated behind; striate—the striæ abbreviated towards the suture; outside of tibiæ toothed. Owen Sound, common. Length 4 lines

CANTHON—CORROMUS

LÆVIS.—*Mels. Cat.* Entirely black, shining like pitch. Clypeus broad, flattish, smooth, and surrounding the eyes, slightly 2-toothed in front; thorax finely margined, smooth, and convex; scutellum obsolete; elytra margined, not reach the anus, with longitudinal grooves, not quite visible to the naked eye; anterior tibiæ with three large teeth on the outside, above which are several smaller ones; posterior legs long and thin. Toronto, not common. Length 8½ lines.

COPRIS

CAROLINA.—*Mels. Cat.* Deep black, and shining like pitch, both on the upper and under sides. Clypeus round in front, thin, and armed with a round black horn bending backwards; thorax margined, lying very high above the head, having four protuberances in front, and a small impression each side near the margin; elytra with crenate furrows, and reaching the anus. Thighs strong, not hairy; anterior tibiæ armed with four teeth, and a strong spur on each; tarsi and ungues small. L. 7 lines.

♀ size and color of ♂, but the protuberances on thorax are not so large. Toronto, not common.

ONTHOPHAGUS

HECATE.—*Mels. Cat.* Black. Antennæ short, lamellate; clypeus polished, with an erect thin dent in front; thorax elongated, projecting over the clypeus, slightly furrowed and armed with two short dents at the point; elytra abbreviated by suture—longest from shoulder to apex; fore legs 4-toothed on the outside; body beneath and legs covered with short hairs. Length 3½ lines.

♀ black. Two transverse ridges on clypeus; thorax densely and minutely punctured, and covered with short hairs; two protuberances in front; elytra finely punctured in rows; fore legs toothed. Size of ♂. Toronto, common.

APHODIUS

FIMETARIUS.—*Mels. Cat.* Head black, with three small tubercles on top; thorax black, slightly hollowed in front, with a red spot each side; elytra red, striate; body beneath and legs black. Toronto, common. Length 3 lines.

STERCORATOR.—*Mels. Cat.* Black. Head and thorax polished, the latter emarginate; elytra striate. Toronto, common. Length 2 lines.

PASSALUS

CORNUTUS.—*Mels. Cat.*; *interruptus*, Oliv. Antennæ arched, covered with short reddish hairs; jaws as long as head, 5-toothed; head has a protuberance each side above the eyes, and a recumbent horn on the crown, thorax black, polished, longitudinally grooved on the disc—fringed with reddish hair under the margin; elytra highly polished, with ten striæ—the striæ punctured; fore tibiæ toothed on the outside; tibiæ of the middle pair with a dense brush of red hair on the outside. Niagara. Mr. Ibbetson. Length 1 inch.

XYLORYCTES

SATYRUS.—*Mels. Cat.* ♂. Clypeus narrow, of a dark chestnut colour, armed with a strong sharp-pointed horn bending backwards, and furnished in front with two small protuberances; hairy beneath; thorax dark chestnut, margined, and finely punctured in front—the upper part elevated, and appearing almost perpendicular; elytra reddish-brown, with many slight punctured furrows, which are longitudinally arranged; thigh reddish-brown, broad, strong, and hairy; anterior tibiæ deeply dentate, with a strong spine at the tips; middle tibiæ strong, hairy, and very spinose at the tips; ungues very small; scutellum triangular. Length 1 inch.

♀ size and colour of ♂, but without the horn. In place of the latter there is a short protuberance; thorax smooth and convex. Toronto, very rare.

PHYLLOPHAGA

HIRTICULA ?—*Mels. Cat.* Bright chestnut. Thorax punctured, and covered with yellow hairs; elytra smooth, punctured, with five longitudinal rows of yellow hairs on each—the fifth on the suture; breast covered with yellow down. Toronto. Length 5 lines.

Probably a variety.

TRICHIUS

PIGER.—*Mels. Cat.*; *rotundicollis*, Kirby. Head and thorax black, the latter rotund and covered with whitish down; elytra truncate behind, black, polished on the outside, yellow-ochre in the centre, with four longitudinal lines of the latter colour pointing like teeth towards the apex; on each elytron, two oblique white stripes branch from the yellow-ochre to margin; a white tuft on each side of abdomen; body beneath and legs hairy. Toronto, common. Length 5 lines.

BUPRESTIS

AURULENTA, Lin. (*Mels. Cat.*); *striata*, Fabr. Antennæ short, black, the basal joints coppery; head and thorax dull coppery, finely punctured. On each elytron there are four raised lines: the outside or marginal line connects at the apex with a longitudinal one near the suture; the two inner lines abbreviated, their furrows tinged with a beautiful green colour; body beneath and legs of a rich metallic lustre. Toronto, on pines, not common. Length 7 lines.

TRACHYPTERIS

FULVOGUTTATA.—*Mels. Cat.*; *Drummondi*, Kirby. Short, and mostly convex; black bronze above, with very fine wavy transverse lines on thorax, which are not very distinct without the aid of a magnifier; elytra rounded at the apex, and punctured; three yellow spots on each—the anterior spots round and near the suture, the central one almost oval. Specimens vary in size, and some are found with two anterior spots (*punctum geminum*) on each elytron; body beneath brassy; anterior legs not toothed. Toronto, June, on white pine.

Taken by Richardson at Fort Simpson, on the Mackenzie river, lat. 62° N. Length 4 lines.

CRATONYCHUS

CINEREUS.—*Mels. Cat.* Dark-brown, covered with ash-coloured hairs. Thorax convex, rounded in front, and finely punctured; elytra with longitudinal rows of punctures resembling stitches, tapering towards the apex; tarsi armed with minute teeth. Toronto, common. Length 6 lines.

PODABRUS

TRICOSTATA.—*Mels. Cat.; Telcophorus Bennetii*, Kirby. Antennæ black, serrate; thorax margined with black and pink, round in front, convex in the centre, and angular behind; elytra dark glossy brown. Common in winter, under the bark of trees. Length 5 lines.

TOMICUS—BOSTRICHUS

CALLIGRAPHUS.—*Mels. Cat.*; *excesus*, Say. Chestnut brown. Thorax oval, and punctured in front; elytra punctured in rows, with a gouge-like hollow at the apex, the sides of which are armed with minute teeth. Toronto, found under the bark of pine trees. Length 2 lines.

PINI.—*Mels. Cat.* Resembles *excesus* in form, colour, and habits, but is much smaller.

SPHENOPHORUS

PERTINAX.—*Mels. Cat.* Antennæ two-articulate, polished, and longer than snout, the first joint dark mahogany colour, the second darker and knobbed at the point; head and snout black, polished, the latter curved, and of an equal thickness throughout; thorax with three black polished ridges, the spaces between of an ashen colour; elytra with abbreviated black, polished, longitudinal ridges, the longest on the suture, and finely punctured at the sides—the spaces between of a dark ashen colour, and finely striate; margin black, polished, with a row of punctures; abbreviated behind; abdomen hirsute; body beneath black, punctured; legs black. Length 5 lines. Toronto, common.

ATTELABUS

BIPUSTULATUS.—*Mels. Cat.* Head bent under the breast; thorax steel-blue and highly polished, narrow in front; elytra with a square reddish-ochre spot on each shoulder; body beneath and legs blue. Toronto, not common. Len. 1¼ lines.

CALLIDIUM

ANTENNATUM.—*Mels. Cat.* Head and thorax steel-blue, the latter emarginate; elytra green, polished, and densely punctured, nearly equal in width throughout; body beneath and legs black, polished. Manitoulin. Mr. Ibbetson. L. 4½ lin.

RHAGIUM

LINEATUM.—*Mels. Cat.* Antennæ ash-coloured, about as long as head and thorax; head depressed on top, ash-coloured, and spotted with black; eyes of a polished dark chestnut color; thorax ash-coloured, wider than head, with a polished longitudinal line in the centre, and a short sharp-pointed tubercle on each side; elytra ash-coloured: on each there are three longitudinal raised lines obliquely spotted with black—the spaces between hirsute; body beneath and legs ash-coloured, variegated with black. Length 6½ lines. Rare. One specimen, Dr. Cowdry, Cobourg.

EVODINUS

MONTICOLA.—*Mels. Cat.;* Le Conte, Agass. Lac. Sup. t. 8, fig. 2. Antennæ reddish; eyes and ring behind the head black; thorax narrow before and behind, and covered on top with yellow silky hairs; elytra yellow, tapering towards the apex, with two small round black spots behind each shoulder, and two larger black spots on the posterior margin; black at the apex; abdomen and legs red. Toronto, Prof. Croft. Length 4 lines.

STRANGALIA

ZEBRATA.—*Mels. Cat.; zebra*, Oliv. Ent. Eyes black; top of head and thorax sprinkled with fine yellow down; elytra black, on which are four oblique bright yellow fasciæ—the first transverse from the shoulders, encircling a black spot on the latter—the second and third are almost equal in form, crosses from margin towards suture—the fourth much smaller, and near the apex; legs reddish; body beneath covered with yellow down. Toronto, on flowers, very rare. Length 5 lines.

FUGAX.—*Mels. Cat.; Leptura tenuior*, Kirby. Antennæ and head black; thorax black, round on top, and covered with yellow silken hairs; elytra dull red, towering behind, on which are four transverse yellow bands, covered with short hairs, having the glossy appearance of thorax; legs and rings of abdomen reddish. Toronto, on flowers, not common. Length 5 lines.

LEPTURA

CANADENSIS.—*Mels. Cat.*; ♂ *tenuicornis* Hald. Antennæ black, ten-articulate: the fifth, seventh, and base of the ninth yellow; head black; thorax globular, black, punctured, narrow in front, on which there is a fine ring; elytra densely punctured, with a broad red transverse band on the shoulders—armed with a small spur at the apex; body beneath and legs blackish. Toronto and Manitoulin, on umbelliferous flowers, not common. Length ♂ 5, ♀ 7 lines.

BIFORIS.—*Mels. Cat.* Antennæ ten-articulate, part of the first joint yellow; second, third, and fourth black: the remaining five are yellow, ringed with black, and the last yellow; head yellow, black on top; eyes black; thorax reddish-yellow, with a longitudinal oval black spot on the centre, connecting with the region of scutel, which is also black; elytra glossy yellow or ashen, with a black spot on the margin behind each shoulder. In the centre, a black tooth-like spot points from margin to suture, and from the latter spot the margin is black to apex; suture finely margined with black; apex two-toothed; legs yellowish—femoræ of fore legs spotted with black: tibiæ, tarsi, and the lower section of femoræ of hind legs black. Toronto, on the *Sambucus Canadensis*, not common. Length 6 lines.

TRIGONARTHRIS

PROXIMA.—*Mels. Cat.*; (Leptura) Say, T. Acad. 3, 420. Antennæ, head, and eyes black; thorax globular, and covered with short rust-coloured hairs; elytra yellow-ochre, black at the apex; body beneath and legs black. Toronto, on flowers, not common. Length 6 lines.

LEMA

TRILINEATA.—*Mels. Cat.* Antennæ black, the first joint reddish; head and thorax rusty-red, the latter swelled out above the femoral joints of fore legs, with two small black spots on top; eyes black; elytra finely punctured, of a nankin colour, with a black line on the outside of each, and the suture black, which forms the three lines; outside of tibiæ and tarsi dusky; body beneath reddish. Makes a creaking sound when held in the fingers. Toronto, not common. Length 3½ lines.

UROPLATA

ROSEA.—*Mels. Cat.* Antennæ black at the base, thickened and red at the tips; head red, narrow, and punctured; thorax conical, punctured, on which are two short longitudinal black lines on top: black at the sides; elytra of a reddish colour; shoulders pointed: square behind, with three elevated smooth longitudinal lines on each, spotted with black and red: the spaces between punctured in double rows; body beneath black; legs reddish. Length 2 lines. Toronto, June, on various plants; not common.

DISONYCHA

CAROLINIANA.—*Mels. Cat.* Antennæ black; eyes dark grey; thorax yellow, with two distinct black dots on the centre;

elytra yellow, on which are five longitudinal black lines, viz., one from the inside of each shoulder, abbreviated near the apex, another on the outside, joins at the apex to the fifth line, which covers the suture—margin yellow; femoræ glossy red; tibiæ and tarsi black. Toronto, not common. Length 3¼ lines.

LABIDOMERA

TRIMACULATA.—*Mels. Cat.* (Doryphora) Say, I. Acad. 3, 454.

Antennæ, head, thorax, scutellum, body beneath, and legs blue; elytra finely punctured, orange, on which are 3 large black spots of the following forms: the first, on the shoulder, is broad and longitudinal; the second is transverse on the suture—its centre almost connects with the scutellum, and spreads into four obtuse branches: the two anterior point towards and slightly connect with the shoulder spots: the posterior branches are rather shorter; the third spot is near the apex, of a triangular form; margin of elytra, orange. Length 4½ lines. Toronto and Coldwater, on the milk plant (*Asclepias Syriaca*). July.

CALLIGRAPHA

SCALARIS.—*Mels. Cat.* Antennæ rust-red; head and thorax dark green; elytra silvery, with a large green spot on each shoulder, and a number of smaller spots on the sides: a broad jagged green stripe down the suture; under side of body dark green; legs rust-red. In May on various plants. Of this beetle there are two broods during summer. About the latter part of July the first disappear, and at this time numbers may be found dead in the lake drift on the peninsula. Mr. Harris says they pass the winter in holes, and under leaves and stones. L. 4 lin.

GASTROPHYSA

CÆRULEIPENNIS.—*Mels. Cat. polygoni* Lin. Antennæ blackish; head, elytra, and body beneath dark blue; thorax and legs dull orange red; plantæ black.

Immediately before the ♀ deposits its *ova*, the abdomen swells beyond the elytra. Length 1⅓ lines. Toronto, common throughout summer on the knot grass.

CHRYSOCHUS

AURATUS.—*Mels. Cat.* (Eumolpus) Harris. Antennæ black; head and thorax polished green, the latter rotund in front; elytra rich golden green, polished, wider in front than thorax, with a very narrow margin; scutellum, body beneath, and legs polished green; tarsi black. Oblong-oval in form, generally about 4 lines in length. Sault Ste. Marie and Toronto, in July and August, on the Dog's-bane (*Apocynum Androsæmifolium*). Not common.

