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Address of the President of the Canadian Institute.

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Messrs. Vice-Presidents and Gentlemen of the Canadian Institute,—I cannot but regard it as a compliment that you have placed me a second time in the office of President, though I confess I had difficulty in persuading myself that I ought not peremptorily to decline it, for reasons which I stated on the last similar occasion, and which I need not now repeat.

It was my expectation, and (if I may take the liberty of saying it) my hope that you would have found it possible this year to nominate a gentleman to preside over your proceedings, who, having some leisure time at his command, which I have not, would possess the further qualification, which I equally want, of being able, from his previous pursuits, to apply his leisure usefully in aiding your exertions for the promotion of science. That you have not found it convenient to relieve me has arisen, I suppose, from some impediment not yet explained; but let me take the liberty of intimating that, whenever the time shall come (and I think it cannot be distant), when you can make a more satisfactory arrangement, you need not allow yourselves to be embarrassed, in making the change, by any scruples as regards myself, for that would, I assure you, be an obstacle altogether imaginary.

In the mean time, you will allow me to bring before you a few considerations which have occurred to me respecting the condition and prospects of the Association.

The last annual report, read at a late meeting by the Secretary, gave a favourable view of the state of the Canadian Institute, both in regard to the increasing number of its members, and the condition of its finances.

It appears that in the last two years the number of members has increased from 112 to 333, of which 135 joined in the year 1853, and 86 in the last year.

This is certainly a very encouraging progress; and it seems not too much to say that the number of members thus early attained, is such as to afford a reasonable assurance of the efficiency and stability of the Institution, and to give good ground of hope that, by an united exertion, its affairs may soon be placed in a condition that will afford to its more active members additional facilities, and enable the Association to attract to itself more general countenance and support.

Of course, whatever hopes may be indulged of good to be accomplished, and the reputation to be acquired by the Canadian Institute, the extent to which such hopes can be realized must wholly depend upon the talent and knowledge to be found among its members, and the use which they may be able and willing to make of them in promoting the interests of science. The inducements to voluntary exertion in so honorable a cause, are the same here that exist in other countries, and the field for exertion is neither more limited nor less interesting. There are, indeed, in Canada, at the present time, some peculiar inducements to the prosecution of scientific inquiries, which need not be pointed out.

No expense is grudged, and no labour spared, in cultivating the minds of the youth of the Province of all ranks, and such are the efforts which are being made to this end, that it does not appear extravagant to say that we may expect, in a few years, to find ourselves living among a people, who, to speak of them in the mass, will be as able as any other that can be named, either ancient or modern, to comprehend the nature and value of discoveries that may be made in the arts and sciences, and to adopt and improve upon such suggestions as may be thrown out by men of superior genius and attainments.

If the system of Common School education which pervades all parts of Upper Canada, shall continue to be maintained in full efficiency, which there is no reason to doubt, the number of those who can enter with pleasure and profit into discussions upon subjects of science will be immensely increased; and those whose generous aim it may be to enlighten and improve others by communicating freely the results of their own researches and experiments, will find abundance of hearers and readers able to understand and reason upon their theories.

There is good ground, too, for the expectation that, with the advantage of the public libraries, selected as they are with care and judgment, which are being formed within the several counties, and even within each school section, a spirit of inquiry will be fostered, and an ambition excited to be distinguished in scientific pursuits, which we may hope will in time add largely to the number and variety of interesting contributions to the Institute

It is a most gratifying circumstance that the Legislature, at the suggestion of the Government, has, within a few weeks, added to its usual grant of £250 for the general purposes of the Association, a further sum of five hundred pounds expressly towards providing a building for its accommodation. This generous act of encouragement is of great importance, because it seems to insure the early accomplishment of the object which it is intended to assist, and it denotes a confidence in the proceedings of the Association, as well as an interest in its success, which cannot fail to supply additional motives to exertion. It gives, also, good ground for hope that as time advances, and as the benefits which may be derived from this Association become more and more developed, the Legislature will not be found wanting on their part in affording such further aid as may seem necessary, provided they find that their grants have been judiciously applied, and have been made the means of conferring a corresponding benefit upon the community.

The grant which I have mentioned will be found sufficient, it may be hoped, to enable the Society to proceed in erecting a building without delay, especially as no part of it will be required to be expended in purchasing a site—a charge from which the Institute will happily be relieved by the generous liberality of the late Secretary. If durability, convenience, and neatness of design be principally consulted in the style of building, without sacrifices being made to architectural ornament, to which our funds will be unequal, the Association need not, I hope, be long without enjoying a home of its own; not one by any means adequate to what we may venture to suppose its purposes will in the course of time require, but one in most respects better than the temporary home, which, by the kindness of the Government, we are at this moment occupying.

It will be no difficult matter, I suppose, with the assistance which the professional knowledge and good taste of many of our members will supply, to devise a plan of such a building as will admit of extension, from time to time, by additions which will be in harmony with the main design. The first step will naturally be to fix upon a plan of such a building, or portion of a building, as will answer reasonably well for present purposes, and to ascertain what sum would be sufficient to complete it. We should then soon be able to satisfy ourselves whether the cost could or could not be met by such efforts as are within our power. I have no apprehension that it could not be; on the contrary, I am persuaded it would be found by no means impossible to proceed with reasonable despatch, and without interruption to the completion of a suitable building.

And there can be no question, as I think we must all feel, that we are bound so to act as to show that we are not indifferent to the interest which has been so kindly manifested by the Legislature in favour of this Association. The encouragement which has been given to us does indeed impose upon us a corresponding responsibility, and makes it a duty to show that we are not unworthy recipients of the public bounty.

In connection with this consideration of duty, it is not out of place to allude to a proposition which has been made by a very zealous friend of science, and urged, indeed, upon the Institute with a laudable earnestness and perseverance. I refer to a suggestion of Major Lachlan, one of the members of the Institute, who resides in Montreal, that we should endeavour to make provision for taking and recording, at different points in Upper Canada, a series of simultaneous meteorological observations, such as might materially assist, if conducted with care and perseverance, in elucidating the laws and explaining some of the phenomena of nature. Indeed, Major Lachlan, in a clear and well-considered paper, which was read before the Institute, pressed more than one object of this description upon its attention; and I shall best state his suggestions by using his own words:

He proposed, in the first place, that there should be in some manner established, through the intervention of the Society, a well-organized chain of daily simultaneous meteorological observations at a number of well-selected stations throughout Canada, with Toronto for its centre, to be connected with a similar arrangement which he ventured to hope might be set afoot in each of the Lower Provinces, and so conducted as to be readily connected with the extended system of meteorological registers already in operation in the United States, under the fostering auspices of the Government, and the various philosophical Associations of that country. He recommended, also, in the second place, the establishment of a simultaneous record of the rise and fall of the great Canadian Lakes, throughout their whole extent.

No one, I think, can rationally question the value of these suggestions. It is obvious that if this Association could be made the means of accomplishing such objects upon a system well considered and steadily carried out, they would be rendering a service to the cause of science which could not fail to be highly appreciated, and they would be placing themselves in a most favourable light, not merely with our own Government and people, but with all friends of science on this continent and elsewhere.

It may be objected that it is too early to engage in an attempt of this magnitude, for that our resources are inadequate to the undertaking. I confess my inability to dispose satisfactorily of this difficulty, because I have not a sufficient knowledge of what ought to be the details of an extensive system of this kind, to be able to count the cost. But it is clear that to count the cost, with the assistance of those who are able to estimate the difficulty, must be the first step; and I would with much diffidence suggest that it seems a reasonable mode of dealing with such a question, that we should first consider what would be the probable expense attending the proposed system of simultaneous observations (carried on in the first place throughout Upper Canada,) upon a scale as extensive as would be desirable, both in regard to the number of stations, and the variety and minuteness of the observations to be recorded. Then having arrived at a safe opinion upon that point, the next step would be to determine how that expense, which no doubt would be large, could be brought within the compass of our means, by a reduction in the number of stations, or by limiting the range of observations to be conducted at each point.

One considerable charge, no doubt, would be for the instruments that would be required, because, to be of any value for such a purpose, they should be of the best construction; but I do not imagine that a serious difficulty would be found in meeting that charge.

The expense of arranging the observations when collected and returned, and of classifying and comparing them, and printing the results, would no doubt be rather formidable, but I take the greatest difficulty to be, the finding or providing a person capable of conducting such observations at each station which it might be desirable to establish, and more especially at some of those points remote from towns and settlements, where the observations that might be taken would possess a particular value, but where we could scarcely expect to find gentlemen residing who could be relied upon for conducting accurately observations which require some degree of leisure, minute and patient attention, and competent intelligence, and skill to use the instruments entrusted to them.

Any difficulty of this kind, however, applies rather to the number and position of the points of observation to be maintained, than to the practicability of establishing some system of the kind on a scale, which though confined as to extent, might still be eminently useful to the cause of Science, and supply valuable materials for confirming or disproving theories which in themselves are of great interest, and can only be established or refuted by such means. I take the liberty of suggesting that if something satisfactory in this way can be effected by any exertion at all within our means, and with such public aid as we might hope to procure, it would be unwise to incur unnecessary delay. It is only from a series of observations of each particular kind, conducted through a succession of years, that results can be obtained on which reliance can be placed. We should be impatient, therefore, to begin what can only produce fruits so gradually, and there is a particular reason against delay which appears to me to have much force in it.