CRYPTOCEPHALUS

SELLATUS.—*Mels. Cat.* Antennæ long, reddish at the base, and black at the point; thorax black, highly polished; scutellum black, tuberculate; elytra densely and minutely punctured in rows, with an orange-red spot behind each shoulder, and another on each side of apex. Length 2 lines. Toronto, common.

Kirby describes the above as *C. notatus* F., which Mr. Haldeman states is a southern species.

HIPPODAMIA

PARENTHESIS (?)—*Mels. Cat.; tridens* Kirby. Thorax black, the margin in front yellow; elytra yellow, on which are three black transverse fasciæ, viz., the first on front, crosses the suture: that on the centre abbreviated nearly equal in breadth throughout: and the posterior one oblique, wider towards the suture; body beneath black. Toronto, not common.

13-PUNCTATA Lin. (*Mels Cat.*) Coce. *tibialis* Say. Oblong. Thorax black: the margin yellow, and on each side a small dot; elytra yellow; six black dots on each—the thirteenth occupy the place of scutellum. Toronto, common.

Taken by Richardson at Great Bear Lake, lat. 65°—67° N.

COCCINELLA

SANGUINEA.—*Mels. Cat.; immaculata* Fabr. Thorax black, polished, with a bright yellow margin, which partly encircle a black spot on each side; elytra reddish-orange colour, immaculate. Small, convex. Toronto, not common.

BIPUNCTATA.—*Mels. Cat.; bioculata* Say. Thorax black, polished, with a yellow marginal spot each side; elytra reddish colour, with a single black polished spot on each.

In winter, numbers of this species are commonly found congregated together under the bark of trees.

NONEMNOTATA.—*Mels. Cat.* Thorax black, with a white angular spot on each side in front, connected behind the head by a white transverse line; elytra dull orange, with nine black dots—two anterior, small: two posterior, large: the ninth is behind the scutellum; body beneath and legs black. Toronto, common.

UPIS

CERAMBOIDES Lin. (*Mels. Cat.*); *reticulatus* Say. Black. Antennæ eleven-jointed, gradually widened from the base; thorax emarginate, minutely punctured; elytra black, broader than thorax, very hirsute, with zigzag polished protuberances; legs long and slender: fore tarsi five-jointed: hind tarsi four-jointed.

Taken by Mr. Ibbetson at Manitoulin, and by Mr. Richardson, on the borders of the Mackenzie and Slave rivers, lat. 62° N.

BOLITOPHAGUS—ELEDONA

CORNUTUS.—*Mels. Cat.* Antennæ composed of short articulations, thicker at the point; shield hirsute, armed in front with two short teeth; thorax hirsute: seven short teeth on each side, and from the centre of which project two horns over the shield, with a dense brush of reddish hairs underneath; elytra hirsute, with three rows of tubercles on each. Entirely of a dull rust color. Found in fungi. Common. L. 5 lines.

♀ has two protuberances on thorax; elytra hirsute. Size and colour of ♂.

NOTOXUS

MONODON (?)—*Mels. Cat.* Antennæ filiform; head bent down, of a dark brown colour; thorax projecting like a horn over the head; elytra yellow, villous, with a black line down the suture, which spreads apart behind, and terminates in a round dot on each: an oblong black spot on the sides. Toronto, common on umbelliferous flowers. Length 1½ lines.

(*To be continued.*)

Water-Works in the United States.

By JACOB HOUGHTON, C.E.

Cincinnati.—The city of Cincinnati is supplied with water from the Ohio river, from which it is elevated, by means of steam-engines, to a height of 175 feet, into a stone reservoir, containing 5,000,000 gallons. There are three engines, one condensing, and two non-condensing. The pumping or rising mains are 800 feet in length. These works were originally owned by a company, from whom the city purchased them for $300,000. To April, 1853, they had expended $700,000 in improvements, making a total cost of $1,000,000. Further extensive improvements are in contemplation. Nine years ago these works were in a very bad condition, the water being distributed principally through wooden logs, which have been entirely replaced with iron pipes. Cincinnati contains upwards of 160,000 inhabitants.

Pittsburgh is supplied with water from the Alleghany river.

At this place there are two reservoirs, at different elevations, the lower one at 160 feet, and the upper one at 396 feet above low-water mark. The water is elevated into the lower reservoir from the river, by means of two large high-pressure engines, through a distance of 2000 feet. At the lower reservoir are two smaller engines, driving pumps which elevate the water into the upper reservoir through a pipe about one-fourth of a mile in length. This pumping pipe is also used as a distributing main, being connected with the distributing pipes; and while the engines are running, the entire service connected with the upper reservoir is supplied directly from the pumps. This mode of using the pump main, for the double purpose of an inlet and outlet, has proved an unfavourable experiment. All means of circulation are prevented, and the water, becoming stagnant, has a bad taste and odour, and gives rise to a great deal of complaint. The reservoirs are built of earth embankments, the inside slopes paved with brick. These works have cost about $700,000, and supply 50,000 inhabitants with water.

Alleghany City.—The population of this city in 1850 was 22,000. Cost of works, to January 1st, 1853, $331,442·12. The water is obtained from the Alleghany river, by means of two steam-engines, which are duplicates from the same patterns as those at the upper works in Pittsburg. The water is raised to a height of 206 feet, through a pump main about 1000 feet in length. The reservoir is of earth embankment, and will hold 10,000,000 gallons.

Buffalo.—The waterworks of this city are owned by a company. The water is taken from the Niagara river, and is carried into the pump well, through a tunnel cut through the rock, under the Erie Canal. The water is raised to the reservoir, by means of two Cornish Bull-engines, cylinder 50 inches diameter, and 10 feet stroke. The reservoir is of earth embankment, and will store 13,000,000 gallons. These works have cost upwards of $400,000. Population of the city about 60,000.

Albany.—The city of Albany is supplied with water from Patroon's Creek, across which, about six miles from the Hudson river, an embankment of earth, 40 feet in height, has been built; thus forming a retentive reservoir, called Rensselaer lake, covering an area of 30 acres, and containing about 160,000,000 gallons of water. From thence the water is conducted by gravitation through a brick aqueduct about 4 miles in length, to Bleecker reservoir, from whence it is distributed in the usual manner. A further supply is delivered to the lower part of the city, through iron pipes, laid directly from Watervliet lake. This artificial lake is on the same stream with, and about four miles below Rensselaer lake, and was formed by constructing a dam, 25 feet in height, across the stream. It overflows about 20 acres, and contains 30,000,000 gallons. These works are capable of delivering 10,000,000 gallons daily, and have cost about $800,000. Population of the city about 60,000.

New York is supplied with water from the Croton river, across which a dam, 40 feet in height, is constructed, forming the Croton lake, covering an area of 400 acres, and containing, at the depth of 6 feet, an available supply of 500,000,000 gallons of water. From thence the water is carried, by means of a brick aqueduct (except at the crossings of the Haarlem river bridge, and the Manhattan Valley, where inverted syphons of the respective dips of 12 feet and 105 feet are used), about 38 miles in length, and having a total fall of 44 feet, to the receiving reservoir, which covers 37 acres of ground, and has capacity of 150,000,000 gallons. From this reservoir the water is conducted through iron pipes to the distributing reservoir, from whence it is distributed in the usual manner. This reservoir is built of stone, covers an area of four acres, and contains 21,000,000 gallons, when full to the top water line. These works are capable of supplying 30,000,000 gallons per day, have cost between $13,000,000 and $14,000,000, and supply water to more than half-a-million of people. An enlargement of the works is now in contemplation, by which the quantity of water delivered daily will be materially increased.

Philadelphia—Fairmount Waterworks.—At the Fairmount waterworks the water is raised from the Schuylkill river, by means of water power. A dam, 1149 feet in length, and 13½ feet in height, above low tide, is constructed. From this dam water is supplied to run eight breast-wheels, and one "Jonval turbine," each driving a double-acting force-pump. The water is forced to a height of 96 feet, through mains of 16 inches diameter, varying in length from 183 to 433 feet. On the hill at Fairmount are four reservoirs, containing, in the aggregate, 22,031,976 ale gallons, and at a distance of three-fourths of a mile is a fifth reservoir, containing 16,646,247 ale gallons, making the total storage of the Fairmount works equivalent to 38,678,223 ale gallons. During the year 1852 the average quantity of water pumped daily was 5,731,744 gallons, which was distributed in a district containing 26,821 houses, in which there were 27,592 ratepayers. The cost of these works to January 1st, 1853, was $3,247,894. These works were the first of any importance erected in the United States, and have served as a model for almost every city in the country.

Spring Garden Waterworks.—The districts of Spring Garden and Northern Liberties are supplied with water from separate works, erected upon the Schuylkill, about a mile above Fairmount. Three condensing engines are in use, which force the water to a height of 115 feet, into an earth embankment reservoir. There are three pump mains, two of 18 inches and one of 20 inches diameter, and 3300 feet in length. The district of Kensington is also supplied by independent steam-power works, situated upon the Delaware river. These works, however, I did not examine.

Boston is supplied with water from Lake Cochituate, formerly called Long Pond, from which it is conducted by means of a brick aqueduct (except at the crossing of the Charles river, where there is an inverted syphon of 58 feet dip), 15 miles in length, with a fall of 4½ feet, to the Brooklyn reservoir. This reservoir covers an area of 22½ acres, and has a capacity of 89,909,730 wine gallons. From the Brooklyn reservoir the water is conducted through iron pipes to three distributing reservoirs, as follows: one on Beacon Hill, in Boston Proper, capacity 2,678,968 gallons; the second on Telegraph Hill, in South Boston, capacity 7,508,246 gallons; and the third on Eagle Hill, in East Boston, capacity 5,691,816 gallons. From these reservoirs the water is distributed by means of iron pipes. The basin containing the water on Beacon Hill is 15 ft. 8 in. deep, supported on arches, the whole being a massive structure of granite, the walls of which, on Derne Street, are 58¾ feet high, and in the rear of Mount Vernon Street, 40 ft. 8 in. high. The other reservoirs are of the earth embankment kind. The water is carried across the channel of Chelsea Creek to East Boston, in a 20-inch flexible pipe, with swivel joints, and of nearly double the ordinary thickness. During the year 1852, these works delivered 8,125,842 wine gallons per day, to a population of about 140,000. To January 1st, 1853, the works had cost $5,370,818.

Chicago.—The city of Chicago, for the last two years, has been engaged in constructing water works, which are now so far advanced, that they will be brought into use within a short time. An inlet pipe, made of pine staves, 30 inches diameter,

is extended into Lake Michigan, a distance of 600 feet, through which water is supplied to the pump well, from which it is elevated, by means of two steam engines (a condensing and a duplicate non-condensing), into a reservoir at a height of 8 feet. For the want of elevated ground, they are compelled to make use of a tower and tank similar to the one in use at Detroit. The tank is made of boiler iron, braced across its centre with wrought-iron rods, is 60 feet diameter, 28 feet deep, and contains about 493,000 gallons. Other reservoirs of like capacity, will be constructed as required. The works are calculated to furnish a daily supply of 3,000,000 gallons, and have cost about $400,000. The unprecedented growth of that city will probably require the immediate extension and enlargement of the works.

The Hurricane of the 18th April, 1855.

The interest excited by the brief and unconnected accounts which have been published from time to time, of the course and effects of the Hurricane of the 18th April, affords sufficient grounds for noticing at length an occurrence which, though not unfrequent in Canada, is still possessed of general and wide-spread interest. It happens very unfortunately in the present instance, that few memoranda of the time when the storm of wind and hail was at its height in different localities appear to have been preserved. The extracts from newspapers to which we have been able to refer, make specific mention of the time of the occurrence in three instances only. It is therefore quite impossible, from the data before us, to trace with accuracy the course of the storm, or to ascertain the width of the moving mass of air in different places. We may, however, obtain some idea of the diameter of the circle described by the storm in its course. Occasionally we find trees, fences, and houses exhibiting its effects over areas many miles in width, while in other places it appears to have struck the earth with extraordinary violence over a narrow belt not more than a few hundred yards broad. The fluctuations in the levels of Lakes Huron and Ontario, and Seneca Lake are evidently nothing more than "Seiches" due to sudden variations in atmospheric pressure, a necessary result of the rapid passage of an immense vertical column of air over the surface of their waters.

It is a rather singular coincidence, that on the 25th of April, 1851, a storm somewhat similar in its effects to the hurricane of the 18th April, 1855, should have traversed nearly the same ground. Two persons were then drowned at Niagara by the sudden rise of the waters of the Lakes. At page 278 of the *Canadian Journal*, Vol. II., an account of this storm may be found, and the following extract from the *Niagara Mail* of May 3rd, 1851, giving a description of the rise in the Lake, may not inappropriately be introduced here:

"About a quarter or half-past six o'clock, p. m., a thunder storm came up from the north-west, with a few flashes of lightning and a heavy shower, accompanied by a strong squall of wind for a few minutes, the weather being quite calm just before the gust, and the same after it. The fishermen who were on the beach, seeing the squall coming on, hurried to get in their lines, when suddenly there appeared rolling in upon them an immense wave from the north-west. The height of this wave could not have been less, we judge, than from six to eight feet, although it is difficult to ascertain correctly. It came rolling on the smooth Lake with great velocity, carrying all before it, and sweeping some of the fishermen into the Two Mile Pond, and dashing others of them high up against the bank, by which, as we stated, two persons were unfortunately drowned. The water came and returned three times in succession, and then settled down quite calm as it had been before this commotion."

The late storm appears to have crossed the Indian Reserve Peninsula from Lake Huron, and passing over Georgian Bay it struck the main land of Canada in the township of St. Vincent, near the village of Meaford.

At Meaford the storm commenced about 1 a. m. "The wind blew a perfect hurricane." "Hailstones of very great size fell in a continued shower for fifteen or twenty minutes." At Owen Sound, a few miles west of Meaford, the storm of wind does not appear to have been noticed. The *Owen Sound Comet* describes the rising and falling of the waters of the Bay on the 18th, and attributes the phenomenon to a storm "of which we may hear in a few days." The following extract is from the *Owen Sound Comet*:

"PHENOMENON.—Last Wednesday a very singular occurrence happened in Owen Sound Bay, such as has frequently been witnessed on former occasions, but not in so great a degree. This last freak commenced by the rising of the water to the height of say nine feet, and immediately falling down say ten feet. The bottom of the Bay was dry when the water went down to within ten or fifteen feet of the end of the wharf, and we are told by Mr. John Boyd, that a man might have waded across to the Indian Village at the time. We are also told by those who were present at the time, that at the bridge crossing on Division Street, a man might have jumped across the river. The rising and falling followed in quick succession, and so suddenly, that an observer could distinctly see the advancing and receding of the water on the shore. When the water commenced to rise it came rushing up the river like a wave about three feet high. This phenomenon is doubtless owing to a storm of which we may hear in a few days having occurred somewhere on the Georgian Bay or Lake Huron."

The course of the storm seems to have followed the south shore of Georgian Bay, from Meaford to Collingwood Harbour, sweeping round the base of the Blue Mountains, and levelling in its passage very considerable tracts of forest.

A similar occurrence very probably took place a few miles east of Collingwood Harbour some years since, as recorded by wide areas of prostrate forest trees in the valley of the Nottawasaga River.

From Collingwood the general direction of the storm appears to have been towards Toronto, along the line of the Northern Railway. Its effects were particularly noticed at Barrie, Lefroy, Richmond Hill, Davenport, Toronto, in the township of Whitby and at Oshawa; then it appears to have crossed Lake Ontario, and its outskirts reached and traversed the Line of the Rochester and Niagara Falls Railways. Its full force was probably felt at Niagara and Port Dalhousie. The hours at which the storm reached different localities are given below as far as we have been able to ascertain them:—Meaford (Georgian Bay), 4 a. m.; Toronto, 6 a. m.; Niagara, 6¾ a. m. We subjoin a number of extracts illustrating the effects of the storm and the Lake phenomena accompanying it:—

1. *Meaford, Township of St. Vincent.*—Wind blew a hurricane.—Hailstones of large size fell. Buildings unroofed.

2. *Lake Shore, from Meaford to Collingwood.*—A very considerable tract of the forest leveled.

3. *Collingwood.*—Houses unroofed—heavy timbers moved to some distance; fishermen's boats carried some distance into the woods; ice in Harbour broken up and blown out. Waters in the Harbour rising and falling continuously.

4. *Davenport (N.R.R.)*—Fences blown down.

5. *Toronto, 17th April, 8 p. m.*—Almost incessant sheet and forked Lightning in W. and N. W., illuminating some dense *cum. strat*, and which would otherwise have been invisible. Zenith clear.

10 *p.m.*—Constant sheet lightning round horizon.

Midnight.—Continued sheet lightning and distant thunder.

18th April.—During the greater part of the night there was a continued display of vivid lightning and a rumbling of distant thunder.

5·30 *a. m.*—Thunderstorm rising in N. W., the sky very dark and peculiarly threatening; very dense *cumulo stratus* rolling over with a rushing noise; the wind for a few minutes (5 50 to 6·05 a.m.) was very violent, scattering the leaves and dust about in every direction. The rain drops which fell during the storm were large, and a few hailstones fell, which were generally ¼ of an inch in diameter.

6-30 *a. m.*—The storm was over, but the clouds were still rolling about in a very peculiar manner. Sultry morning.

8·00 *a. m.*—Detached clouds passing in almost opposite directions: the upper strata from S.W., the under rapidly from *East*.

The direction of the wind which was E. b. N. during the night, suddenly backed round the N. to N.N.W. at 6 a. m., but it returned to its original direction at 6.20 a.m. The velocity of the hour was about 13 0 miles, but from 5 55 to 6 05 it must have equalled the rate of 38 miles per hour.—*Extract from Met. Reg. Pro. Ob.*

INSTRUMENTAL OBSERVATIONS.

Day.	Hour.	Barom.	Thermometer. Dry.	Thermometer. Wet.	Hygrometric. Elast.	Hygrometric. Hum.	Wind. Direc.	Wind. Force.
			°	°				
17th	10 p. m.	29·625	47·6	46·0	·287	89	Calm	Calm
"	Midnight	29·611	47·4	46·0	·290	90	Calm	Calm
18th	6 a. m.	29·552	51·3	50·4	·350	94	E b N	11·2
"	8 a. m.	29·540	54·0	52·7	·375	91	East	8·3
"	2 p. m.	29·441	62·9	57·4	·400	71	Calm	Calm
"	4 p. m.	29·437	55·1	52·1	·349	81	Calm	Calm
"	10 p. m.	29·457	47·0	45·1	·273	86	E S E	1·6
"	Midnight	29·414	51·3	50·4	·350	94	N	1·0

REMARKS.

17th, 10 p. m.—Partially overcast. Sheet lightning round horizon.

Midnight.—Clouded, sheet lightning, and frogs croaking loudly. Distant thunder.

18th, 6 a. m.—See previous remarks.

8 a. m.—Mostly clear. Detached clouds passing in almost opposite directions. Mild morning.

2 p. m.—Detached clouds passing in Z., and hazy round horizon. Sultry close day.

4 p. m.—Light clouds and haze dispersed. Sultry and close.

10 p. m.—Overcast and haze. Some open spaces to N. W. Dark and close at night.

Midnight.—Densely overcast. Some heavy drops of rain at 10·15 p. m. Almost incessant forked lightning and distant thunder, from 10·30 p. m. in S. b. E and S. W. Commenced to rain again at 12·05 (only a few drops).—*Extract from Met. Reg. Pro. Ob.*

The waters in the Lake rose rapidly in the form of a huge advancing wave, and swept over the sand bar separating Ashbridge's Bay from Lake Ontario.

Fluctuations continued throughout the day, and were noticed in the Humber Bay.

Picton, 25th.—In Picton Harbour the water fell nearly three feet, and has not yet recovered its usual level. At Wellington, it fell between four and five feet, and although it returned after a few minutes, it is not yet within two feet of its former level. At South Bay, it receded forty-nine paces from the shore, and is still low.—*Picton Gazette.*

Putneyville (State of New York), 18th.—This morning, the Lake presented a different appearance from anything within the recollection of the oldest inhabitant. Soon after sun rise, the sky was overcast with dense clouds, and thunder was heard in the distance. For a short time the wind blew furiously, and the rain poured down in a copious shower. This was between 7 and 8 o'clock. The clouds thickened, and the darkness became almost appalling; one could not see to read or write without a candle.

The Lake rose and fell every eight or ten minutes, generally about two feet; but several times the difference between the highest and the lowest mark, was at least five feet. The water would rush up on the shore beyond its usual limits, and then recede after a few minutes several rods from the shore, leaving the stones and sand bare. Thus it would remain for, say, ten minutes, when it would roll gently back again to its former height. After 9 o'clock this agitation gradually subsided, and in the course of the day the Lake resumed its natural level. D. C. Higgins.

The *American* gives an account of a similar ebbing and flowing at the mouth of the Genesee River. A captain who proposed to let his craft lie outside the piers till a favourable wind should spring up, states that suddenly a heavy tidal wave set *out from shore*, and left his vessel in water so shallow, as to cause it to careen quite on to the side. Soon after a return swell lifted her up again, and enabled him to make the harbor. It is evident from the description of these phenomena, noticed at points so many miles apart, that they proceeded from the same general cause, and were indeed parts of one and the same great tidal phenomenon.—*Rochester Daily Union.*

Seneca Lake.—During the whole of Wednesday and yesterday, the waters of Seneca Lake would rise and fall, in spaces of time varying from ten minutes to half an hour, continuously through those days, from five inches to two feet in height. Just after sundown on Wednesday evening, a friend of ours made an exact measurement of the fall and time. In fifteen minutes the water fell 16½ inches, when it commenced rising again.—*Seneca Lake.*

Niagara.—A little before seven, a. m., the sky assumed a green color, succeeded in a few minutes by a clear white, which indicated the presence of the hurricane. The storm came from the North, or N.N.E., apparently leaping in its course, and striking the ground at intervals with redoubled force. The rush of wind lasted about five minutes, and was at its height not more than one minute. But the damage it did was tremendous.

It struck the Niagara Car works, and in an instant levelled two large finishing shops, each 175 feet by 50, and two stories high, containing a number of new Cars, and took the roofs partly off some of the other buildings. A large new frame, 200 by 70, intended for a Foundry, and ready to be enclosed, was piled in a mass. The carpenter and blacksmith shops in the shipyard were blown down. The Engine House of the Erie and Ontario Railway was also very much twisted, and the large Woodshed nearly destroyed. A passenger Car was lifted bodily off the track near the station-house and thrown over to some distance from where it stood.

Throughout the Town the damage was very great—roofs, fences and chimnies blown down in all directions. The St. Andrew's Church received great injury—a third of the roof and gallery inside was swept away.

During the hurricane the water suddenly rose from five to eight feet along the Lake shore and in the river.—*Mail.*

Port Dalhousie.—For two or three hours after sunrise the heat was very oppressive. Off to the north, over the Lake, the clouds presented an unusually wild, lowering, I may say dreadful, appearance. Banks of fog would rise suddenly in the direction of Toronto, whirling about wildly, and then form into horizontal streaks of a dark leaden hue. About 6 o'clock, a. m., a black cloud came drifting along towards the shore with great velocity. It appeared to pass too high to do much damage in the port, but about half a mile inland it descended to the level of the earth with full force, and scattered fences as if they had been chaff. Fortunately the squall here was only a few yards wide, and it appeared to have risen again, after passing about a quarter of a mile across the country, as I have heard of no damage being done save in the one spot. The air continued perfectly tranquil a few yards from where the squall was passing. Shortly after this cloud had passed, a dark hue appeared to move along the surface of the lake towards the shore, which, as it drew nearer, was discovered to be a huge wave. It came rolling forward, apparently about 6 or 7 feet high at its crest, and dashed against the piers and swept far up on the shore. One large three masted vessel was torn from her moorings and dashed against the pier, but without being seriously damaged. The huge wave, however, retreated as rapidly as it advanced, and carried with it the water to a depth of four or five feet, leaving only a narrow stream where there is usually a sheet of water about a quarter of a mile wide. Each time the wave receded a number of fine fish were left floundering in the mud and shallow pools. The water continued receding and advancing in this manner the whole day, but it gradually diminished in force and volume towards the evening. It flowed in, on each occasion, for about half an hour, and receded for the same length of time. It was noticed that when it turned shorewards, there was a chill puff of wind from the north.

At Wellington, the water at the Lake shore acted precisely as described above. The water receded from Mr. McFaul's wharf so that parties could walk round it; then again the water came back and overflowed, rising from four to eight feet over its usual level. For a day or two the Lake appeared more or less unsettled.

Sir Henry de la Beche and Mr. Greenough.

The loss in one week of two eminent geologists is a severe blow to science. The name of Sir Henry de la Beche will be more familiar to our readers than that of Mr. Greenough. The director of the geological survey has been prominently before the public for many years. The father of the Geological Society was a worker rather than a writer; though seventy-seven years of age when he died, yet the greater portion of his life was spent in the pursuit and accumulation of facts. Sir Henry de la Beche was born in London in 1796, and was therefore only 59 years old at his death.

In 1810, Mr. De la Beche entered the Royal Military College; on

leaving which he entered the army, but in a little time he resigned the profession of arms for the pursuits of science, thus resembling another great geologist, Sir R. Murchison.

He gave himself up to the study of Geology, and made it the business of his life.* In 1817 he became a member of the Geological Society, then in the tenth year of its existence.

The year 1819 was spent by Mr. De la Beche in an examination of the geological formations of Switzerland and Italy, and his zealous prosecution of similar inquiries led to his being elected in that year a Fellow of the Royal Society. In 1820 a paper by Mr. De la Beche, 'On the Temperature and Depth of the Lake of Geneva,' the result of a most careful examination, was published in the *Edinburgh Philosophical Journal*. In his geological investigations of the British rocks the Rev. Wm. Conybeare, now the Dean of Llandaff, was, to some extent, connected with Mr. De la Beche; and his first communication to the Geological Society was the joint production of these two geologists,—announcing the discovery of a new fossil animal of the Saurian family, in the lias limestones of Bristol, which they named, as being distinctive of its species, the Plesiosaurus. From this time the name of De la Beche became closely connected with the science of the day. Many valuable papers were communicated to the Geological Society, including an elaborate account of the Geology of Switzerland; the Fossil Plants found at the Col de Balme, near Chamouny; a communication on the Geology of the Coast of France; and several papers on the Geology of various districts in the British Isles,—especially of Southern Pembrokeshire, of Lyme Regis, Dorsetshire, and of Beer in Devonshire.

Mr. De la Beche possessed extensive estates in Jamaica. He now visited his property,—Halse Town, in the neighbourhood of Spanish Town,—and on his return, in 1825, he communicated to the Geological Society his remarks on the geology of that West Indian island, of which nothing had been known previously.

Between 1827 and 1830, Mr. De la Beche published numerous important Geological papers in the *Transactions* of the Society, the *Philosophical Magazine*, and the *Annals of Philosophy*, and also a tabular proportional view of the superior, supermedial, and the medial rocks. In 1830 his first book, 'Geological Notes,' appeared; and in the same year, 'Sections and Views of Geological Phenomena.' Great skill in the use of the pencil enabled the author to furnish the whole of the drawings for these works, and to them all subsequent illustrators have been indebted. 'The Geological Manual' was published in 1831, and was speedily translated into French and German,—becoming a text-book for geologists throughout Europe, and passing through several editions. In 1832 Mr. De la Beche proposed to the Government to supply the data for colouring geologically the maps, then in progress of publication, of the Ordnance Trigonometrical Survey. This offer was accepted, and at the Land's End, in Cornwall, was commenced the great work of this eminent geologist's life. Mr. De la Beche, who bore himself the greater part of the expense of the Geological Survey of Cornwall, devoted several years to a careful investigation of all the conditions, lithological and mineralogical, of Western England; and he published a series of Maps of Cornwall, Devonshire, and Somerset, which exhibited a correctness and detail such as had never before been attained. This Survey was fairly established under the Ordnance. "It was,"—says Sir Henry De la Beche, in his Inaugural Discourse, delivered at the opening of the School of Mines, on the 6th of November, 1851,—"It was while (in 1835) conducting the Geological Survey then in progress, under the Ordnance, in Cornwall, that being forcibly impressed that this Survey presented an opportunity not likely to recur, of illustrating the useful applications of geology, I ventured to suggest to Mr. Spring Rice (now Lord Monteagle), then Chancellor of the Exchequer, that a collection should be formed, and placed under the charge of the Office of Works, containing specimens of the various mineral substances used for roads, in constructing public works or buildings, employed for useful purposes, or from which useful metals were extracted, and that it should be arranged with every reference to instruction; as by the adoption of this course a large amount of information, which was scattered, might be condensed, and those interested be enabled to judge how far our known mineral wealth might be rendered available for any undertaking they are required to direct, or may be anxious to promote, for the good or ornament of their country." Being supported in this recommendation the nucleus of the Museum of Practical Geology was formed.