Among the speculations which interest men of science, we find it frequently discussed, what effect has been produced upon climate by the progress of cultivation in countries which originally were covered thickly with timber. Now we have at this moment large tracts in this Province, particularly in the north-western part of Upper Canada, in which the change from wilderness to cultivated fields is going on most rapidly—some in which it is but just commencing, and others in which it is not yet actually begun. In all portions of this immense tract, the process of clearing the land of its timber is certain to go on with speed; for the advantages of Upper Canada as regards climate, fertility of soil, means of transportation, and proximity to markets are now at length known and understood, and population is pouring into the new townships with surprising rapidity. It is to be considered too, that our system of assessment laws ensures reports being annually made of the number of acres of cleared land in each township,—thus affording the means of comparison, year by year, as to the quantity of land in cultivation, and its proportion to that which remains still in a state of nature,—and affording also through such comparison the means of judging what effect the clearing up of the country has upon the climate, as regards heat and moisture. It would seem to give occasion for regret, that such an opportunity of obtaining a knowledge of interesting facts of this description should be lost, for the results of observations taken under circumstances so favourable, might materially tend to correct false impressions, and establish the truth upon points which have given rise to a great deal of speculation among philosophers.

For these reasons, among others of more weight, that might be mentioned, it does seem to deserve immediate and earnest consideration, whether progress cannot at once be made in acting upon the suggestions which I have referred to.*

I will detain you, gentlemen, but a few moments longer, while I solicit your attention to some reflections which have naturally presented themselves in connection with the Institute.

We have here an association formed for the advancement of Science, established by Royal Charter, and which the Government and Legislature have very early condescended to countenance and encourage by some very gracious marks of confidence and goodwill. The Province, I will venture to say, contains a very fair proportion, if not its due proportion, of men of cultivated minds, active intelligence, and of laudable enterprise and ambition.

Can there then be any reason why the Canadian Institute may not be made to do for Canada whatever the spontaneous and united efforts of learned men have been able to do in other countries for the promotion of the Arts and Sciences?

There is certainly nothing in our political system to fetter the mind—no barrier to mental improvement presented by any impediment physical or moral, but on the contrary, unusual encouragement from the certainty that the decisive, comprehensive, and well-sustained measures that have been taken for the general diffusion of education must soon have the effect of raising the standard of knowledge among the inhabitants of Canada much above the ordinary level in other countries.

If a large expense were inseparable from the maintenance of such associations as this, still that consideration need not operate more strongly as a discouragement in Canada than in other countries, for it would be no easy matter to point to any part of the world in which wealth is more rapidly accumulating, though undoubtedly, the proportion of individuals possessed of large wealth is less in Upper Canada, than in countries where commerce and manufactures have flourished for a much longer period. But in truth large means are not required for our purpose. Nothing can be more simple and inexpensive than the system by which literary and scientific institutions of this nature proceed to accomplish whatever it is in their power to effect.

A building suitable for the purpose is clearly indispensable: this calls for an expenditure which must be once incurred, and the earlier the better. But after that shall have been accomplished, although large means might no doubt be usefully applied in promoting objects fairly within the range of such institutions, yet a large expenditure is by no means necessary for the attainment of its purposes to an extent that would be useful and satisfactory.

There are contingent expences of an ordinary kind not to be avoided, for which a certain and adequate provision should be made with as little delay as possible, for until this has been done on a reasonable scale, there can be neither comfort nor efficiency in the management of any such Association. But a very moderate sum will be sufficient for this purpose and for all beyond it, such as the gradual collection of books, and whatever is necessary for illustrating the different Sciences we may trust to the benefactions of liberal patrons, and the continued aid of the Legislature, which we may trust will not be withheld if the institution shall be found to be steadily advancing in the path of usefulness.

As an instance of the manner in which this Association may be made to assist in serving very important interests, I refer to the late publication in a Supplement to the Canadian Journal of the several papers upon the improvement and preservation of the Harbour of Toronto, which were submitted by different gentlemen to the Harbour Commissioners, with diagrams illustrating the subject—which subject I need not say is one of extreme interest not only to this rising city but also to a large surrounding country.

And I may refer to the papers of Mr. Billings, a native of this Province, which have been spoken of so approvingly in the last report of the Council, as proof of the tendency which the Canadian Institute must have to stimulate and encourage those whose tastes happily lead them to prosecute with ardor such investigations.

They have thus presented to them an opportunity of submitting conveniently the fruits of their observations for discussion and examination among men of similar intellectual habits and pursuits—who can estimate their value and understand the difficulties which have been overcome—and they have in the Journal of the Institute a channel well adapted for conveying the results of their researches to those quarters where they are most likely to receive attention.

Whatever can assist materially to strengthen in the minds of Canadian youth an attachment to such studies, or to assist them in pursuing them, must be acknowledged to be important not merely as it tends to render them more valuable members of society, but as it makes them in themselves more happy, multiplying their sources of rational and innocent enjoyment, increasing their self-respect, and saving them from the dangers of idleness, and from the remorse which sooner or later must follow an ill-spent life.

Observations Suggested by Specimens of a Class of Conchological Relics of the Red Indian Tribes of Canada West.

Read before the Canadian Institute by DANIEL WILSON, LL.D.;
Professor of History and English Literature,
University College, Toronto.

Among the numerous relics of the Indian tribes pertaining to the northern regions of this continent, there is one class, consisting of certain large species of the sea shells of the Gulf of Mexico and the West Indian Islands, and of articles of personal ornament fashioned from these, which appear to present some special claims to attention.

* The suggestions referred to have undergone the consideration of the Committee of the Council, which very recently reported, but they thought it advisable, before recommending any special steps to be taken, that correct information should be procured of the working of a system, which has been in operation some years in the United States; but they had taken steps to procure such information, and were not prepared until it was received to recommend any definite course of action

Two of these tropical American shells, both of them specimens of the *pyrula perversa*, the native habitats of which are the Antilles, and the Bay of Campeachy, on the main land, have been recently presented to the Canadian Institute; not as additions to our specimens of native conchology of the tropics, but as Indian relics pertaining to the great northern chain of fresh water lakes. The first of these, presented by Dr Richardson at a meeting of the Institute in January last, was discovered on opening an Indian grave-mound, at Nottawasaga, on the Georgian Bay, and along with it a gorget made from the same kind of shell. The second example, presented by Sandford Fleming, Esq., was brought by him from the Fishing Islands, near Cape Hurd, on Lake Huron; while a third specimen now exhibited, the property of James Beaty, Esq., constituted one of the contents of a large sepulchral depository in the same Northern Lake district. It was found lying at the head of one of a group of Indian graves, along with a copper kettle, and other relics; and the graves are reported to have contained additional specimens of the pyrula.

About the year 1837, one of those extensive Indian Ossuaries, which have furnished so many relics pertaining to the period of ancient Indian occupation of the Canadian clearings, was accidentally discovered in the township of Beverly, twelve miles from Dundas. Here an elevated ridge, running from north to south, was covered by an old growth of full-grown beech trees, standing somewhat widely apart; and across this, and consequently running from east to west, a series of deposits of human bones were exposed, ten or eleven of which were opened. They contained an immense number of bones, of both sexes and of all ages, promiscuously heaped together, and interspersed with many Indian relics, which furnished the chief temptation to their exploration. These depositories of human bones are referred to by Dr. Schoolcraft, as specially characteristic of the ancient period of occupancy of the Upper Lakes, and are described as consisting of "sepulchral trenches or ossuaries, in which the bones of entire villages would seem to have been carefully deposited, after the bodies had been previously scaffolded or otherwise disposed of, till the fleshy parts were entirely dissipated, and nothing left but the osteological frame." In commenting on this Indian sepulchral rite, he further observes: "A custom of this kind may be supposed to intervene, in the history of nations, between that of burning the body,—which is still practised, we are told, among the Tacullies of British Oregon, or New Caledonia,—and that of immediate interment, which is so generally practised."* On enquiring, however, of Mr. Paul Kane, whose practical knowledge of Indian rites and customs is so extensive, he informs me that in the above remarks this American ethnologist confounds the customs and sepulchral rites of two entirely distinct classes of the Indian tribes of North America. Among the Chippeways, the Pottowatamays, the Menamonies, the Ottawas, and the Indians of the Six Nations, the practice prevailed of interring their dead in large sepulchral depositories, into which the bones were promiscuously gathered, after the final honours and sacrifices had been offered to the deceased. This custom fully accounts for the large Ossuaries brought to light within the original localities of these tribes. The other practice of depositing the corpse on a scaffold or raised platform above ground, constitutes the entirely distinct and final sepulchral rite of other tribes lying to the north and west of the former, including the Chinouks, Kliketats, Coulitz, and all the Indians of the Columbia River. The most common and characteristic elevated bier of these western tribes is the canoe, raised on poles, and decorated with relics pertaining to the deceased; and with the offerings of his friends. These Indian biers are invariably erected on an isolated rock or island, inaccessible to beasts of prey, and are regarded as the final resting-places of the dead.* With reference to the ossuaries of the eastern tribes, such as those now more especially referred to, discovered at Beverly, it may be noted that they indicate a permanent location of the tribe, and may afford some clue to the duration of their occupation of the region of country where such are brought to light.