In 1848, the honour of knighthood was bestowed on the Director of the Geological Survey; and in addition to this honour, in 1853 Sir Henry De la Beche was elected, by the suffrages of forty-seven members, Corresponding Member of the Academy of Sciences of Paris. The Order of the Dannebrogg was bestowed on him by the King of Denmark; and he received the Order of Leopold from the King of the Belgians.

Beyond the works and papers which we have enumerated, Sir Henry De la Beche published a voluminous report on the 'Geological Survey of Cornwall, Devonshire, and West Somerset,' 'Researches in Theoretical Geology,' and 'How to Observe.' In the various journals will be found forty papers and memoirs; and in 1851 Sir Henry De la Beche completed his last work, 'The Geological Observer,' founded upon his former work 'How to Observe.' In all these productions will be discerned a minuteness of detail and an excellence of illustration which mark the rare union of a skilful scientific observer and a finished illustrative draughtsman.

Although paralysis was seen by his anxious friends to be slowly but surely spreading its fatal influences over his once energetic frame, Sir Henry De la Beche would not allow himself repose. The labours of the Geological Survey and the business of the Museum engaged his attention daily,—and even two days before his death he spent several hours in the Museum directing the business of that establishment with his usual acuteness, although then powerless to move himself.

Sir Henry De la Beche raised for himself a splendid memorial of his talents and his zeal, and he created for the public an establishment which cannot but prove eminently useful, if it be carried onward in the spirit and with that well defined idea—which has been the creative power and the sustaining influence—under which the Museum of Practical Geology and the School of Mines were formed and have been supported.

Mr. Greenough, born in 1778, and consequently seventy-seven when he died, was educated at Cambridge and Göttingen, and served in Parliament for the borough of Gatton. But he made no great figure in the House of Commons. His genius was a genius for map-making, not for speeches and legislation; and the records of his zeal which remain to tell posterity of his useful labours are 'The Geological Map of England and Wales,' the map of 'Hindústan,' and the 'General Sketches of the Physical Features of British India.' He was on a journey to the East, in hopes of collecting materials for new maps, when he died at Naples; and it is understood that he has left behind a vast accumulation of materials, some of which will doubtless be available for the press.

Mr. Greenough had a great reputation among men of science, without being very widely known to the British public. More than thirty years ago he published his one volume, 'A Critical Examination of the First Principles of Geology.' Addresses and discourses to scientific Societies followed from time to time; but not with that persistence of assault by which literary fame can alone be carried. Yet was Mr. Greenough considered by English Geologists as the leader of their band, and he was one of the founders and was the first President of the London Geological Society.

* See *Athenæum* for April 21st, 1855.

The Antiquities of Canusium. (Apulia.)

The tomb which has most recently been brought to light has much of an Oriental character, as the doors narrow towards the top. The colour of the ground is of a dark red and blue. The chamber facing the entrance appears to have been devoted to the chief of the family, whilst the lateral ones were occupied by the women; and there, on beds of bronze, decorated with ivory statuettes and other ornaments, were found female skeletons. All that beauty, all that wealth ever gave could not save them from the universal lot. The ground was covered over with gold thread, which Signor Bonucci supposes to be the remains of a golden carpet or cloth; whilst round the walls were disposed more than forty vases, of various though graceful and elegant shapes. In some paterae of an enormous size, eggs and other eatables were found, as also the dregs of some liquids. In harmony with the idea that the deceased would resume the habits of this life in another world, the skeletons bear upon them the traces of the most magnificent dresses. The principal female figure, for instance, was found with ear-rings representing two peacocks, not merely in shape but in every tint: the colour of the plumage being given by smalt upon gold. Golden bracelets of a serpent form surrounded dry bones, round which once beat the pulses of passion. Her vest must evidently have been embroidered, for garlands of myrtle, both the leaf and the berry, were found in gold, and all are clearly pierced with the holes by which

they were once attached to the dress. Round the head was a diadem of various flowers, the cups of which were formed of rubies and jacynths and emeralds of great beauty, and sometimes of smalts of different colours. A beautiful ring was found on one of the fingers of this female. The circle is formed of two clubs of Hercules, the point where they meet beneath being surmounted by a ruby; whilst on the upper and opposite part of the ring is a box, where might have been the hair of a lover or Persian perfumes: the cover is formed of a large emerald. The work is of the most delicate filagree, displaying a great variety of beautiful forms: in short, all regard it with astonishment, and doubt whether modern art could produce anything so perfect. Signor Bonucci supposes that the age of the tomb may be about that of Alexander the Great, or, at least, 2000 years. The art of the painter, and the potter, and the sculptor, and the architect of that time is brought before us as fresh as though it had been executed but yesterday; nay, more, the handiwork of the milliner and the upholsterer is shown to our wondering eyes; and, dressed in the habiliments of the drawing-room, the inmates of the tombs seem ready to receive us.

The Ash Mounds of Jerusalem.

In a letter to the London *Athenæum*, Mr. Finn, the British Consul at Jerusalem, gives a description of the "Ash Mounds" near Jerusalem, and mention some curious results of their examination which may lead to important and highly interesting discoveries.

"Outside of this city (Jerusalem) towards the north-west, and not far from the Nablus Road and the Tombs of the Kings (so called), are some considerable heaps of blue grey ashes, on which no grass or weeds ever grow. One of them may be 40 feet in height. They are remarkable objects in themselves, especially as contrasted in colour with the dark olive groves around them. Hitherto it has been questionable whether the two *ash-hills without* the Damascus Gate have been heaped up from the ashes of the burnt sacrifices, or from the residuum of the produce of potash in the soap manufactories here. Dr. Roth, who had taken with him two samples, states 'that their analysis in our famous Liebig's laboratory bears evidence to the supposition that those ashes are the remnant of the *burnt sacrifices*, because they are *chiefly of animal*, and not of vegetable origin; and even *contain small fragments* of bones and teeth burnt to coal; and yet it would be impossible to ascertain the species of the animals to which they belonged.' The analysis exhibits a small percentage of *silicic acid*, which is never found in the ashes of flesh or bones. Dr. Roth is of opinion that we may account for this circumstance by supposing that the ashes of the *meat-offerings* in which silicium may be found, were likewise carried off to the hills in question. The samples were taken both from the top and the basis of the larger hill,—not *just from* the surface, nor from a considerable depth either.

This almost unexpected result is one that leads to important antiquarian consequences,—not only exciting wonder at the confirmation of Holy Writ, and bringing our feelings back to immediate contact with those of the Aaronic priesthood, but as helping among other facts to determine the course of the ancient walls, since these ashes must have been thrown beyond the wall.

The Relations of Lead to Air and Water.

Dr. Christison states that "water containing 1-1000 or 1-1200 part of salts, may be *safely conveyed* in lead pipes, if the salts are chiefly *sulphates and carbonates*; and that lead pipes cannot be safely used when it contains 1-4000th part of saline matter, if this consists of muriates."

At the request of the Board of Consulting Physicians of the city of Boston, Prof. E. N. Horsford, of Cambridge, U. S., in 1849 examined, with great care, the relations of lead to air and water, and gives the following as his conclusions: "A coat of greater or less permeability forms in all natural waters to which lead is exposed. The first coat is a simple sub-oxide, absolutely insoluble in water, and solutions of salts generally. This becomes converted in some waters into a higher oxide; and this higher oxide, uniting with water and carbonic acid, forms a coat soluble in from 7000 to 10,000 times its weight of pure water. The above oxide unites with sulphuric and other acids, which sometimes enter into the constitution of the last coat; uniting with organic matter and iron rust, it forms another coat, which is in the highest degree protective."

Dr. Horatio Adams, in a lengthy and very able report, before the American Medical Association, at its annual meeting, in 1852, deprecates the use of lead pipe for the conveyance of water, under any circumstances. Having shown, both by analysis, and its effects on the system, that lead is present in the Cochituate water drawn through lead pipes, also in the Croton water, the New Orleans water, the Cincinnati and Louisville water, he concludes—"That it is never safe to use water drawn through lead pipes, or stored in leaden cisterns, for *domestic purposes*; and that any article of food or drink is dangerous to health which, by any possiblity, can be impregnated with saturnine matter."

Gmelin, a distinguished German chemist, does not differ from Christison.

Salubrity of Towns.

M. Junod, of the French Institute, has communicated to that body some interesting facts respecting the relative salubrity of parts of cities according to their aspect and position. He says that in most European cities, the wealthier and more intelligent portion of the inhabitants have settled upon and occupied the western districts, while in the eastern parts have been located the working classes and trading population. This is the case not only in London and Paris, but also at Berlin, St. Petersburg, and Vienna. The old Italian cities exhibit the same peculiarity, and all their cemeteries are situated eastward. M. Junod endeavours to prove that these arrangements are in strict accordance with reason, and are based on a natural law. During westerly winds, the barometer in general is very depressed, and all the evaporations of the earth, as well as the smoke and other emanations from the burning of fuel, descend and remain near the surface. When, on the contrary, easterly winds prevail, the barometer ranges high, and the air becomes purified, as all vapours ascend, and soon disappear. If, therefore, westerly winds blow, they convey to the inhabitants of the eastern districts the unwholesome exhalations and vapours of the west; whereas the western districts receive only the purer air of the surrounding country. If easterly winds prevail, the noxious vapours of the eastern districts become scattered before they reach the western portions of the city.

From these observations the following inferences are deduced. Considerations of health ought to induce a preference for the building of residences in the western portion of a city. And, on the contrary, all the trades and occupations which are of an unwholesome nature, or which produce and emit smoke, steam, or other offensive exhalations, should be consigned to the eastward. Even in single dwellings, it is expedient to plan the kitchens, larders, washhouses, &c., to face the east.

Cholera and the Water Supply.

The connection between the prevalence of epidemic cholera and the impurity of the water used for domestic purposes has frequently been pointed out. In a paper read before the London Chemical Society in April last by Dr. Thomson, samples of Thames water taken from service pipes in localities where the mortality was great were exhibited, which contained most striking indications of the presence of sewerage. Not only was nitric acid detected in all of them, but ammonia was distilled over in considerable quantities, and sulphate of ammonia prepared by this process was exhibited to the Meeting. The mechanical impurities gave equally strong evidence to the same purport, being composed of vegetable and animal organisms, &c.,—and even the *debris* of human food can be demonstrated with the greatest facility by the microscope in the sediment derived from the service-pipes in those waters which are pumped from the lower sources of the Thames.

Dr. Thomson considers Dr. Clarke's plan for softening hard water perfectly practicable; and suggests that in order to adopt a uniform scale by which to measure the amount of foreign matter in water; distilled water should be represented by 0°, and every grain of matter present in solution in water per gallon by a degree; so that waters may be described as being possessed of so many degrees of mechanical, organic, and inorganic impurity respectively.

Meeting of Dr. Barth and Dr. Vogel.*

On the 1st of December, 1854, it fell to the share of Dr. Barth—he who had already been believed dead—*to meet in "very good health and spirits"* Dr. Vogel:—to see once more the face of a European and grasp the hand of a countryman who had been sent to join him.

Dr. Vogel had left Kuka in the latter end of November, to proceed in a westerly direction *en route* for Zinder, the north-western frontier town of the Empire of Bornu,—being anxious to extend his astronomical and other observations to that place. *Happily in the beginning of the journey, he received a letter from Dr. Barth, dated Kano, the 24th* of October; and this was the first direct news he had received from him. According to this letter, Dr. Barth had left Kano *en route* for Kuka, about the same time that Dr. Vogel had departed from the latter place to proceed westward, on the very road which the former had chosen. Thus, both travellers had started to meet without knowing it themselves. Dr. Vogel, keeping on the Kano road, and leaving Zinder on the right had the happiness to fall in with Dr. Barth at Bundi, a small town situated about 110 geographical miles north-east from Kano, and nearly 200 geographical miles due west from Kuka. As only a few preliminary hasty lines from Dr. Vogel, written in pencil, have come to hand, the particulars of this event have not yet transpired; but it may easily be conceived what it must have been to Dr. Barth. It was exactly six years since he left Europe, in company with Mr. Richardson and Dr. Overweg; and since the decease of the latter, on the 27th of September, 1852, not only had his communications with Europe been all but entirely cut off, but he had indeed been isolated from the civilized world, and *left to battle with manifold hardships and dangers.*

Dr. Vogel writes, that Dr. Barth had moved on to Kuka, whence he intended to proceed, without further delay, home, *via* Murzuk and Tripoli. As to himself, he continued his journey to Zinder; whence he despatched a letter with the above news, dated the 7th of December last, and which took nearly four months to reach Tripoli by way of Ghadamis.

Since the above was written, letters from Dr. Barth himself have come to my hands, which, though written before his meeting with Dr. Vogel, are of great interest, as they contain the first news respecting his journey from Timbuktu back to Sudan, and the first positive information ever received from a European traveller of the River Kowara between that place and its lower course

It appears that Dr. Barth had been detained at or near Timbuktu several months beyond the date of his last letters despatched from that region, namely, the 23rd of March, 1854, between which date and the time of his arrival at Kano, which took place on the 17th of October last, nearly seven months intervene. *Dr. Barth himself says:*—"After a protracted stay of *nearly a year* at Timbuktu—the "Queen of the Desert," as it is justly called by the natives—I retraced my steps eastwards along the shores of that magnificent river, which the undaunted Scotchman [Mungo Park] descended about fifty years since, fighting his way through numerous fleets manned by Tuaricks and Sudans—lost labor to science, his journal having perished with him;—while I went *along reconciling* and befriending those very people, and obtaining *full security from their chiefs for any* English visiting their territories, whether by land or by water." Thus, Dr. Barth has been able to realize his great wish, namely, to trace this river between Timbuktu and Say; which latter place is situated in about 13° 10′ north lat. and 3° east long., Greenwich. This, its middle course, seems everywhere navigable and enlivened with large fleets, its shores densely inhabited by people, who received and treated Dr. Barth most kindly, and implored him to stay with them altogether, or to return soon in an English ship. They learned from him with astonishment as to whence the river—which forms the basis of their existence and wealth—comes from, and where it terminates.