One of the depositories of bones opened at Beverly, and carefully explored, was found to measure forty feet in length, with a breadth of eight feet; and throughout this entire area it consisted, to a depth of six feet, of a solid mass of human crania and bones.

Along with numerous specimens of clay pipes, beads, amulets of red pipe-stone, copper bracelets and personal ornaments of different kinds, obtained from the Beverly ossuaries, there were found various shell-beads, a worked gorget made from a large sea-shell, with the original nacre of red not entirely gone, and two entire specimens of the large tropical sea-shells already referred to. One of these furnishes another specimen of the *pyrula perversa*, and the other is described as the *pyrula spirata*, a shell, if I mistake not, peculiar to the western coasts of Central and South America. The shell beads, it may be added, appear to be of precisely the same kind as some described in the transactions of the American Ethnological Society, (Vol. 1, 1835) which were discovered far south, in the Grave creek mound, Virginia.

The interest which pertains to these conchological Indian relics, manifestly depends on the fact of our thus discovering along the shores of our great inland chain of fresh-water lakes specimens of the large tropical sea-shells of the Atlantic and Pacific Coasts of Central America, and of the West Indian Isles. The attractions offered by this and other allied species of the large and beautiful tropical shells are sufficiently apparent, and are by no means limited to the untutored tastes of the Red Indian, nor to the products of the Mexican coasts.

The *Pyrum*, and others of the large and beautiful shells of the East Indian seas, of the species *Turbinella*, are highly prized by the natives of the neighbouring districts; and this is especially the case with a sinistrorsal variety which inhabits the coasts of Tranquebar and Ceylon, and is made use of by the Cingalese in some of their most sacred rites. The greater number of the genus *Pyrula*, are dextrorsal, or rise in a spiral line from right to left, so as to present the mouth on the right side when held with the elongated canal or tube downward. Such is not the case, however, with the two species referred to as belonging to this continent, and hence apparently the origin of the name given to the more abundant of these, the *Pyrula Perversa*.

In the East Indian Seas, however, examples of sinistrorsal monstrosities of the native species are occasionally met with, and are highly prized. Such reversed shells of the species *Turbinella*, are held in special veneration in China, where great prices are given for them. They are kept in the pagodas by the priests, and are not only employed by them on certain

* History, Condition, and Prospects of Indians of the United States," vol. 1, pp. 68, 102.

* Mr. Paul Kane exhibited at the meeting an oil painting executed by him from sketches taken on the Coulitz River, of a group of the canoe biers of the Coulitz Indians, among whom he resided for some time.

occasions as the sacred vessels from which they administer medicine to the sick; but it is in one of these *sinistrorsal turbinella* that the consecrated oil is kept, with which the emperor is anointed at his coronation.

It is probably in reference to this custom that Meuschen, who considered what is now recognised as the full-grown shell a different variety from the smaller one—called by him the *Murex Pyrum*—gave to it the name of *Murex Sacrificator*.* These shells are often curiously ornamented with elaborate carvings, fine specimens of which are preserved in the British Museum. In the Synopsis of the Zoological Galleries in that Museum, it is remarked, "The *Turbinella* from their form have been called turnip shells. These are often used as oil vessels in the Indian temples, and for this purpose are carved and otherwise ornamented, as may be seen by some in the collection. When reversed, they are much sought for by the Ceylonese, and highly valued; one of these reversed shells is in this collection. They are said to sell for a very large price in Ceylon and China."

In the great basin of Lake Superior, and in the higher latitudes beyond—the regions occupied by the Algonquin Indians—the traces of older occupation are, with one exception, few and slight. Dr. Schoolcraft remarks of this region:—"There are no artificial mounds, embankments, or barrows, to denote that the country had been anciently inhabited. . . It is something to affirm that the mound-builders, whose works have filled the West with wonder, had never extended their sway here. The country appears never to have been fought for, in ancient times, by a semi-civilized, or even pseudo-barbatic race. There are but few darts or spear heads. I have not traced remains of the incipient art of pottery, known to the Algonquin and other American stocks, beyond the Straits of Saint Mary, which connect Lakes Huron and Superior; and am inclined to believe that they do not extend in that longitude beyond the latitude of 36° 30′. There is a fresh magnificence in the ample area of Lake Superior, which appears to gainsay the former existence, and exercise by man, of any laws of mechanical or industrial power, beyond the canoe-frame and the war-club. And its storm-beaten and castellated rocks, however, imposing, give no proofs that the dust of human antiquity, in its artificial phases, has ever rested on them."

It is in this region that the great mineral treasures are found which attracted the attention of the native Indians long before the discovery of this continent by Columbus or Cabot, and in that prehistoric period of America furnished the chief element of traffic, and the consequent source of intercourse between the north and south. I have referred in a former communication* to the working of the copper by the Indians of Lake Superior, without any skill in the metallurgic arts, and indeed without any precise distinction between the copper which they mechanically separated from its native matrix, and the unmalleable stone or flint out of which they were ordinarily accustomed to fashion their spear and arrow heads. This metal, Dr. Schoolcraft remarks, "was employed by the Indians in making various ornaments, implements, and instruments. It was used by them for arm and wrist-bands, pyramidal tubes, or dress ornaments, chisels and axes; in all cases, however, having been wrought out exclusively by mere hammering, and brought to its required shapes without the use of the crucible or the art of soldering. Such is the state of the manufactured article, as found in the gigantic grave creek mound, and in the smaller mounds of the Scioto Valley, and wherever it has been scattered, in early days, through the medium of the ancient Indian exchanges. In every view which has been taken of the subject, the area of the basin of Lake Superior must be regarded as the chief point of this intermediate traffic in native copper. In exchange for it, and for the brown pipe stone of the Chippewa River of the Upper Mississippi, and the blood-red pipe-stone of the Coteau des Prairies west of the St. Peters, they received certain admired species of sea-shells of the Floridian Coasts and West Indies, as well as some of the more elaborately and well-sculptured pipes of compact carbonate of lime, grauwacke, clay slate, and serpentines, of which admirable specimens, in large quantities, have been found by researches made in the sacrificial mounds of the Ohio Valley, and in the ossuaries of the Lakes. The makers of these may also be supposed to have spread more northwardly the various ornamented and artistic burnt-clay pipes of ancient forms and ornaments, and the ovate and circular beads, heart-shaped pendants and ornamented gorgets, made from the conch, which have received the false name of ivory, or fine bone and horn. The direction of this native exchange of articles appears to have taken a strong current down the line of the great lakes, through Lake Erie and Ontario, along the shores of the States of Ohio and New York, and into the Canadas. Specimens of the blood-red pipe-stone, wrought as a neck ornament, and of the conch bead pendants and gorgets, &c., occur in the ancient Indian burial grounds, as far east as Onondaga and Oswego, in New York, and in the high country about Beverly, and the sources of the several small streams which pour their waters into Burlington Bay, on the north shores of Lake Ontario."*

In view of this ancient traffic between the north and south, the conchological relics now referred to are of peculiar value. Whatever doubt may be thrown on the derivation of the specimens of ancient native manufacture, or of the copper found in sepulchral and other deposits in the Southern States, and in Central America, no question can be made as to the tropical and marine origin of the large shells now exhibited, and brought from the inland districts, lying between the Ontario and Huron Lakes, or the still remoter shores and islands of Georgian Bay, at a distance of not less than two thousand miles from the shores of Yucatan, on the main land, where the *pyrula perversa* is found in its native locality.

It is obvious from the large and cumbrous size of the American *pyrulæ*, that they must have possessed some very peculiar value or sacredness in the estimation of the Indian tribes of the northern regions, to encourage their transport from so great a distance, through regions beset by so many impediments to direct traffic. Their transport to the Canadian Lake regions appears to have been practised from a very remote period. Dr. Schoolcraft describes specimens of the *pyrula perversa* obtained by him in these regions in an entire state, among traces of Indian arts and customs, "deemed to be relics of the Ante-Cabotian period;" and from the circumstance of their discovery in sepulchral mounds, and laid at the head of the buried chief, with his copper kettle and other peculiarly prized relics, the *pyrula* of this continent would appear to have been held in no less veneration by the natives of America, than the Asiatic species now are by the native Cingalese, or the more civilized and cultivated priests of China. The examples found are generally more or less marked or ornamented. The

* Dillwyn's Descriptive Catalogue of Recent Shells, p. 569.

* Canadian Journal, vol. ii., p. 214

* History, &c., of Indian Tribes," vol. i., p. 67, 68.

shell now exhibited from Nottawasaga has the upper whorls removed, so as to expose the internal canal. Five lines, or notches, are cut on the inner face of the canal, and it is perforated on the opposite edge, showing in all probability where the wampum, scalp-lock, or other special decoration of its owner was attached. It also exhibits abundant traces of its long and frequent use. The surface is smooth and polished, as if by constant handling, except where it is worn off, or decayed, so as to expose the rough inner laminæ of the shell: and all the natural prominences are worn nearly flat by frequent attrition. We shall not probably greatly err in assuming the *pyrula* thus venerated by the ancient Indians of Canada West, to have closely corresponded to the *Conopas*, or rude Penates of the Peruvians, as described by Rivero and Von Tschudi. Any singular or rare object in nature or art seems to have sufficed for one of these Peruvian minor deities, amulets, or charms. "Every small stone or piece of wood of singular form was worshipped as a conopa. These private deities were buried with their owners, and generally hung to the neck of the dead."* The choice of natural objects for their singularity of form is thus seen to present the same psychological characteristic which leads to the Chinese veneration for the sinistrorsal turbinella.

Trifling as such relics of Indian superstition, or of the rude traffic of barbarous tribes, may appear, they are not without some value to us, both in regard to the light they throw on the ancient history of this continent, and also, perhaps, in respect to some of the forms in which the progressive civilization of its new occupants may be modified by the same physical causes which largely controlled the ancient intercourse between north and south, and between west and east.

In no respect is this continent, to which these Indian relics pertain, more directly diverse from that of Europe than in its broadly-marked physical characteristics. The greatest diameter of Europe is from east to west, so that its chief area of occupation is embraced within a nearly similar range of temperature. Yet along with this climatological homogeneity, its surface is broken up by mountain ranges, and its coasts indented by bays, estuaries, and land-locked seas, by means of which its various populations are even now isolated as by clearly defined natural lines of demarcation. Altogether different is it with this continent, where the great levels are so little broken, that not only the boundaries of properties and townships, but even of states, provinces, and dominions, are drawn without reference to any natural features of the country, excepting in the cases of the great lakes, the St. Lawrence, the Rio Grande, and very partially in that of the Mississippi. We have to note, moreover, that the most important navigable river of Europe flows from east to west, in one parallel of latitude, and through a population in all ages rendered somewhat homogeneous by influences of climate and all external circumstances: but the Mississippi and the Missouri flow together through 20° of latitude, with all the varieties of climate still further increased on a continent which extends its widest area within the arctic circle, and where consequently the curves of equal temperature, in the isothermal lines drawn across the two continents, approach as much towards the equator in the meridian of Canada as they recede from it in that of the west of Europe, while under the tropics the isothermal lines are everywhere parallel to the equator.

Looking back into the most ancient history of Europe, we find that that continent also had its northern mineral treasures; its *tin*, pertaining to the Kassiterides, or British Islands, and its amber, found then as now in most abundance on the shores of the Baltic. But it was by maritime intercourse, through the agency of the Phœnician merchantmen of Asia, that the north of Europe exchanged its mineral treasures for the coveted possessions of regions lying towards the tropics. Herodotus, in the earliest known reference to the British Isles as the source of tin, refers to them only to declare his total ignorance of them; and in noticing the rumour that amber is brought from the northern sea in which they lie, he says:—"I am not able, though paying much attention to the subject, to hear of any one that has been an eye witness that a sea exists on that side of Europe." Nor did this singular isolation, so peculiarly characteristic of Europe, disappear even in the later ages of Roman rule. Dr. Arnold, in contrasting our knowledge of the globe with the ignorance of earlier ages, remarks:—"The Roman colonies along the Rhine and the Danube looked out on the country beyond those rivers as we look up at the stars, and actually see with our eyes worlds of which we know nothing."

The class of Indian relics to which I have drawn attention, when taken into consideration with the copper weapons, implements, and ornaments of Southern grave mounds, appear to throw a light on the past history of this continent in its antehistoric ages, and to show it then as now, as clearly distinct in political as in physical characteristics from ancient or modern Europe. Europe never could be for any length of time the area for a nomadic population. In America, with its great unbroken levels, even the home-loving Anglo-Saxon becomes migratory, and seems to lose in a degree his old characteristic of local attachment. In Europe the diverse ethnological elements are still kept apart by its physical features: the Iberian of Ante-Christian centuries surviving in the Pyrenees, and the Gaul and Briton of the first century finding still their representatives on the coasts of Brittany, and in the mountains of Wales. But on this continent a homogeneous aboriginal population appears to have occupied nearly its entire area; and now that its ancient tribes are being displaced by the colonists that Spain, England and Ireland, Poland, Hungary, France and Germany, pour unceasingly on its shores, the distinctions of Iberian, German, Celt and Saxon, which have survived there for well nigh two thousand years, appear to vanish almost with the generation that sets foot on this continent. When we consider how largely all European history has been affected by the peninsular character of Greece and Italy, and by the insular character of Britain; as well as, in a secondary degree, by the similar isolation of Spain, France, Denmark, and the Scandinavian peninsula, we cannot fail to perceive in this a key to some of the contrasting elements of fusion already noticeable throughout this continent.

It is obvious that a very different future awaits America from that which fills the ample page of history in relation to Europe. The wars of Marlborough and Wellington, in so far as they constituted practical protests against the dismemberment of Europe's old nationalities, were assertions of the eternal laws written by the finger of God on the whole physical aspect of the continent; and it is in the assertion of a like great principle that England has now once more unsheathed her sword. But on this continent, our own Canadian frontier is, if not the only one, at least one of the very few clearly defined lines, whereby nature has recorded her enduring protest against *annexation*. Southward and Westward, the

* "Peruvian Antiquities," translated by F. L. Hawks, D.D., p. 172

Anglo-Saxon may still wander, as the old nomade Indian did, when his frail barque bore down the Mississippi the metallic products of our most northern lake shores; and by the same highway the prized products of tropical seas were transferred to the regions of our great inland lal es. One opposing element alone interferes with the apparent adaptation of this continent for one vast empire or republic of the future, and that is the climalotogical variations consequent on the very element of essential difference between America and Europe: its extreme diameter extending from North to South. The variations of temperature implied in this, are, as has been noticed above, still further increased by the conformation of the continent; and in accordance with this we already see nature asserting the influence of her immutable laws; and while she still facilitates the interchange of the products of the North and South, as in those old times of Indian traffic to which the relics now brought under notice belong, every year seems to increase growing characteristics which so clearly separate the planter of the Southern States from the Anglo-Saxon settlers on the northern area of this continent.

On the Effect of Pressure on the Temperature of Fusion of Different Substances.

By Mr. Hopkins.*

The author began by stating that it was most fortunate for the success of his researches that, in the very commencement of them he had applied to Mr. W. Fairbairn, who had, with the utmost enthusiasm, entered into his views, and aided him to the utmost extent of the incomparable facilities afforded by his celebrated establishment. Mr. Hopkins then gave a short description of the apparatus which he had used, and the successive steps by which failures in some contrivances had led him to th : which were ultimately found to answer. In particular how, from the enormous pressures to which the substances were subjected, they found it impossible to use glass to see what was going on within the cylinders in which the substance to be experimented upon was inclosed; which difficulty had been got over by causing an iron ball to rest on the top of the substance within the cylinder; while its presence deflected a sma.. magnetic needle outside, but the instant the melting of the substance inside permits the ball to fall, the magnetic needle returning to its position indicated the .t. The use of this needle made it necessary to make the cylinder of brass; and Mr. Hopkins stated that with the first cylinder they used, they were surprised to find when enormous pressures were laid on that the liquid within wasted; the cause of this they long sought to discover in vain, until at length they found that it was escaping through the very pores of the metal in thousands upon thousands of jets so minute as to be almost imperceptible. This they remedied by greater care in the casting of the cylinder, and hammering it well on the outside. The method of laying on the pressure was by a piston well packed and forced down by a lever. This they adopted as the simplest means of getting a numerical estimate of the actual compressing force.—Mr. Hopkins then described the method by which the friction has been determined which opposed the motion of the piston, and so diminished the pressure by so much. This was done by noting the weight required to drive the piston in a certain small distance; this, less by the friction, was equal to the compressing force; then noting the weight which allowed the piston to return exactly to its first position; this together with the friction, was equal to the compressing force; but as these two compressing forces are equal, the friction is equal to half the difference of the two weights used, and is then a matter of very simple calculation. Mr. Hopkins then gave the results of the experiments, of which the following are the most important:—

Substances experimented upon.	Pressure in lbs. to the Square Inch.			Temperature Fahrenheit at which it liquefied.		
Spermacetti	0	7,790	11,880	124°	140°	176·5°
Wax	0	7,790	11,880	148·5	166·5	176·5
Sulphur	0	7,790	11,880	225	275·5	285
Stearine	0	7,790	11,880	158	155	165

Of course when the weight 0 was on the piston, the substance was under atmospheric pressure, or about 15lb to the square inch; and the pressure of 7,790lb per square inch was just that at which the Britannia Bridge had been raised. Mr. Hopkins had also tried the metallic alloys which fuse at low temperatures, but had not detected any elevation of fusing temperature required by increasing the pressure; but these experiments required to be repeated and confirmed before they could be relied upon.

Nouvelles Experiences sur le Mouvement de la Terre au Moyen du Gyroscope.