Dr. Barth alludes to a large map of the river drawn by him, which he had sent to the Foreign Office. He has also transmitted with the present letters some of a former date, which has been despatched by him while on his way to Timbuktu, but which, as he found on his return to Sudan, had not been forwarded, probably, because their envelopes and addresses had been lost. These letters are dated "Dore, in Libtako, 16th July, 1853," *which is about midway between Sokoto and Timbuktu (see map in my 'Geographische Mittheilungen,' part I.)*, or in lat. 14° 30′ north, and close upon the meridian of Greenwich, and they contain a full account respecting that region, which was entirely unknown before.

* *Athenæum.*

Libtako forms a portion of the very extensive Fellata dominions, and is a very important commercial point. The principal article of trade is the salt of Taodenni, which is brought thither by the Arabs of Timbuktu, while the Tuaricks bring corn and butter, the people of Mosi their celebrated donkeys and their famous cotton manufactures, cheap black shirts and a large peculiar kind of guro nuts. The inhabitants of the country supply sweet and sour milk, and *their manufactures* consist chiefly of very handsome and cheap shawls made of cotton and wool, and of various colours. The market at Dore, the chief place of Libtako, is held every day. Cowries are almost the sole medium of *interchange.*

Libtako occupies an elevated, dreary plain, devoid of trees and shrubs, and suffering from the want of rain. Granite protrudes in *many places out of the soil. Dr. Barth made many enquiries respecting* the town of Adafudia, reached by Mr. Duncan, and which, according to the position assigned to it by that traveller, ought to be within 100 geographical miles from Libtako—but in vain; he could hear nothing whatever of it. Though the country was *in a state of anarchy when* Dr. Barth passed through it, he did not suffer on that account, but rather from the too exalted manner in which he was received everywhere, the inhabitants flocking from all quarters to receive his blessing. The Arabs looked upon him as no common Christian, owing to the information he possessed of topics specially interesting to themselves, and to the fact of his coming from the East. The Tillalins had christened him "Módibo," by which name he was *universally known* in those countries.

It was near Libtako where Barth was so fortunate as to make the acquaintance of one of the followers of the Sheikh el Bakay—the Pope of *Timbuktu,—who subsequently* became his best friend and greatest benefactor. This person exercises his influence over a very extensive region, nearly as far as Sokoto in the east; and he may be said to have created of *Timbuktu a kind of African Rome,*—the centre of the power of Islam.

The region between Libtako in the west and the river Kowara (here called Tsa, Say or Mayo) in the east is occupied by territories belonging to the large country of Gurma, *only the northern part of which* belongs to the Fellatas. The language of Gurma, has a few words in common with that of Benin. Within Gurma are various rivers, all tributaries of the Kowara, the largest being the Sirba, which Barth found twelve feet deep in the beginning of July, and which he had to cross by means of immense bundles of reeds fastened together, as boats are entirely wanting. The valley of the Sirba is very ill-famed as being most destructive to all kinds of cattle and horses. The soil along the course of the river swarms with black worms.

Dr. Barth's letters contain interesting extracts from the "Tarikh el Sudan," an important work on the history of Sudan, hitherto unknown.

On his arrival at Kano, in October last, Dr. Barth, instead of finding letters and supplies from home, received information of the rumour of his death having been spread in Sudan, and even reached Europe, about which, not knowing exactly the origin and circumstances connected with it, he felt very sore and indignant, while the absence of all needful supplies put him to great straits and inconvenience. Happily these, as we know, he subsequently got over. His longing to reach Europe knew no bounds, as he declares that the being exposed to another rainy season (the sixth), or to remain much longer without the refreshing influence of European atmosphere and proper food, would be his certain death. Yet in the same sentence he speaks of ultimately returning to the field of his labours, and trying to penetrate into the interior of Africa from the coast of Zanzibar, after having strengthened his health!

The only cause of joy which awaited him in Kano was the news of the success of the Chadda Expedition, of which he seemed to have learnt all the particulars from the natives. Among others, he met an old acquaintance, the Governor of Hamarrua, a country situated on the shores of the upper course of the Chadda. This person told him that the exploring steamer Pleiad had also reached his country, that he had received the Expedition very friendly, and had made the commander a present of six oxen.

AUGUSTUS PETERMANN.

Novel Arrangement of Picture Galleries.

After the late M. Rothmann had acquired a great reputation as a landscape painter, King Louis of Bavaria sent him to Greece, where that artist produced works highly spoken of by the German press. Some consider them the *ne plus ultra* of landscape delineation, each painting being a poem, representing in the perfect concordance of

earth light, and air, the incorporate image of some ideal harmony; we are struck, moreover, by an objective coherence to nature, and the utmost faithfulness of a positive locality, its picturesque and vegetative physiognomy. It is as if the Athenians, the Spartans, arose anew from their resting-place of ages.—as if a battle was again to be fought on those spots so intimately represented in the Eleusian groves, once the place of sacred initiation. Such appreciation led to the desire of having these productions of art exhibited in the best possible manner, and an especial saloon has been appropriated to them in the new Pinakotheca, at Munich. The architect, M. Voit, being intrusted with its construction, has erected a gallery, where the light coming from above strikes only the pictures, the visitor viewing them from the shade of a covered hall, which occupies the middle portion of the room. By this arrangement, the paintings are brought out in a very striking illumination, imparting to them that mysterious sentiment, under which, without doubt, most works of art ought to be viewed.

Progress of Melbourne—Australia.

A view of the commerce, revenue, and rise, of Melbourne, is unlike the commercial growth of a rising city, and rather resembles youth starting up at a bound to the full maturity of manhood: its population, which in 1836 was 224 persons, having reached in 1853, 250,000. Its exports, which in 1838 amounted to 21,000*l.*, reached in 1850 to 1,042,000*l.*, in 1852 amounted to 7,451,540*l.*, and in 1853 swelled to 9,080,574*l.*; while the increase of imports in the same year was equally striking, advancing from 71,000*l.* in 1838, to 751,000*l.* in 1850, to 4,067,742*l.* in 1852, and to 15,842,637*l.* in 1853. The revenue of the colony is also very remarkable—in 1850 it amounted to 261,321*l.*, in 1851 it was 379,824*l.* in 1852 it reached to 1,576,801*l.*, and, in 1853, it swelled to 3,202,249*l.* A large part of these amounts was obtained from the sale of Crown lands, and the licenses to dig for gold yielded, in 1853, 660,838*l.*, the present reduced rate being 1*l.* per month, or 8*l.* for the year. The total produce of gold for 1853 was nearly 129 tons, valued, at 4*l.* per oz., 12,361,368*l.*, being upwards of 1,000,000*l.* a month: but, as we learn from the most recent advices, that the amount of gold shipped from Victoria, in the first nine months of 1854, amounted to 1,653,999 ozs., against 1,831,468 ozs. shipped during the first nine months of 1853, some decline will be observable during the last year. This is attributed, partly to the fact that a large part of the population has settled down to ordinary industrial, particularly agricultural pursuits, but still the average weekly produce in October last was about 40,000 ounces.—*Min. Jour.*

The Great Minnesota Copper Mine.

The Lake Superior *Mining News* furnishes the subjoined summary account of the monster mine, known as the Minnesota:—

"The greatest depth attained in this mine is 380 feet. The main shaft or piston that works the pumps is here about 300 feet long. The lowest depth attained at the south vein is 166 feet. Silver is interspersed in all the copper of this mine, and in some others on this range. When any fine specimens of silver do make their appearance in *verges*, or in any other collection, they are generally secured by the miners. The amount of copper shipped from this mine during the season of navigation was 1,543,407 pounds, net weight, being over 771 tons, worth over $300,000. The product for the month of December is over 77 tons. Three hundred and ninety men are required to carry on this vast operation. It requires a supply of over 20,000 pounds of candles for this mine during six months. There are about forty buildings clustered around this mine, and making a respectable village, for they have their Catholic and Protestant churches, their school-house, warehouse, and doctor's office. It is one of the mines that give character to this country, for upon its success depends the confidence of all stockholders in copper mines; and it will maintain that place until some others shall show an equal success, and share that responsibility with the Minnesota and Cliff mines."

Miners and their Privations.

The census of 1851 presents many curious facts relating to mining industry. It appears that in Great Britain this class of the population numbered as follows:—

		Production in 1851 about
Coal miners	216,366	52,000,000 tons of ore.
Iron miners	27,098	2,250,000 "
Lead miners	21,617	65,000 "
Copper miners	18,468	11,000 "
Tin miners	12,912	9,000 "

This population, in a great measure, exists in mines which are distinguished from the workshops of other operatives by the peculiarities of the temperature, pressure, moisture, and composition of the air, of the gases, and miasmata which prevail in them, by the absence of sunlight, and by the mode of lighting, quite as much as the motions and working positions of the men differ from those belonging to any other occupation. The average age of miners living varies from 25·7 years in the case of tin miners, to 28·9 amongst lead miners, being a difference of about three years, but this is accounted for by the tin miners commencing work at 10½ years of age, the lead miners not till above thirteen years, on the average. These are the extremes of age, within which, on an average, each of the five classes of miners begin work. Iron miners are the unhealthiest of all; for, notwithstanding that the men do not commence work till about 13 or 14 years of age, their span of labour only reaches 25·4 years, which is 2¼ years below the average time in which a miner wears out. The machine lasts but 27·7 years, whilst 42·3 years are got out of the agricultural labourer. In other words, the lives of the miners, in addition to excessive sickness and diminished strength, are shortened by an amount equivalent to more than half their working life.

Lightening of Labour in Mines—the Man Machine.

The "Man Machine" is an apparatus contrived for the purpose of saving miners time and labour in ascending and descending to and from their work. One hundred men can be elevated or lowered together from as many different depths of the mine (in a perpendicular shaft) by this simple contrivance. The single acting man machine consists of a strong rod of wood or iron, extending the whole depth of the shaft, to which are fixed platforms about 4 feet by 2½ feet at intervals of ten feet. There are corresponding platforms fixed at the same distances to the sides of the shaft. The rod has a reciprocating motion up and down of ten feet, communicated to it by the crank of a water-wheel or steam-engine. Now, a person stepping on the rod when it is about to go up, and off it on to the side platform when it is about to go down, and repeating the operation at every stroke of the rod, would arrive without effort at the top. One man can be on each platform at a time. In the double machine there are two rods, which move up and down alternately; and, therefore, double the speed of the ascent.

The Canadian Journal—New Series.

The members of the Canadian Institute and the subscribers to this Journal are aware that the first number of the *Canadian Journal* was issued in August, 1852. Each yearly volume was thus made to terminate at a period found by experience to be extremely inconvenient in relation to the Society's financial arrangements; and it has long been thought desirable, that an effort should be made to connect the financial year of the Institute with that of its Journal. This step has not hitherto been taken, as it appeared to the Council that the prospects of the Society were such as would warrant the issue in a short period of a NEW SERIES, with such changes in size, form and arrangement, as would adapt it to to the rapid growth and strength of the Canadian Institute. It is now thought that the time has arrived for effecting this change, and it is therefore proposed to continue the monthly issues of the present volume to December 1855; and in January 1856 to issue the first number of a NEW SERIES. Further information on this subject will be published when the necessary details have been determined.

Canadian Saturniæ.—Silkworms.

In the April number of the *Canadian Journal* of last year (vol. ii. page 212) we published a short paper by Thomas Cottle, M.D., of Woodstock, C. W. "On some of the Canadian Saturniæ, and suggestions on the possibility of using their silk for textile purposes."* We are glad to find in the correspondence of M. Jerome Nicklès with "The American Journal of Science and Art," dated December 30th, 1851; that the French "Zoological Society for Acclimation and Domestica-

* Read before the Canadian Institute March 11th, 1854.

tion," have directed their attention to the Saturniæ, with a view to their acclimation. M. Nicklès says.—

"Since the muscardine has made so great ravages among the mulberry silkworm, there has been an attempt to introduce other kinds of silkworms. I have already spoken of the Bombyx of the Ricinus. It is now proposed to acclimate three American species of Bombyx; the *Cæropia* whose larvæ feed on leaves of the willow and may be fed also on the plum; the *Luna*, an elegant species of a green color, which lives on the Liquidambar, and which will also eat the leaves of different species of walnut; the *Polyphemus*, a large *Attacus*, of a brownish gray color, which feeds on the apple, oak, beech, &c. These three species are abundant in the woods of Louisiana, Georgia and South Carolina. Their silk is of inferior quality; but it costs so little to obtain it, that the acclimation of the species is regarded as desirable on the score of economy."

It may be a novelty to some of the members of the "Society for Acclimation," to find that the three magnificent insects alluded to in the foregoing paragraph are found in Canada, one species in great abundance; and the question of using their silk for textile purposes, has not only been suggested, but actually tried on a small scale, and found quite practicable.

Canada West—Information for Intending Emigrants.

Mr. Commissioner Widder has recently published a fourth edition of a little pamphlet containing answers to questions respecting the climate, soil, husbandry, state of education, &c., in Western Canada. The former editions have been widely circulated in the United Kingdom and in Germany. The very remarkable changes, however, which have occurred in Canada during the last three years, by the construction of railways and the introduction of foreign capital, have rendered it advisable to prepare a new and revised edition, extended to the present time.

In the preface to the new edition, Mr. Widder alludes to the general condition of the Province in 1855, and draws an encouraging picture of the stability of its present prosperity and the certainty of future rapid advancement.

INTRODUCTION TO FOURTH EDITION.

"During the last three years, a combination of circumstances has caused a most extraordinary change in the relative position of everything. The price of land, of labour, of provisions,—in fact, of everything, has advanced. The inducing causes have, no doubt, been most materially the introduction of railroads,—the demand for labour arising from them,—the large amount of money disbursed for the works, and also brought to this Province for investment,—together with the high prices obtained for the past two years' harvests; to which must be added the large emigration from Europe, and of settlers from the United States, seeking this Province as their adopted home.

"Those events continued to stimulate great progress in our affairs, until the effects of the Russian war acted upon the money market in England, and were more deeply felt in Canada, superinduced upon the very large importation of goods from Europe and the United States, and the great depreciation in the price of lumber.