By M. Foucault.*

The author spoke in French, but very distinctly, and the apparatus was so simple, beautiful, and exquisitely constructed, that the experiments all succeeded to a miracle, and fully interpreted the author's meaning as he proceeded. The gyroscope is a massive ring of brass connected with a steel axis by a thinner plate of the same metal, all turned beautifully smooth, and most accurately centred and balanced; in other words, the axis caused to pass accurately through the centre of gravity, and to stand truly perpendicular to the plane of rotation of the entire mass. On this axis was a small but stout pinion, which served when the instrument was placed firmly on a small frame, containing a train of stout clock-work, turned by a handle like a jack, to give it an exceedingly rapid rotatory motion on its axis. But to this clock-work frame it could be attached or detached from it instantly. This revolving mass was only about three inches wide, and four of them were mounted in frames a little differently. The first was mounted in a ring, attached to a hollow sheath, which only permitted the axle and the pinion to appear on the outside, so that it could be laid hold of, or grasped firmly in the hand, if the pinion were not touched, while the mass inside was rapidly revolving without disturbing that motion. By this modification of the gyroscope, the author afforded to the audience a sensible proof of the determination with which a revolving mass endeavours to maintain its own axis of permanent stable rotation, for upon setting it into rapid rotatory motion, and handing it round the room, each person that held it found himself forcibly resisted in any attempt to turn it round either in his fingers, to the right hand or left, or up or down, or in his hands if he swung it round. So that the idea was irresistibly suggested to the mind, that there was something living within which had a will of its own, and which always opposed your will to change its position. The second modification pre-

* British Association for the Advancement of Science, 1854.—*Athenæum.*

* British Association for the Advancement of Science, 1854.—*Athenæum*

sented the mass suspended in a stout ring, which was furnished with projecting axles, like the ring of the gymbal. These axles could be placed in a small frame of wood, bushed with brass. This small frame, when placed on a piece of smooth board, could be turned freely round by turning the piece of board on which it rested as long as the gyroscope was not revolving, friction being sufficient to cause the one to turn with the other; but when the gyroscope was set rapidly revolving, in vain you attempted to turn the frame, by turning the board on which it rested, so determinately did it endeavour to maintain its own plane of rotation, as quite to overpower the friction. In the third modification of the gyroscope, it was suspended in gymbals, so exquisitely constructed that both the gyroscope proper and the supporting gymbals were accurately balanced, so as to rest freely when placed in any position in relation to the earth. By this the author showed most strikingly the effect of any attempt to communicate revolving motion round any other axis to a mass already revolving, for, on placing the gymbals in a frame of wood while the gyroscope was not revolving, it remained quite steady; but, when thrown into rapid revolving motion, the slightest attempt to turn the frame round to the right or to the left was instantly followed by the entire gyroscope turning round in the gymbals, so as to bring its axis to coincide with the new axis you endeavoured to give it, with a life-like precision, and always so as to make its own direction of revolution be the same as that of the slightest turn you impart to it. Having thus demonstrated the necessary effect of combining one rotatory motion with another, he then proceeded to demonstrate palpably that the earth's revolving motion affected the gyroscope in precisely a similar way. Having, by the screw adjustments, brought the gyroscope, in gymbals, to a very exact balance, it remained fixed in any position when not revolving. But rapid rotatory motion having been communicated to the gyroscope mass as soon as the gymbal supports are placed on the stand, you see the entire apparatus, slowly at first, but at length more rapidly, turn itself round, nor ever settle until the axis, on which the gyroscope is revolving, arranges itself parallel to the terrestrial axis, in such a sense as to make the direction of the revolving gyroscope be the same as that of the whole earth. He next showed that the determination with which it did this was sufficient to control the entire weight of the instrument, though that amounted to several pounds, for, taking the ring gyroscope, from the side of the ring of which a small steel wire projected, ending in a hook, the wire coinciding with the prolongation of the axis of the gyroscope: of course, when not made to revolve, the hook, if placed in a little agate cup at the top of a stand, would permit the instrument by its weight, to fall instantly, as soon as the support of the hand was taken from it. But, upon imparting to it rapid rotatory motion, it stood up even beyond the horizontal position, so as to bring its axis of rotation nearly to the same inclination to the horizon as the axis of the earth, while the whole acquired a slow rotatory motion round the point of the hook; and so steady was its equilibrium while moving thus, that a string being passed under the hook and both ends brought together in the hand, the whole may be lifted by the cord off the stand and carried revolving steadily about the room. Next, to show the motion of the earth sensibly, he placed the gymbal gyroscope suspended freely by a fine silk fibre in a stand with the lower steel point of its support resting in an agate cup; a long light pointer projecting from the ring carried a pointed card which passed over a graduated card arch of a circle placed concentrically with the gyroscope; upon imparting rapid rotatory motion to the gyroscope the index was seen as the earth moved to point out the relative motion of the plane of rotatum exactly in the same way: the law of the motion being also the same as that of the well-known pendulum experiment. Lastly, he set the ring gyroscope in motion, and by placing a small pointed piece of brass at the end of the axle on the ring, the instrument went immediately through all the evolutions of a boy's top on the floor, humming meanwhile loudly also.

On Arctic and Antarctic Currents, and their Connexion with the Fate of Sir John Franklin.

By Mr. A. G. Findlay. *

Allusion was made to a former paper, read to the Association at Hull last year, describing the currents of the Atlantic and Pacific Oceans, in the latter of which it was thought some new features were described. It was shown that a great similarity existed in the movements of the two oceans,—a system of westerly drifts between the tropics, which on arriving at the western side of each ocean turned north and south from the equator on each side of it, and re-curving when beyond lat. 30° N. and S., they passed to eastward, and re-entering their course on the eastern sides, they formed a complete circulatory system. In the present paper it was shown how the Polar regions were connected with these movements, and how tropical warmth reached the poles, and the cooling effects of the extreme climates were brought into more temperate zones. The nature of the enormous magnitude of the antarctic ices, which offer a perfect contrast to those of the North Pole, was explained.—From the southern part of the southern connecting current, which encircles the southern part of the globe between lat. 40° and 50° S., a system of S.E. drifts is found, impelled by the prevailing N.W. winds. These drifts, as found by Capts. Sir J. Ross, Durville, Wilkes, Ballery, and others, run at a rate between ten and twenty-five miles per day towards the vast icy barrier whose limits, as far as known was explained. This enormous collection around the South Pole is purely the result of atmospheric deposition, and is remarkable as lying to the south of the greatest area of ocean water on the earth's surface, and over which the winds pass towards it; but from the fact of all countries in south latitude having arid climates, and those in the north the reverse, this was another evidence that the evaporation of the northern hemisphere is deposited in the south, and *vice versa.* One fact analogous to those observed in the North Atlantic Ocean,—of dust once supposed to be volcanic, but proved to be microscopic Crustacea,—was cited as occurring near to the antarctic circle, and also adding a confirmation of the theory of the atmospheric circulation. The face of the icy barrier, consisting of cliffs elevated from 150 to 210 feet above the sea level, perfectly wall-faced, and extending continuously for hundreds of miles, was an evidence that ocean currents did not penetrate that circle, which we only know from its external edge. These table-topped barriers were the result of surface deposition, and, being above 1,000 feet thick, were of sufficient solidity to be protruded bodily downwards from the interior lands, which might consist of mountains of solid ice of sufficient inclination seawards to allow the set of the stratified upper portions to glide downwards, bearing on their under surfaces immense quantities of earth and detached rocks. The floating ice met with in such large quantities is the result of the breaking up of the detached table-topped crags, and from the face of the cliffs, and not on the

* Athenæum.