"A check was given to our Railway Works—and Remittances for investments became limited. No monetary crisis, however, arose from these occurrences—they merely caused a suspension in our rapid advancement. At the same time, the wealthy condition of the farmers, and the great demand for produce, advanced the prices of their productions, and that of Wild Land, and of all Real Estate, and affirmed the substantial position which the Province has acquired. It may be said we are simply pausing for breath, after the recent excitement, and that we are about recruiting ourselves for a new start in our career; which it is believed will be a more permanent and important one, in its results of positive progress and prosperity, than has hitherto been witnessed. But this state of transition throws embarrassment around the desire to give perfect data and unchangeable prices, such as is desired in a work of this description: for a continuance of the war, the scarcity of money, and the suspension of our public works, or bad harvests, may seriously affect the data given; on the other hand, a contrary position of those affairs, would place this Province in a most extraordinary state of prosperity. Nor should it be forgotten that we are about reaping the advantages of an extended commerce with the United States, through the Reciprocity Act; which cannot fail to be of great importance to us.

"With reference to the imports, the following statement, from the official returns, will prove extremely interesting, as showing the very great increase in the trade of the Province during the past four years, and its great power of consumption of goods induced by its prosperity:

COMPARATIVE STATEMENT OF IMPORTS.

Exhibiting in contrast the Value and Amount of Duties collected on Goods entered for consumption in Canada, during the years 1850, 1851, 1852, 1853, *and* 1854, *respectively.*

WHENCE IMPORTED.	VALUE.				
	1850.	1851.	1852.	1853.	1854.
Great Britain	£2,407,980	£3,012,663	£2,097,583	£4,622,280	£5,740,832
N. American Colonies	96,494	109,232	120,238	158,161	168,778
West Indies	1,112	2,166	1,278	809	485
United States	1,618,515	2,091,441	2,119,423	2,911,531	3,583,274
Other foreign countries	91,503	142,571	102,899	268,507	338,777
Totals	4,215,547	5,358,607	5,071,622	7,905,359	10,132,331
Duty on the above	610,634	767,459	730,263	1,028,676	1,221,751

"To any one in Europe who may have been sceptical of the necessity or advantages of railways in this Province, or that they could be supported, with a prospect of a fair return on the capital invested in them, a most convincing argument is set forth in the Returns of the Great Western Railway Company of Canada, opened in January, 1854, which show that the revenue for the six months ending in January last, amounted to £192,719.

"The views adopted in Europe, upon railroads, are not applicable to this country. *There*, railroads are the consequences of the requirements for quick and cheap conveyance of a dense population, and of its manufactures and productions: *here*, railroads are self-creative of support, by raising population,—through opening up a new and fertile country, which transmits its productions, in return for the supplies of its wants.

"The effects of railroads upon the prices of produce, will probably be, to equalize them throughout the Province; whilst it can scarcely be expected they will reduce the cost of living, in the towns and ports where the railroads have their termini and depôts for exportation and importation. The requisite shipping, the great trade and commerce, combined with the docks for ship-building, and manufactories, that will necessarily arise, will induce a consequent increased permanent and transient population, who must be supplied, and can well pay for their wants. Such has been the effect upon the cities of New York and Boston, and other places similarly situated. As to real estate, it must, from the same causes, be affected in a like manner, in the towns and ports; whilst farm lands will, in every manner, be greatly benefited by railroads. About five years since, the price per acre for lands in the Genesee Country, and other parts of the State of New York, was from £12 10s. to £18 10s.: they are now selling at £18 to £25 per acre, including the ordinary farm-buildings; these are cleared lands, but the value of the timber would have been greater than the cost of clearing. The prices of wild lands, in Upper Canada, have undergone a very great advance, during the past three years; but, circumstanced as this Province is, and considering its comparative small amount of population, it will not, perhaps, be taking a too sanguine view, if we anticipate, that we shall, in a year or two, approach the prices now paid in the State of New York, for lands in this section of the Province enjoying an equally fertile soil, and having the like facilities of railroad and water communications.

"It has been well observed by Professor Johnston in a recent article of the *Journal of the Royal Agricultural Society of England*, on the relations of Geology to Agriculture in North America, that the *Peninsula* of Upper Canada, encircled by Lakes Ontario, Erie, and Huron, has a much wider expansion of those happily combined soils, which are so eminently distinguished for the growth of the finest quality

of Wheat, in large abundance, than even the far-famed Genesee District of the neighbouring State of New York.

"In this extensive range of country, (bounded by the great Lakes.) there is absolutely no land that is naturally sterile; and, probably, there is no other tract of equal area on the North American Continent, so well adapted, from circumstances of soil and climate, to the general purposes of Agriculture. This interesting region has already been materially benefited by the opening of the Great Western, and the Ontario, Simcoe, and Huron Railways; and is rapidly settling by a persevering and industrious class of people. It will in a few years be the Garden of Canada, if not of North America."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

WEDNESDAY, 4TH APRIL, 1855.

The following gentlemen were proposed as Associate Members, viz. Charles Walker, and Hammond Gowan.

A Paper was read by Lieut. E. Ashe, R.N., F.R.A.S, "On the Connection between Astronomy and Navigation."

The thanks of the Society were ordered to be given to Lieut. Ashe for his paper, which was referred to the Class of Science.

Mr. A. R. Roche's Paper on "Russian America" was recommended for publication by the Class of Literature.

MONTHLY GENERAL MEETING.

11TH APRIL, 1855.

The following gentlemen were elected members:—

The Hon. John A. Macdonald, Attorney-General for Upper Canada: F. T. Roche; George Desbarats; Charles Walker; Hammond Gowan; Walter Sericold, late Captain 66th Regiment; William Chessell.

As Corresponding Member:—T. E. Campbell, C.B., late Major 7th Hussars.

STATED OR LITERARY MEETING.

WEDNESDAY, 25TH APRIL, 1855.

(Wednesday, the 18th April, being the day of Humiliation, the meeting was adjourned to the following Wednesday, 25th April.)

A Paper was read by Mr. F. N. Boxer, giving a description of the River Saguenay, Lake St. John's, and surrounding country.

The thanks of the Society were ordered to be given to Mr. Boxer for his paper, which was referred to the Class of Literature.

HENRY E. STEELE,
Recording Secretary.

Notices of Books.

Journal and Transactions of the Board of Agriculture of Upper Canada. No. I. Vol. I.—April, 1855.

We most cordially welcome the appearance of the First Number of the "Transactions of the Agricultural Association and Board of Agriculture of Upper Canada." It has long been an undeserved reproach to the industry and intelligence of this magnificent farming country that no effort has hitherto been made to furnish the public with an official record of the progress of our Agricultural industry, and the efforts which have been made for many years past by the Government, by Societies, and by individuals, to encourage farming enterprize and elevate the standard of Canadian Husbandry.

The "Journal of the Board of Agriculture" will supply this want, and if we may judge from the appearance and contents of the number before us, a very important and valuable aid to the Scientific and Practical Farmer, has commenced its career.

The present number contains a brief sketch of the rise and progress of county and township Agricultural Societies, together with a notice of the various Provincial enactments which have modified the organization of such Societies up to the time of the Institution of the Board of Agriculture. The organization of the Agricultural Association of Upper Canada is described; and a sketch given of the operations of the Association as connected with Annual Provincial Exhibitions, &c., up to the year 1850. It is proposed, in the second number of the Journal, to continue the account of the proceedings of the Association, and to publish the records of the Organization and Transactions of the Board of Agriculture, as well as the Prize Essays and County Reports to which premiums have been awarded by the Board.

The Canadian Literary News Letter and Booksellers' Advertizer; H. Ramsay, Montreal, and A. H. Armour & Co., Toronto.

It is a very encouraging proof of the progress of Literature in Canada, that the present demand for new works issued in the United Kingdom and the United States, should warrant the publication of the "*Canadian Literary News Letter.*"

Even were the project seemingly one of doubtful commercial advantage to the publishers, it would still be gratifying to know that it gave promise of future success. We note, therefore, with much cordiality the progress which has been made during the short period of five months in the issues of the *Literary News Letter*. In the first number we were promised a circulation of 2,500 copies monthly, in the May number (fifth) we find that 3000 copies are circulated throughout the Province and 500 addressed to the leading Booksellers and Publishers in the United States and Great Britain. We hope this rapid increase will prove as advantageous to the publishers as it is to the Canadian Public.

It may happen that some of our readers are not familiar with the design and object of the "*Literary News Letter:*" we shall therefore endeavour to give a brief account of the contents of the May number.

The inducements held out to the publishers by the frequent applications made to the Colonial Trade generally for the prices, sizes, and standing of new works issued in Great Britain and the United States, were sufficient to lead them to establish such a medium as would satisfy to the full, the demand continually made upon them. One Division of the *Literary News Letter* is devoted to editorial reviews of new books and periodicals. A second Division furnishes a monthly list of the books published in the United Kingdom, and is partly occupied by reviews of the works named, from the London Athenæum, the London Literary List (Bents) &c., &c. A third Division refers more particularly to the United States—and besides giving a list of the new publications, furnishes also brief reviews from Norton's Literary Gazette, (N. Y.) &c., &c. Then follow Literary Notices, Miscellaneous Announcements, and a large number of Publisher's advertisements.

The "*Literary News Letter*" will prove a valuable and acceptable monthly gift to the Canadian Public.

Rice Lake Bridge.

In the present number of the Journal we publish a very interesting description of the Rice Lake Railway Bridge. The cost of the structure has already been enormous, yet it is far from being entirely serviceable or safe. It is doubtless an experiment much too costly for the people of Cobourg, and should never have been hazarded. We have no hesitation in saying, although somewhat in opposition to the last paragraph of Mr. Clarke's paper, that whether viewed in its mechanical construction or design, its location, or even its necessity, a greater engineering or commercial blunder can scarcely be found in the Canadas, or one which reflects less credit on the judgment of all concerned. The public are largely indebted to Mr. Clarke for collecting the facts, and for observing and recording the effects of ice during the past winter.

The Provincial Observatory.

We see, by the *Gazette*, that a Chair of Meteorology has been established in University College, Toronto. Professor Cherriman, who lately occupied the Chair of Natural Philosophy, has been appointed to the new Chair of Meteorology. The Rev. J. W. Kingstone, of Quebec, is the new Professor of Natural Philosophy in University College.

Terrestrial Magnetism.*

As early as 1825, Col. Sabine had inferred that an influence was exerted by the sun and moon on terrestrial magnetism. In a set of observations taken at the winter station of one of the Polar Expeditions where the declination was about 90°, and discussed by him, it was remarked: that when the Sun and Moon were on the meridian at the same time, the diurnal variation reached 5°; but that when they were at right angles to each other this quantity fell as low as 20′. The sagacity he exhibited in his inference from this isolated set of observations has been sustained by the laborious and patient observations and discussions of fifteen years. Some quantities so minute are developed in the researches, that a less time would hardly have served to separate them from the larger quantities in which they are involved. The results set forth by Col. Sabine are as follows:

1. The diurnal variation, following in all places the order of solar time, and being at its maximum about two hours after noon, changes its sign at the time of the two equinoxes. Thus, while the maximum diurnal deflection from the magnetic meridian is eastward in all places up to the 21st March, a change on the amount of deviation begins on the 22d, and is completed in about ten days, after which the maximum daily variation is to the westward, and at a mean equal to the eastern variation of the preceding six months.

2. There is an annual variation in the intensity of terrestrial magnetism, of small amount indeed, but affecting both the northern and southern hemisphere in the same manner, the intensity being greatest when the sun is in perigee, and least when it is in apogee.

3. It being well known that all the instruments in magnetic observation are from time to time affected by disturbances, or *storms* as they are often called, these disturbances have been found to be subject to a periodic fluctuation. This period has been discovered to correspond with that assigned by Schabe to the spots on the solar disc.

4. It has been clearly shown that there is a variation in magnetic declination dependent on the change of the moon's position in relation to the meridian of the place of observation, and having, therefore, for its period the lunar day. This although first inferred by Sabine from a single set of observations, was fully proved by Kriel from observations made in the Austrian States before the publication of the paper of which we are stating the substance.

Finally, the hypothesis which ascribes the variations in the phenomena of terrestrial magnetism to local variations of temperature is completely refuted.

May we not hope, that the relations of the magnetism of the earth to the two heavenly bodies which exert the greatest influence in other respects upon our planet, having been thus conclusively shown, a basis is now provided upon which to erect a science that will be as simple in its laws, and as fertile in its results as the theory of universal gravitation? Up to the present time, terrestrial magnetism as a science has had no other foundation than vague and unsupported hypotheses, or empiric propositions, which although true, have been founded on no general law. Henceforth it would appear to be as closely within the reach of mathematical methods as the tides.

* Communicated to the American Journal of Science,—May, 1855.

Miscellaneous Intelligence.

Mode of Measuring the Force, &c., of Earthquakes.—Dr. Kreil (former director of the Observatory at Prague) has invented an ingenious instrument to measure the force, duration, and direction of earthquakes. It consists of a pendulum so contrived that, whilst it can move in any direction, it cannot return. A perpendicular cylinder is attached, which, by means of clockwork, turns on its vertical axis in 24 hours. A pole with a thin elastic arm is fixed near the pendulum: this arm points towards the cylinder, and presses on it gently a pencil, by which means an unbroken line is formed on the surface of the cylinder as long as the pendulum is at rest, but, if it is put in motion by an earthquake, the pencil makes broken marks, which shows the strength, direction, and period of the earthquake.

The Reported Death of Dr. Barth.—The following is an extract of a letter from Malta, dated the 26th of March:—"A highly interesting letter from Colonel Herman, Her Majesty's Consul at Tripoli, has reached the island, dated the 13th of March. It says:—'You will, I am confident, be delighted to hear that the rumour of Dr. Barth's death was unfounded. A letter from him, dated Kano, the 15th of November last, reached me yesterday. He then calculated on arriving at Moorzouk within three months, but which, as he purposed moving by the circuitous route of Kooka, he never would accomplish. The rumour of his death was fabricated by the ex-ruler of Bornou for the purpose of possessing himself of a depôt of supplies that had been formed at Zejhan against the doctor's return, and in which he succeeded. The overthrow of this man was most fortunate, otherwise the fabricated report might have been converted into a stern reality.'"

Museum of Practical Geology.—In the House of Commons, Sir S. Northcote has enquired whether it was intended to fill up the vacancy created by the death of Sir H. De la Beche in the Museum of Practical Geology?—Lord Palmerston replied, that the lamented death of Sir H. De la Beche was felt, not only by that particular institution over which he presided, but by science generally. It was intended to fill up the vacancy by the appointment of Sir R. I. Murchison, in whose favour a memorial has been presented, which was signed by almost every name connected with the object for which that institution had been founded. The sum of £800 per annum has been attached to this appointment.

A Letter from Dr. Vogel to Consul Herman, dated Kaka, September 15, 1854, was read before the Geographical Society, April 30th 1855, announcing his returning from Mandara without having heard of the Chadda Expedition, which was navigating that river from August 7 to October 20, and has since safely arrived here. Dr. Vogel intended to proceed to the Chadda river by way of Jacoba, but he was compelled to turn back at Mandara, by the chief of that country. His future progress is intended to be directed towards Lake Fitri, and the eastern side of Lake Chad; but in the event of obstacles being insurmountable, he purposes to direct his steps to the Niger, by way of Nyffi, and descend that river on his way to Europe. Also a letter from Dr. Barth to Vice-Consul Gagliaffi, dated Kano, November 12, 1854, communicated by the Foreign Office. Dr. Barth disclaimed all desire of having his tomb prepared for him, as had been done by Dr. Vogel; on the contrary, he hoped, within three months, to be in Mursuk, on his return to Europe.

Dr. George Wilson, of Edinburgh, has been appointed Director of the Industrial Museum of Scotland. The museum is to be erected in the immediate vicinity of the University of Edinburgh. The ground has been purchased by Government.

The English papers announce the death of Mrs. Nichol, formerly Miss Bronte, who, under the *nom de plume* of Currer Bell, established a lasting reputation by the publication of *Jane Eyre*. We have two other novels from her pen, *Shirley* and *Vilette*, and all are especially distinguished for great power of conception and vigorous portrayal of character. The unfortunate lady, who was the last survivor of a family of six, died, at her father's house at Haworth, Yorkshire.

M. Braconnot, the discoverer of Xiloidine, Pyrogallic acid, Esquisetic Acid, Leucine, Populine, ect., the author of the transformation of Wood into Sugar, died at an advanced age at Nancy in the department of Meurthe on the 13th Jan., 1855, where he was established and where nearly all his labours had been performed.

Joseph Remy, who gave to humanity a new branch of useful industry well named, pisciculture, died at the village of La Bresse, in the Department of the Vosges, at the age of 51. His son has been charged by the Minister of Agriculture to re-people the Loire.

The dimensions of the Sault St. Mary Canal are as follows:—Its length is one mile and an eighth, its width 70 feet, depth 12 feet, and it is of sufficient capacity to admit steamboats of 2000 tons.

Herr R. Luther, of the observatory of Bilk near Düsseldorf, discovered a new asteroid planet of the eleventh magnitude, on the 19th of April. The new planet is to be named Leukothea. Its distinctive sign will be an ancient light-tower.

Errata.—Page 253, line 12, col. 1, for "Huron," read "Ontario." Same page, bottom line, read—"un ossiliferous."

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—April, 1855.
Latitude, 43 deg. 39.4 min. North. Longitude, 79 deg 21. min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
					°	°	°	°	°														
1	29.256	29·263	—	—	25·5	26·2				0·102	0·113	—	—	·73	·78	—	—	NWbW	NWbW	N W	26·40	...	0·1
2	·112	·169	29·636	29·529	12·2	30·7	21·9	22·1	—14·5	·053	·075	0·097	0·076	65	43	·81	·63	NWbW	NWbW	NWbW	22·10	...	...
3	·822	·901	·874	·875	18·4	37·0	27·4	27·6	— 9·4	·071	·143	·127	·112	67	65	81	72	N N W	S	Calm.	3·90	...	...
4	·918	·894	·822	·872	25·5	44·5	29·8	33·3	— 4·1	·101	·128	·148	·132	74	44	89	71	*Calm*	S b E	Calm.	1·48	...	...
5	·674	·503	·317	·483	32·3	46·0	36·0	38·1	+ 0·4	·170	·173	·194	·182	91	57	92	81	E b S	E S E	N	3·03	...	...
6	·233	·345	—	—	32·9	42·3	—	—	—	·173	·192	—	—	93	72	—	—	N N W	N W	NWb N	12·25	Inap.	...
7	·580	·526	·133	·508	24·4	40·2	31·6	32·1	— 6·3	·113	·123	·144	·131	81	50	S0	73	N b E	S S E	S W b S	5·16	...	...
8	·379	·306	—	—	34·8	54·3	—	—	—	·176	·185	—	—	88	45	—	—	Calm	S W b S	NWb N	8·83	0·035	...
9	·507	·516	·536	·517	32·9	53·2	39·1	12·6	+ 3·6	·176	·177	·214	·197	95	44	91	77	S S W	W	Calm.	6·95	0·015	...
10	·451	·489	·569	·506	36·2	40·8	32·3	36·2	— 3·3	·199	·138	·156	·163	94	55	86	79	S b W	W N W	Calm.	14·53	...	1·1
11	·668	·800	·913	·808	32·6	43·6	36·6	37·5	— 2·3	·152	·137	·189	·160	82	49	87	74	NWb N	N N W	N N W	21·09	...	...
12	·963	·906	·882	·914	33·0	51·2	37·6	10·4	+ 0·2	·118	·109	·182	·146	78	29	81	62	N N W	NWb N	N b W	7·98	...	0·1
13	·813	·726	·586	·687	36·0	36·3	35·5	36·7	— 3·7	·186	·169	·177	·181	88	79	86	84	NWb N	E	N E	4·88	0·655	...
14	·387	·345	·582	·412	38·1	60·5	41·6	47·3	+ 6·6	·220	·375	·228	·242	96	72	87	78	Calm	S S W	N N W	7·01	...	...
15	·656	·651	—	—	33·5	50·6	—	—	—	·158	·224	—	—	82	61	—	—	NWb N	S	Calm.	1·99	...	...
16	·761	·749	·746	·751	31·2	62·0	38·8	45·6	+ 4·1	·149	·312	·180	·221	84	57	77	72	Calm	S b E	Calm.	2·17	...	...
17	·659	·528	·625	·591	40·6	59·8	47·6	50·5	+ 8·8	·224	·264	·287	·265	89	52	89	75	S E	E S E	Calm.	1·78	0·095	...
18	·552	·441	·457	·473	51·3	62·9	47·0	53·6	+11·5	·350	·400	·273	·349	94	71	86	86	E b N	Calm	E S E	4·27	0·025	...
19	·443	·472	·485	·467	51·7	62·8	49·5	55·0	+12·7	·339	·333	·312	·336	90	60	89	80	Calm	N b E	Calm.	1·74	Inap.	...
20	·467	·623	·786	·639	45·2	60·9	43·4	49·0	+ 6·2	·279	·283	·184	·247	93	54	67	73	N	S b W	Calm.	4·94	...	...
21	·814	·729	·601	·707	35·0	63·0	46·3	48·3	+ 5·2	·166	·280	·266	·233	82	51	86	71	Calm	S E	Calm.	1·27	...	...
22	·563	·662	—	—	*44·2*	*61·5*	—	—	—	·238	·226	—	—	83	42	—	—	*Calm*	N b W	N b W	9·29	...	...
23	·811	·754	·704	·757	38·1	62·1	44·2	49·7	+ 6·0	·166	·299	·238	·239	72	55	84	68	Calm	S F	Calm.	0·61	...	...
24	·655	·478	·482	·537	40·4	63·8	58·0	55·0	+11·0	·221	·325	·338	·301	89	56	72	71	Calm	E S E	W S W	3·60	...	...
25	·704	·765	·674	·713	45·9	48·5	43·4	45·8	+ 1·1	·276	·296	·255	·269	90	88	92	88	N b W	E b N	E b N	6·54	0·695	...
26	·371	·521	·861	·596	44·5	51·6	39·2	45·4	+ 0·7	·274	·226	·180	·228	94	60	75	76	Calm	NWb N	W N W	14·43	...	...
27	·939	·914	·990	·950	36·7	53·3	35·5	42·7	— 2·3	·152	·082	·127	·135	71	19	62	52	W b S	N W	N b W	11·29	...	...
28	·988	·942	·809	·903	35·5	40·0	34·5	37·0	— 8·4	·180	·112	·157	·158	87	45	78	73	Calm	E	E	8·11	Inap.	...
29	·717	·683	—	—	36·3	39·6	—	—	—	·198	·211	—	—	93	88	—	—	E b N	E	E b N	6·65	0·446	...
30	·567	·415	·449	·470	40·2	54·1	48·6	47 0	+ 0·9	·235	·317	·300	·285	95	78	89	89	E b N	E S E	Calm	2·79	0·076	...
M	29·664	29·642	29·659	29·654	35·7	51·2	39·4	42·9	+ 1·4	0·192	0·220	0·206	0·208	85	56	83	75	6·11	10·78	5·25	7·57	2·0	1·6

Highest Barometer..... 29·998, at 8 a.m. on 28th } Monthly range:
Lowest Barometer..... 29·233, at 6 a.m. on 6th } 0·765 inches.
Highest registered temperature 69°·4, at p.m., 4th } Monthly range:
Lowest registered temperature 10°·7, at a.m. on 2nd } 58°·7.
Mean Maximum Thermometer..... 52°·93 } Mean daily range:
Mean Minimum Thermometer..... 32°·06 } 20.87
Greatest daily range.....37°·2, from p.m. of 14th to a.m. of 15th.
Least daily range ..... 5°·7, from p.m. of 29th, to a.m. of 30th.
Warmest day..... 19th. Mean temperature.....55°·02 } Difference,
Coldest day..... 2nd. Mean temperature.....22°·10 } 32°·92.
Greatest intensity of Solar Radiation, 81°·5 on p.m. of 21st } Range,
Lowest point of Terrestrial Radiation, 8°·6 on a.m. of 2nd } 72°·9.
Aurora observed on 9 nights: viz. 4th, 7th, 9th, 11th, 12th, 14th, 15th, 20th and 22nd.
Possible to see Aurora on 19 nights. Impossible on 11 nights.
Raining on 8 days. Raining 23·0 hours; depth, 2·030 inches.
Snowing on 3 days. Snowing 8·0 hours; depth 1·6 inches.
Mean of Cloudiness, 0·51.
Halos were observed round the moon on the 3rd at midnight and 21st at 10 p.m.
Thunder storms occurred on the 14th, 17th, 18th, 19th and 29th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—2937·92 West—2581·36 South.—624·56 East—875·65.
Mean direction of the Wind, N 36° W.
Mean velocity of the Wind, 7·57 miles per hour.
Maximum velocity, 40·0 miles per hour, from 11 a.m. to noon on 26th.
Most windy day, the 1st; mean velocity, 26·40 miles per hour.
Least windy day, the 23rd; mean velocity, 0·61 " "
Most windy hour, 1 p.m.; Mean velocity, 11·76 miles per hour.
Least windy hour, 5 a.m.; Mean velocity, 4·35 miles per hour.
Mean diurnal variation, 7·41 miles.
1st. The most windy day yet recorded at the Observatory.
4th. Robins seen. 7th. Blue birds seen.
8th. Butterflies numerous. 9th. Frogs first heard.
13th. Swallows observed. 14th. First thunder storm of the season.
16th. Ice totally gone from Toronto Bay.
18th. Violent thunder storm and hurricane from 5-30 to 6-30 a.m. during which the wind for 10 min. (5-55 to 6-05 a.m) fully attained the velocity of 38 miles per hour. Heavy rain and large hailstones fell *during the storm.* (*For details see Canadian Journal.*
21st. In digging on the north side of the tower at the Observatory the ground was found frozen to the depth of 2 feet 9 inches.
27th. 5-30 a.m. ice ¼ inch thick on small ponds and pools.

Comparative Table for April.