surface of the sea, which maintained a comparatively high temperature. This high temperature was brought by the S.E. current previously alluded to as setting from the southern portions of the south connecting current, and the rates and duration of which were inferred from the examples cited at from ten to twenty-five miles per day. Arriving at the face of the icy barrier this current was lost, close under it there being but little movement felt; what there was being a drift to the *westward*,—a circumstance similar to what has been related north of Siberia. On the surface, then, no outlet is appreciable for the waters, but the drifting of the immense tabular bergs, immersed 800 feet, and rising 200 feet out of the water, was a proof of a northern or rather a north-easterly set, which by different observations was considered to move from twelve to eighteen miles per day when free from the barrier. The zone of equal temperature of the ocean, 39°·5, was observed by Capt. Sir James Ross to encircle the South Pole in a mean latitude of 56° 26′ S. On this circle the temperature was the same from the surface to the bottom, and was connected with these surface and subsurface currents moving in opposing directions. The icebergs and drift ice being thus transported into more temperate climates disappear, and the north-east drift adds its share to the eastward currents, which strike the western shores of Patagonia, and then turning northward form the Peruvian current, and against the west coast of Africa forming the cool south African current. In this manner the frigid influences of the antarctic climate were attempered, and brought into connexion with the other portions of the great world of waters, and illustrated that mighty system of ocean circulation everywhere evident in its effects on climate and the subject of meteorology in general. In the North Polar Sea a very different order of things exists: in many points a perfect contrast to those just described; but, as the subject was more familiar, it was not so largely entered into, the chief features only being selected. The fact of the Arctic Basin not being a sea of perpetual ice (or one solid mass of ice) was an evidence that it was pervious to the influences of more temperate climates; and that there being no old ice was a proof that means were at work for renewing it and dissipating the surplus of what the short summer does not dissolve. The current through Behring Strait,—an offset of that which the author first described, in 1851, as the Japanese current, similar in the Pacific to the Gulf Stream in the Atlantic,—was shown to be an unimportant northerly set through the narrow strait, and, therefore, was quite inadequate to produce any marked effect on the polar ices. The main body of warm water passed between Greenland, or rather Iceland, and Norway, and was an offset to the north-east of a portion of the Gulf Stream. The mode of this drift was explained by a diagram of the winds in lat. 47½° north, long. 32½° west, derived from Commander Maury's observations, but which showed some imperfections in the recording or arrangement. In this the great prevalence of the south-west over the north-east winds was clearly seen; and to this was owing the drift, which renders England and Iceland habitable, and enters the Arctic Basin, as has been described. The course of this stream was then traced step by step, eastward, till it emerged into Baffin's Bay or north of Greenland, between it and Spitzbergen, whence, passing southwards, it joined the southerly set down Baffin's Bay, across the banks of Newfoundland, transporting the deeply immersed bergs into the warm waters of the superficial Gulf Stream, and then, turning to the south-west, between the Gulf Stream and the coast, it was last at Cape Hatteras. In the north, then, as well as in the south, the circulatory system is apparent, and then each portion of the waters of the ocean visits, by turns, every portion of the earth. The fate of Sir John Franklin was next brought forward as a collateral subject. Mr. Findlay held that the statement, that two deserted and dismantled ships, seen on the ice on the north edge of the Newfoundland Banks on April 20, 1851, was quite possible, and that if true, of which he had no doubt, they were the unfortunate Erebus and Terror. The perfect consistency of the story as related by the different parties, and the improbability of any whaling ships remaining perfect for many years, led to the conclusion that they could be no other. Similar instances, as related by Dr. Scoresby, the parent of Arctic meteorology, of the drift of Sir James Ross, and of the Grinnell Expedition, might all be taken as evidences of the possibility of the statement. It was, therefore, believed that Franklin's track might be followed up the Wellington Channel from 1846 for one or two seasons; that, proceeding to the west or north-west, perhaps for 500 miles each step, he either got fixed in the main pack or else in some enclosed bay, like that of Capt. M'Clure as at present, and then deserting his ships, has not been able to reach any point where rescue was at hand; and that the ships, obeying the universal law, that all floating bodies within the Polar Basin must come out, drifted by the ocean currents either through Smith's Sound, found clear by Capt. Inglefield in the succeeding spring, or round Greenland, and down between it and Iceland, reached, without any great chances of demolition, the spot where they were stated to have been seen. There is no difficulty in allowing all this, and in finding perfectly analogous cases; but the main point, the ultimate end of the unfortunate Expedition, it was thought, would ever remain shrouded in the most painful mystery, as the search had only just begun in the right direction, and the last ray of hope would be extinguished if the present Expeditions return without bringing any intelligence.

Mean Meteorological Results at Toronto during the Year 1854.

Read before the Canadian Institute, Saturday, 20th January, 1855, by J. B. CHERRIMAN, M.A.

The mean temperature of the year 1854 has been above the average of 14 years by 0°·87, due chiefly to excess of heat in July and October, but reduced by a fall in December; the months form May to November were above their average temperatures; the rest, with the exception of March, below.

The year is the hottest on record, with the exception of 1846.

The hottest month was July, and the coldest February, which is in accordance with the normal march of the temperature; the *climatic difference* is 51°·4, which is 7°·9 above the average.

July was the hottest month ever recorded, being 5°·7 above its average temperature, and no less than 3°·6 above the next inferior, which was July 1850.

The hottest day was July 3d (81°·3), and the coldest January 28th (1°·6), the difference between these being 79°·7.

Thr greatest daily range occurred on July 4th, amounting to 44°·5, and the range on the whole year is 110°·0, between 99°·2 on the afternoon of August 24th, and —10°·8 on the morning of February 3d, the former being by 4°·9 the highest temperature ever recorded.

The deviations at particular times from the normal march of the temperature, as given by Col. Sabine from 12 years' observations, have been extremely numerous and excessive, there being no less than 46 instances where the temperature, at the hour of observation, deviated from the normal by more than twenty degrees; of these the greatest number (39) were in defect, and occurred mainly in January and December. The most extreme were at 10 P.M., December 19th, 31°·6 below, and at 2 P.M., August 24th, 25.°·7 above.

Among periods of days remarkable for continued deviation, are the following:—

From January 23d to 25th, inclusive, mean deviation	—16°·7
February 2d to 6th	—15°·4
March 13th to 16th	13°·1
„ 24th to 29th	—15°·4
September 5th to 6th	16°·2
December 4th to 8th	—13°·5
„ 18th to 22d	—20°·6

On the whole, the year presents a remarkable instance of conformity with Col. Sabine's law of "permanence in the mean annual temperature, combined with great variability during the year."

By an inspection of the thermic anomalies, it will be seen that only one month (July) has been above the temperature due to it from geographical position, all the rest being more or less below.

Arranging the year into the ordinary seasons, we find their mean temperatures to be—

	Winter (1853-54)	Spring.	Summer.	Autumn.
	23°·3	41°·3	68°·2	49°·1
Difference from averages of 14 yrs	—1°·6	+0°·4	+3°·2	+2°·4

The summer is the hottest recorded, and the autumn is only exceeded by that of 1846.

The thermic anomalies for the respective seasons are—

Winter —11°·2; Spring —8°·2; Summer +0°9; Autumn —3°·7.

These anomalies, however, ought each to be increased by about one degree, to reduce them to the sea-level, and the summer will thus have been about 2° hotter, the remaining seasons still considerably colder than their geographical position requires; the year thus partly confirming, partly being an exception to Dove's conclusion that "the summers of North America are not warmer than is due to their latitude, while the winters are much colder."

The mean humidity of the year is ·79, having attained a maximum in February and a minimum in July. Complete saturation has only occurred four times—on January 12th, at 2 P.M.; February 13th, at 8 A.M.; March 2d, midnight; March 3d, at 6 A.M. The lowest humidity (·27) occurred on August 7th, at 2 P.M.

The extent of clouded sky on the average of the whole year is ·59, so that nearly three-fifths of the sky has been overcast on the mean of the whole. The clouds were least prevalent in July, most in December; and no less than seven months have been on the average more than half overcast.

The mean direction of the wind was from N. 42° W., with a mean velocity of 6·02 miles per hour, making the most windy year of the series of 8 years. In all the months except September and October, the velocity was in excess of the average, and in November and December particularly so.

The depth of rain fallen has been 27 76 inches, which is 3·58 inches less than the average: and if to this we add 4 95 inches for the amount of rain equivalent to the fall of 49·5 inches of snow, we have a total of 32 71 inches. The chief deficiency in the fall of rain occurred from August to December, the earlier part of the year having been in excess. As usual, the greatest depth fell in September, and the least in December. The fall of rain was distributed over 114 days, and that of snow over 52, so that there have been 199 perfectly fair days, on which neither rain nor snow fell. Of these August enjoyed the most (26) and February the least (8).

The whole period of time during which rain was falling is 17·4 days, and snow, 8·4; so that, though the fall of rain and snow was distributed over 166 days, the total duration of the fall only amounts to 25·8 days.

Frost occurred in every month except June, July, and August, the latest in Spring being on May 22d, and the earliest in Autumn on September 21st. The last snow of Spring was on April 29th, and the first of Autumn on October 16th. Toronto-bay was clear of ice on April 8th, and frozen over on December 2d; being crossed on foot on the morning of the 8th, this being unusually early. Only a few days about 26th October gave ill-defined indications of the Indian summer.

The number of thunder-storms during the year has been 58, more numerous than usual. Of these none occurred in January and February, one in March; the number increasing up to 16 in July, and then again descending to none in December. The most violent occurred on April 25th and 26th, May 17th and 20th, July 4th and 8th, from 19th to 22d, August 13th, and September 6th. That of July 4th was a complete hurricane, the wind for some minutes reaching a velocity of 60 miles per hour.

During the year there have been 203 nights the state of which would have permitted Aurora to be seen if it existed. On 55 of them Aurora was actually observed. Only two displays of the first magnitude occurred, on March 27th and April 10th, both accompanied by great magnetic disturbance. On July 10th and September 10th perfect Auroral arches were formed, but without active features.

EDUCATION IN SCOTLAND.—From a parliamentary paper recently issued, it appears that there are in Scotland 4,984 schools, whereof 1,138 are burgh or parochial schools, 2,104 endowed (other than burgh or parochial) schools, 1,567 adventure schools, and 175 charity schools. The burgh or parochial schools have 1,342 teachers, and educate 85,190 scholars, of whom 10,257 are educated gratuitously; the endowed schools, with 3,265 teachers, educate 175,031 scholars (20,362 gratuitously); and the adventure schools, with 2,150 teachers, educate 87,660 scholars, of whom 2,173 are gratuitously educated: and the charity schools, with 284 teachers, educate 16,600, all gratuitously, with the exception of about 300 children, who make some slight payment. The total number of teachers is 7,041; of scholars, 364,481; and of gratuitously educated children, 49,100. The total salaries and incomes of these schools amount to 271,641*l.* [illegible] 2*d.*, of which burgh or parochial schools have 78,382*l.* 3*s.* 6*d.*; the endowed, other than burgh or parochial schools, 117,844*l.* 15*s.* 2*d.*; the adventure schools, 64,621*l.* 1*s.* 6*d.*; and the charity schools, 10,793*l.* 13*s*

General Meteorological Register for the Year 1854. Provincial Magnetical Observatory, Toronto, C.W.

Latitude 43° 39′·4 North; Longitude 79° 21′·5 West. Elevation above Lake Ontario, 108 feet. Approximate elevation above the sea, 342 feet.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sep.	Oct.	Nov.	Dec.	Year 1854.	Year 1853.
Mean Temperature	23.57°	21.09°	30.68°	41.04°	52.20°	64.12°	72.47°	68.03°	61.04°	49.52°	36.84°	21.88°	45.21°	44.78°
Difference from Average (14 years)	—1.16	—2.20	+0.39	—0.15	+0.97	+2.53	+5.68	+1.56	+2.75	+4.30	+0.15	—4.42	+0.87	+0.44
Thermic Anomaly (Lat. 43°-40′ N.	—9.2	—13.6	—9.4	—9.2	—5.9	—0.5	+3.8	—0.5	—0.5	—4.3	—6.4	—14.2	—5.8	—6.2
Highest Temperature	46.4	42.8	55.1	65.1	71.4	92.5	98.0	99.2	93.6	75.4	55.4	44.8		
Lowest Temperature	—5.4	—10.8	7.4	20.2	25.2	35.2	42.5	45.6	35.8	26.4	13.8	—7.0		
Monthly Range	51.8	53.6	47.7	44.9	46.2	57.3	55.5	53.6	57.8	49.0	41.6	51.8	50.90	48.47
Mean Maximum Temperature	29.31	29.62	36.32	47.82	61.82	74.50	84.79	80.72	72.59	58.97	42.08	29.46		
Mean Minimum Temperature	13.53	9.15	22.94	30.69	37.90	49.84	58.46	55.26	49.09	41.32	28.13	14.38		
Mean Daily Range	15.78	20.47	13.38	17.13	23.92	24.66	26.33	25.46	23.50	17.65	13.94	15.08	19.77	16.89
Greatest Daily Range	39.6	37.1	27.1	35.4	32.2	41.8	44.5	38.4	35.9	27.4	29.1	31.2		
Mean Height of Barometer	29.6067	29.6947	29.5246	29.6379	29.5661	29.5514	29.6403	29.6477	29.7008	29.6955	29.4392	29.5873	29.6077	29.6299
Difference from Average (12 years)	—.0231	+.0822	—.1068	+.0308	—.0174	—.0304	+.0430	+.0116	+.0467	+.0557	—.1796	—.0590	—.0122	+.0100
Highest Barometer	30.219	30.172	30.698	30.233	29.986	29.955	29.885	29.845	30.142	30.121	30.196	30.245		
Lowest Barometer	28.693	29.002	28.788	29.045	29.066	29.287	29.308	29.384	29.302	28.731	28.685	28.917		
Monthly Range	1.526	1.170	1.310	1.188	0.920	0.668	0.577	0.461	0.840	1.390	1.511	1.328	1.074	0.986
Mean Humidity	.84	.86	.85	.80	.74	.74	.71	.72	.79	.80	.80	.80	.79	.79
Mean Elasticity of aqueous Vapour	0.122	0.110	0.156	0.207	0.288	0.434	0.550	0.478	0.430	0.287	0.180	0.109	0.279	0.271
Mean Direction of the Wind	W. 12° N.	N. 7° E.	W. 40° N.	E. 37° N.	E. 24° S.	N. 10° E.	W. 32° S.	W. 28° N.	N. 18° W.	N. 25° E.	W. 1° S.	W. 43° N.	N. 42° W.	N. 38° W.
Mean Velocity (miles per hour)	6.86	6.91	8.02	6.82	5.38	4.12	4.26	4.74	4.31	4.60	7.58	8.66	6.02	5.08
Difference from Average (8 years)	+0.16	+0.13	+1.43	+0.13	+0.03	+0.02	+0.20	+0.48	—0.47	—0.09	+2.09	+2.26	+0.53	—0.33
Mean of Cloudiness	0.78	0.71	0.62	0.63	0.38	0.49	0.35	0.41	0.47	0.65	0.75	0.79	0.59	0.57
Total Amount of Rain (inches)	1.270	1.460	2.425	2.685	4.630	1.460	4.805	0.455	5.375	1.495	1.115	0.590	27.765	23.550
Difference from Average (14 years)	—0.515	+0.421	+0.803	+0.077	+1.628	—1.514	+1.053	—2.354	+0.998	—1.465	—1.799	—0.909	—3.576	—8.076
No. of Days Rain	7	5	9	12	11	9	9	5	14	15	13	5	114	109
Total Amount of Snow (inches)	7.5	18.0	2.8	2.7	Inapp.					Inapp.	1.3	17.2	49.5	53.2
Difference from Average (12 years)	—5.0	+0.0	—6.4	+0.7						—1.2	—1.2	+4.2	—8.9	—6.1
No. of Days Snow	11	15	3	4						3	4	12	52	52
No. of Fair Days	13	8	19	14	20	21	22	26	16	13	13	14	199	204
No. of Auroras Observed	3	4	12	8	6	2	4	1	6	5	3	1	52	57

On the Cause of the Aurora Borealis.

BY PROF. A. DE LA RIVE.*

(*Continued from page 124*)

Agreement of the theory with the facts.

We have remarked that all observers agree now in regarding the aurora as an atmospheric phenomenon, and we have cited facts in support of this view. One more fact may be alluded to here which places it beyond doubt; it is from the observations on the aurora borealis published in the history of the Voyage of Captain Franklin Lieutenant Hood and Dr. Richardson were 55 miles apart for the purpose of making simultaneous observations, in order to ascertain the parallax of the phenomenon and consequently its height. The result from three trials place it alike at a height of 6 to 7 miles. On the 2nd of April, at the most northerly station a brilliant arc was seen 10° above the horizon; at the other station, it was not visible. The 6th of August the aurora was at the zenith at one station, and 9° in height at the other. On the 7th of April it was again in the zenith at the first station, and 9 to 11° in height at the second.

Again, Hansteen, and after him, MM. Lottin and Bravais, were led to believe as a consequence of their observations, that the arc of the aurora is a luminous ring whose different parts are sensibly equidistant from the earth, and which is centered around the magnetic pole so as to cut at a right angle all the magnetic meridians which converge towards this pole Such a ring is the auroral arch and its *apparent* summit is necessarily in the magnetic meridian of the place. M. Bravais also observes that the arc seems to have a kind of movement of rotation from the west to the east passing by the south. From this description the phenomenon is quite similar to the result of the experiment described above, and the direction of the rotation in the luminous ring is precisely that which ought to take place according to the laws governing the mutual action of currents, if it be the positive electricity which passes from the atmosphere to the surface of the earth, thence to penetrate about the north magnetic pole, reunite with the negative electricity, and thus constitute the current.

The diameter of the luminous ring will be greater, as the magnetic pole is more distant from the earth's surface, since this pole ought to be found in the intersection of the plane of the ring with the axis of the terrestrial globe.

It hence results that each observer sees the summit of the auroral arc in his own magnetic meridian; and hence only those on the same magnetic meridian see the same summit, and can take simultaneous observations for ascertaining the height.

If the summit of the arc pass the zenith of the observer, he is surrounded on all sides by the matter of the aurora, or the auroral influences which proceed from the earth, and then, if at all, the crackling sound which has been alluded to should be heard. If it does not reach the zenith, the observer is then outside of the region; and the aurora is more or less distant according to its altitude. The noise may be produced by the action of a powerful magnetic pole on luminous electric jets very near this pole, as I have proved by experiment; I have succeeded in producing a similar sound by bringing a piece of iron, strongly magnetised, to the luminous arch formed between the poles of a voltaic battery.

As to the sulphurous odor, it proceeds like that which accompanies lightning, from the conversion of the oxygen of the air into ozone by electric discharges.

The light of the aurora is not polarized, as was remarked by Biot in 1817, from his observations at the Shetland Islands. This negative result is confirmed by Mr. Macquorn Rankine, who has shown that this absence of polarisation is not due to the feebleness of the light, since this same light viewed after reflection from water is found to be polarised by this reflection. The most careful study and experiment have found no trace of polarisation in electric light, whether the discharges be made in the air or in a vacuum. This is a new proof of the identity of these two kinds of phenomena.

Finally, we discover in the resemblance between auroral appearances and certain clouds as well as the disturbances of the magnetic needle, a further important confirmation of our theory.

The observations of Dr. Richardson already mentioned, which show that the aurora exists at moderate elevations, also indicate that it is often connected with the formation of different kinds of *cirro-stratus* clouds Lieutenant Hood, in speaking of the luminous bands or columns of the aurora, says that he is convinced that they are carried by the wind, because they retain exactly their relative situation, which is not the case when the luminous matter moves in the air by its own direct action. Finally, the coëxistence of the aurora with small ice needles in the atmosphere, such as exist in elevated clouds, is shown by Captain Richardson, who having seen at a temperature near — 32° C. (— 35° F.) an aurora whose superior arc was near the zenith, remarked that although the sky appeared perfectly serene during the phenomenon, there fell a fine snow hardly perceptible to the eye, though easily observed as it fell on the hand and melted. The same fact had been previously observed in full sunshine, the rays of the sun rendering the floating particles of ice visible.