Year.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind Mean Velocity.	
1840	42·4	+1·1	65·9	25·3	40·6	14	3·420	2	...	...	
1841	39·2	—2·1	62·9	22·1	40·8	3	1·370	3	...	0·51	lb.
1842	43·1	+1·8	89·5	21·6	67·9	8	3·740	2	...	0·57	lb.
1843	40·9	—0·4	70·0	15·1	54·9	7	3·185	3	0·1	0·46	lb.
1844	47·5	+6·2	73·5	17·2	57·3	10	1·515	1	Inap.	0·24	lb.
1845	42·1	+0·8	66·0	14·8	51·2	11	3·290	4	1·5	1·00	lb.
1846	44·0	+2·7	79·4	24·4	55·0	10	1·300	2	1·3	0·55	lb.
1847	39·2	—2·1	65·6	8·4	57·2	8	2·870	2	4·0	0·59	lb.
1848	*41·3*	*0·0*	*65·4*	*26·5*	*38·9*	*5*	*1·455*	*1*	*0·5*	4·89	*Miles.*
1849	39·0	—2·3	70·9	23·2	47·7	10	2·655	2	1·7	7·50	Miles.
1850	37·9	—3·4	63·2	18·2	45·0	7	4·720	2	1·1	7·64	Miles.
1851	41·3	0·0	59·2	25 8	33·4	11	2·295	3	1·2	8·07	Miles.
1852	38·2	—3·1	53·8	19·8	34·0	6	1·990	4	9·4	6·68	Miles.
1853	41·9	+0·6	65·7	27·0	38·7	10	2·625	1	1·0	5·20	Miles.
1854	41·0	—0·3	65·1	22·3	42·8	12	2·685	4	2·7	6·82	Miles.
1855	42·4	+1·1	63·8	12·2	51·6	8	2·030	3	1·6	7·57	Miles.
										0·56	lbs.
M'n.	41.34		67·55	20·24	47·31	8·7	2·571	2·4	2·0	6·80	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—April, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in	Snow in	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.	Inch.	Inch.	6 A.M.	2 P.M.	10 P.M.
1	29·249	29·482	29·186	30·1	33·0	11·7	·160	·171	·085	·86	·83	·88	N E b E	N W	N W	1·25	8·71	25·00	...	...	Clear.	Str. 10.	Str. 10.
2	·013	·139	·411	5·7	15·4	24·1	062	092	097	80	83	65	W N W	W N W	N W b N	32·97	21·98	15·51	...	3·14	Snow.	Snow.	Do. 10.
3	·811	·901	30·091	9·0	32·5	25·3	062	161	123	84	78	80	N W b W	W b N	W b S	19·20	13·53	7·50	...	...	Clear.	Clear.	Cum. Str. 6.
4	30·111	30·141	30·110	25·0	45·9	37·5	141	282	218	90	86	91	W	W	W	6·28	0·56	0·59	...	...	Do.	Do.	Str. 10.
5	30·034	29·879	29·650	36·4	47·0	35·7	192	220	192	83	66	83	W S W	E b N	E N E	0·09	1·04	1·68	...	...	Cum. Str. 10.	Do.	Cum. Str. 10.
6	29·450	·434	·630	32·4	46·0	27·1	178	253	157	88	76	82	N E b E	W	N W	11·37	0·47	14·51	Inap.	Inap.	Do. 10.	Rain.	Clear.
7	·731	·700	·716	17·0	37·5	26·2	096	207	108	83	84	66	N W	W S W	W b S	8·10	10·33	8·75	...	...	Clear.	Clear	Do.
8	·710	·691	·681	27·0	44·4	39·2	119	241	199	71	79	79	S W	S S W	S S W	11·58	4·57	4·06	...	...	Do.	Str. 10.	Cum. Str 8.
9	·580	·836	·880	35·6	49·0	31·8	210	281	191	91	76	95	S W b W	S S W	W b S	2·26	1·62	1·12	...	...	Str. 10.	Clear.	Cl'r Auro. Bor.
10	·850	·789	·788	34·0	39·6	33·6	182	210	210	84	79	99	E S E	E S E	S W b W	0·23	1·50	0·07	0·500	...	Cum. Str. 8.	Rain.	Rain.
11	·801	·896	·899	33·5	38·0	36·6	186	207	199	87	81	88	E b N	N E	E b N	0·37	14·76	9·75	1·136	1·20	Snow.	Rain.	Cum. Str. 10.
12	·945	·980	·998	33·2	47·4	37·8	178	282	182	86	74	77	N	N N W	N b W	9·64	8·33	10·11	...	...	Clear.	Clear.	Cl'r Auro. Bor.
13	30·013	30·081	·890	28·0	44·0	33·9	153	241	186	88	79	87	N b W	N b W	W	0·15	0·16	Calm	...	...	Do.	Cir. Cum. 4.	Do.
14	29·770	29·611	·660	34·1	39·8	36·2	204	233	212	95	90	94	E N E	S	S S E	0·62	1·55	Calm	0·166	...	Cir. Str. 10.	Rain.	Cum. Str. 9.
15	·800	·891	·800	33·6	52·(	39·2	214	326	233	99	81	90	W	S W b S	S W b W	1·07	2·20	0·72	...	...	Clear.	Clear.	Cl'r Auro. Bor.
16	·969	30·070	30·060	34·4	58·6	46·1	212	367	209	99	73	74	W b S	S W b W	S W b W	4·62	8·03	Calm	...	...	Do.	Do.	Do.
17	·990	29·950	29·946	35·7	71·6	47·7	210	414	291	71	55	86	S S W	W S W	W N W	2·37	1·50	1·17	Inap.	...	Do.	Cir. Cum. Str. 4.	Str. 10.
18	30·000	·810	·740	41·0	47·1	40·0	210	271	210	74	79	79	N E b E	N E b E	N E b E	2·54	5·00	9·51	0·296	...	Str. 10.	Cir. Str. 10.	Cum. Str. 10 h.
19	29·742	·800	·889	36·7	44·3	40·6	218	223	227	91	73	83	N E	N E	N E b E	Calm	6·94	2·17	...	...	Cum. Str. 10.	Do. 8.	Str. 10.
20	·811	·860	·960	30·1	46·6	40·1	178	213	227	86	74	85	N E	N E b N	S	2·16	1·02	Inap.	...	...	Str. 10.	Cir. Cum. Str. 8	Clear.
21	·930	30·081	30·000	36·6	63·2	49·2	174	307	251	77	53	70	S W b W	S W b W	W b S	0·89	6·35	5·07	...	...	Clear.	Clear.	Do.
22	·881	29·892	30·091	44·1	55·7	43·6	223	372	201	83	78	81	S W b W	S W b W	N	0·25	2·92	6·92	0·140	...	Do.	Str. 10.	Do.
23	30·141	30·089	29·943	30·6	61·0	54·3	160	352	283	86	60	69	N	S S W	W S W	1·11	1·65	6·99	...	...	Do.	Light Cirr.	Cum. Str. 8.
24	29·884	29·880	·852	49·9	70·8	51·2	270	421	300	72	57	78	W S W	W b S	N E	3·62	2·92	1·95	Inap.	...	Do.	Clear.	Do. 10.
25	·917	30·111	30·161	40·0	57·3	43·0	218	398	252	85	84	85	N E b N	N E b N	E	18·12	3·75	5·69	...	...	Cum. Str. 10.	Do.	Clear.
26	·731	29·400	29·819	40 6	51·7	41·1	245	337	217	92	87	88	S S E	S b E	W N W	36·50	19·64	15·27	1·010	...	Rain.	Cir. Str. 8.	Cum. 4.
27	·861	30·012	30·105	31·6	40·6	34·9	195	179	136	91	68	87	W	W N W	W N W	26·18	24·27	21·25	...	Inap.	Cum. Str. 8.	Cir. 2.	Clear.
28	30·201	30·190	30·189	28·0	43·0	33·7	135	377	153	75	52	74	N W	W N W	N W b N	16·22	7·87	4·64	...	...	Clear.	Clear.	Do.
29	30·214	30·121	29·949	33·5	55·8	41·7	187	351	253	89	79	91	N E b E	E S E	S E b S	1·12	5·04	7·78	...	...	Do.	Do.	Str. 10.
30	29·731	29·892	·732	42·5	65·0	48·2	272	306	302	92	49	86	S S E	S b E	S b E	0·87	3·75	1·37	0·916	...	Rain.	Str. 10.	Do.

Barometer	Highest, the 29th day	30·214
	Lowest, the 2nd day	29·013
	Monthly Mean	29·849
	" Range	1·171
Thermometer	Highest, the 17th day	76°·8
	Lowest, the 2nd day	5°·7
	Monthly Mean	40°·15
	" Range	71°·1
	Mean Humidity	·808
Greatest Intensity of the Sun's Rays		89°·9
Amount of Evaporation in inches		1·70 in.

Rain fell on 10 days, accompanied by thunder on 1 day, amounting to 1,191 inches, raining 41 h. 20 min.

Snow fell on 4 days, amounting to 4,31 inches. Showing 17 hours 40 minutes.
Most prevalent Wind, W. Least prevalent Wind, N.
Most Windy Day, the 26th day; mean miles per hour, 33·80.
Least Windy Day, the 13th day; mean miles per hour, 0.10.
Aurora Borealis visible on 3 nights. Might have been seen on 10 nights.
The electrical state of the atmosphere has been marked generally by high tension; and during the thunder storm of the 18th day indicated a very high tension of a negative character.
The *Rossignol*, the harbinger of the spring in Lower Canada, 1st seen on 9th day.
Swallows first seen on the 14th day. Frogs first heard on the 21th day.
Crossing on the ice at Montreal ceased on the 22nd.
Ozone.—The amount of Ozone on the atmosphere was less during the month than usual.

Monthly Meteorological Register, Quebec, Canada East, April, 1855.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P. M.	10 P. M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	10 P.M.	2 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·218	28·909	28·621	29·926	29·9	32·8	16·3	26·3	0·160	0·173	0·392	0·142	96	93	95	95	E	E N E	W b S	19·7	16·0	17·9	...	6·0	
2	28·646	·744	29·109	·833	5·9	14·9	18·7	13·2	·062	·085	·083	·077	100	93	78	90	W b N	W b N	W b N	19·7	34·0	21·3	...	8·0	
3	29·446	29·699	·851	29·666	13·6	28·1	24·7	22·1	·065	·091	·101	·087	76	62	73	70	N W	W	Calm.	22·7	10·0	0·0	...	...	
4	·912	·818	·883	·871	17·8	39·2	33·6	30·2	·085	·109	·107	·100	83	45	56	61	S W	NWbW	Calm.	3·8	6·2	0·0	...	...	4th. Aurora at 9 p. m., and Auroral light at 10 p.m.
5	·859	·737	·551	·717	29·8	42·9	31·0	34·6	·130	·157	·154	·147	78	57	89	75	Calm.	E N E	E N E	0·0	12·4	21·6	...	...	
6	·313	·184	·297	·265	29·1	35·9	29·5	31·5	·141	·156	·112	·136	88	74	69	77	E N E	N W	N W	27·8	8·0	18·3	0·204	...	6th. Aurora observed at midnight.
7	·498	·460	·529	·496	13·5	28·6	24·1	22·1	·073	·090	·097	·087	83	57	73	71	N W	S S W	Calm.	12·4	10·0	0·0	...	...	
8	·637	·569	·720	·642	24·0	38·3	35·8	32·7	·093	·121	·139	·118	70	51	67	63	E S E	Calm.	S	2·0	0·0	3·8	...	...	
9	·629	·643	·697	·656	32·3	36·6	31·2	34·1	·160	·198	·179	·179	87	92	92	90	Calm.	Calm.	Calm.	0·0	0·0	0·0	0·066	...	9th. Aurora observed at 8
10	·763	·747	·718	·743	33·8	35·2	34·1	34·4	·159	·184	·190	·178	81	90	97	89	S S W	S E b E	E N E	3·8	5·2	13·9	0·699	Inap	p. m. Sky overcast at 10
11	·735	·735	·726	·732	32·6	33·5	33·3	33·1	·177	·178	·168	·175	96	94	88	93	E N E	E N E	E N E	10·0	13·9	18·3	0·132	...	p. m.
12	·726	·682	·751	·720	30·7	42·8	36·2	36·8	·147	·163	·083	·131	84	59	39	61	N E	Calm.	N N W	3·8	0·0	10·0	...	...	12th. A very fine Aurora
13	·870	·812	·882	·865	25·1	30·6	28·1	27·9	078	·115	·130	·108	57	67	84	69	Calm.	E S E	Calm.	0·0	10·9	0·0	...	...	observed.
14	·721	·436	·390	·516	26·0	38·5	35·7	33·4	·114	·140	·208	·154	79	60	100	80	N E	Calm.	S W	5·2	0·0	7·2	0·448	...	
15	·518	·591	·818	·652	33·5	43·3	33·3	38·0	·172	·151	·168	·164	91	54	76	74	Calm.	S W	S S W	0·0	6·2	2·0	...	...	
16	·680	·710	·747	·712	33·6	50·8	43·5	42·6	·165	·165	·151	·160	86	45	54	62	W b S	W N W	Calm.	5·2	6·2	0·0	...	...	
17	·747	·614	·756	·706	42·6	58·6	48·4	49·9	·174	·186	·247	·202	65	39	74	59	Calm.	N W	S S W	0·0	9·3	6·2	Inap.	...	
18	·791	·761	·589	·714	37·4	41·0	36·9	38·4	·164	·153	·128	·148	74	60	59	64	E N E	E N E	E N E	11·3	7·2	16·0	0·184	...	
19	·568	·622	·693	·628	31·8	33·1	31·7	32·2	·179	·166	·147	·164	100	88	82	90	E N E	E N E	E N E	17·9	16·0	10·9	...	...	
20	·685	·635	·756	·692	32·6	42·7	34·6	36·6	·162	·196	·187	·178	88	72	94	85	E N E	Calm.	Calm.	5·2	0·0	0·0	...	...	
21	·814	·[illegible]	·747	·774	30·4	53·4	39·8	41·2	·148	·196	·163	·169	88	48	67	68	W S W	Calm.	Calm.	5·2	0·0	0·0	...	...	
22	·643	·571	·839	·685	38·4	52·7	42·0	44·4	·181	·131	·126	·147	79	59	48	62	E	W	Calm.	2·0	8·0	0·0	0·249	...	21st. At 11 p.m. a bright
23	·939	·839	·660	·813	31·7	50·6	43·6	43·0	·144	·179	·170	·164	72	57	61	63	Calm.	W	Calm.	0·0	0·0	0·0	...	...	Aurora observed through a
24	·659	·654	·716	·680	42·6	55·3	33·0	45·6	·200	·196	·138	·178	74	46	58	59	W N W	S W	E S E	8·0	8·8	17·6	0·046	...	break in the clouds.
25	·811	·930	30·001	·923	33·8	39·0	34·7	35·8	·171	·130	·150	·150	89	55	74	73	E	E N E	E	16·0	16·5	7	...	...	27th. At 2 p. m. very
26	·802	·372	.....	.....	35·4	35·2			·147	·201			73	98			E	Calm.	E	13·9	0·0		1·914	...	heavy gusts of wind, varying
27	·548	·564	29·759	·624	32·9	35·5	29·8	32·7	·109	·142	·072	·108	58	70	43	57	N W	N W	N W	27·8	22·7	21·3	...	...	in velocity from 39 to 50
28	·936	·901	·941	·927	17·7	36·0	29·3	27·7	·052	·058	·076	·062	51	26	47	41	N N W	N W	N W	16·9	17·6	3·8	...	...	miles per hour.
29	30·030	·923	·912	·956	21·8	43·6	32·7	32·7	·085	·059	·106	·083	70	21	57	49	N E	W S W	N N E	3·8	3·8	7·2	...	...	
30	29·892	·768	·735	·798	34·0	38·6	36·6	36·4	·105	·083	·191	·126	54	79	88	74	N E	E b S	E b S	8·8	9.3	5·2	0·692	...	*Note.*—At 2 p. m. of 23rd, 28th, and 29th, the observed Dew Point was respectively 18°5, —2°8, and 3°2.
	29·666	29·623	29·669	29·6527	29·03	39·73	33·67	31·14	0·133	0·140	0·140	134	79	62	72	71				8·24	8·91	8·27	4·434	14·0	

Maximum Barometer, 6 a.m. on the 29th ..... 30·030
Minimum Barometer, 10 p.m. on the 1st ..... 28·621
Monthly Range ..... 1·409
Monthly Mean ..... 29·6527
Maximum Thermometer on the 17th ..... 59°·8
Minimum Thermometer on the 1st ..... 5·9
Monthly Range ..... 53·9
Mean Maximum Thermometer ..... 43·01
Mean Minimum Thermometer ..... 25·91
Mean Daily Range ..... 17·10
Mean Monthly Temperature ..... 34·14

Greatest Daily Range of Thermometer on 1st ..... 30°·5
Least Daily Range of Thermometer on 19th ..... 2°·8
Warmest Day, 17th. Mean Temperature ..... 49·9
Coldest Day, 2nd. Mean Temperature ..... 13·2
Climatic Difference ..... 36·7
Possible to see Aurora on 16 Nights.
Aurora visible on 16 Nights.
Total quantity of Rain, 4·434 inches.
Total quantity of Snow, 14·0 inches.
Rain fell on 11 days.
Snow fell on 3 days.