Observers are agreed with regard to the existence of a stratum or dark segment, which rests in the northern horizon, and appears to be the source of the auroral display. The numerous observations of M. Struve at Dorpat, and those of M. Argelander at Abo confirm this appearance. It is like a veil, which although permitting the light to pass gives the sky a more sombre aspect; moreover it is borded by a luminous arc. The existence of such a dark segment is confirmed by an observation of Gisler, who says that in Sweden, upon the high mountains, the traveller is sometimes suddenly enveloped in a very transparent mist of a grayish white colour, verging towards green, which rises from the soil, and is changed into the aurora borealis.

The *cirro-cumulus* and the mists become luminous when they are traversed by electric discharges sufficiently energetic, provided daylight does not efface the feeble light. They may sometimes be detected in the day: thus Arago establishes most incontestably that Dr. H. Usher was not deceived in a notice published in volume II. of the memoirs of the Irish Academy, where he describes an aurora seen at mid-day, on the 24th of May, 1788. This observer, during the day after a night in which he had witnessed a brilliant aurora, having observed an oscillation of the stars as seen with his lens, perceived in the sky rays of a white quivering light which rose from all points in the horizon towards the pole of the dipping needle, where they formed a light and whitish corona like that which the most

* Mem. Soc. de Phys. et Hist. Nat. de Genève, xii., and Bib. Univ., xxiv. 337, Dec. 1853.

brilliant aurora presents at night. Arago, on consulting old records at the observatory, found that there were considerable magnetic disturbances that day in the magnetic needle kept for showing the diurnal variation, thus proving beyond question that the phenomenon observed by Dr. Usher was a veritable day aurora.

I find also in the account of the voyage of the Venus by M. de Tessan, that M. Cornulier, an intelligent officer in the French Navy, often observed on the coast of New Holland a particular direction in the cirrus clouds during the day, from which he was enabled always to announce a fine aurora australis at night. M. Cornulier, like M. Verdier, was convinced, from a study of the arrangement of the cirrus clouds, that in those reigons, auroras occur during nearly every day, and that the variation is only as to their brightness; they are often hid from view by clouds and storms. This remark agrees with the observations made under the direction of Captain Lefroy in Canada, at 13 different stations, and with others, collected by the Smithsonian Institution. It results from all these observations, that the aurora was seen on almost all clear nights, when the moon was not too bright, although not at all the stations. This is especially true during the months when the nights are longe t. From October to March, there is scarcely a night without a visible aurora; and they are most brilliant in the month o February. The tables show that auroras were seen during 2o1 nights in 1850, and 207 in 1851. It is also remarkable and natural, that the auroras should have been seen most frequently in the stations nearest the magnetic pole.

Recurring to the coëxistence of icy particles in the air with the auroras, we find striking proof on this point in the Canada observations. The tables give with exactness the weather before and after the auroras. The aurora was almost always preceded by a fall of rain or snow; it also often happened that a fall of one or the other succeeded the aurora. The appearance of lunar halos, a common prelude to auroras, is a proof of the presence in the atmosphere of these icy particles which make up the network illuminated by the electric current.

But the most important proof of the electrical origin of the aurora is that derived from its action on the magnetic needle. The observations by Arago at the observatory of Paris,* by Forster, Farquharson, and by all voyagers, establish the following conclusions:—

1. During the day preceding the night on which an aurora appears, the declination of the magnetic needle to the west is always augmented 10, 20 or 30 minutes, or more.

2. On the contrary, at the middle, and at the end of the exhibition, the needle deviates from its normal state to the east.

3. Finally, the needle often undergoes irregular perturbations during an aurora, amounting to several minutes.

It happens ordinarily that the maximum deviation of the needle during the day preceding the night of the aurora, is at noon, or half an hour after noon; and the deviation due to the disturbance may be 5 to 30 minutes or more, beyond that of the days before or following. Sometimes the maximum western deviation is at other hours in the morning, and it is probable that in such cases there is an aurora during the day. Arago cites several cases of this kind. Thus, on the 17th of August, 1828, the declination from 8½h. A.M till noon was 5′ above the mean of the month for the same hours; and on the same day, at 10h. P.M., Messrs. Coldstream and Foggo perceived feeble traces of an aurora which was probably the end of a day aurora. During the evening the needle was in its ordinary position.

The magnetic observation made in the regions near the pole confirm the influence on the needle. Thus at Reykiavik (64° 8′ 15″ N.) MM. Lottin and Bravais, having made numerous observations on the diurnal variation of the needle parallel with similar observations at Paris and Cherbourg, were struck with the almost continual disturbance of the needle. They at first attributed it to some movement in the earth: but afterwards, remarking the concordance of their observations with those of M. de Löwenörn made in 1786, 50 years before, they satisfied themselves that the effect was due to auroras invisible to them because of the continued presence of the sun above the horizon. M. Ginge, a Danish Missionary, made observations in 1786, 1787, continued through the 24 hours, which showed that the western declination was ordinarily strongest from 9 to 10 in the evening, and least at 9 to 10 in the morning, a fact which he attributed without hesitation to the aurora. This conclusion it confirmed by the very numerous and excellent observations of MM. Lottin and Bravais.

We thus see, that for a long period observations near the pole have shown that auroras must be more frequent than was supposed, and this is confirmed by the facts observed in Canada and the United States.

We therefore conclude, that the production of auroras, northern and southern, is the normal mode of neutralising the positive electricity of the atmosphere with the negative of the earth. This neutralisation should not take place in a manner very uniform or regular. It is evident that the variations in the mists or conducting capabilities of the atmosphere will be attended by variations in the facility of this neutralisation.

These differences will be evinced by the deviations or disturbances of the magnetic needle, which will be sensible at great distances from the poles, as in the temperate zone where they are often observed. The western deviation which in the middle latitudes usually precedes an aurora, indicates a large accumulation of electricity, due to a powerful condensation of vapours in the polar regions, which by facilitating the reunion of the two electricities, augment, the intensity of the terrestrial current passing in our hemisphere from the equator to the north, and consequently carries the needle more to the west. When the aurora is once visible, the current becomes less strong, because the light itself of the aurora is proof of the resistence (probabl due to the congelation of the particles of water suspended in the air that constitutes the mist) which the reunion of the two electricities encounters;* the needle will then retrograde to the east, as actually takes place.

In the higher latitudes, the disturbances of the needle are continual, because the slightest differences in the intensity of the electric discharges that take place in the polar regions should be there perceived. As to the observations of MM. Ginge, Löwenörn and Lottin, that the maximum deviation of the needle takes place from 8 to 10 o'clock in the evening, and the minimum at 9 to 10 in the morning, they were made only during some weeks in summer, and they prove only that at this season of the year, the greatest amount of condensation of

* Ann. de Ch. et de Phys., x. 120; xxx, 423; xxxvi, 398; xxxix, 369; xlii, 351; xlv, 403.

* It is clear that the mist when first formed should be a better conductor than when, afterwards, it consists only of icy particles.

moisture take place, as should be the case, at times just preceding and following the setting of the sun, and at least 7 or 8 hours after its rising. In the observations of Lieutenant Hood, made in the voyage of Captain Franklin, between the 1st of February and the 31st of May, the greatest declination took place at 8 and 9 o'clock in the morning, and the least at an hour after noon. Thus, as is seen, the times of the maxima and minima are widely variable in those high latitudes, where there are great differences in the length of the day, and also in temperature, and therefore considerable electric disturbances of the air.

It is a singular fact, sometimes noticed, that when an observer is in the midst of an aurora, so to speak, the action on the needle may be null. This was remarked by Mr. Forster, at Port Bowen, beyond 65° N., the latitude of Forts Franklin and Enterprise, where Dr. Richardson had on the contrary observed the action of the needle. In fact, a needle in the interior of the circle formed by the aurora about the magnetic pole, is no longer under the influence of the currents which circulate around it and not above or below, and it ought therefore to experience only a variable and irregular action.

I have said that the aurora was probably of daily occurrence, and varied only in intensity. These differences in intensity are the reason for its being not always perceptible, and also for its less frequency remote from the magnetic poles. As to the differences of number for each month, they are attributable to two causes—but especially to the unequal length of the nights, for there should be fewer in the shorter nights. Thus in May, June and July the fewest are seen, because the days are the longest, while in the nine others, and especially in March, September and October, they are most numerous. This preeminence of these three months above others, of still shorter days, can be due only to this, that the auroras are most frequent at the times of the equinoxes, and especially the autumnal equinox. This is readily understood if we consider that the vernal equinox is the time when the sun transfers to the northern hemisphere its powerful influence either direct or indirect in the developement of electricity; and that the autumnal should be followed with a large condensation of the vapours accumulated in the atmosphere during the months of summer—a condensation which, as already explained, facilitates the neutralisation of the two electricities, developed in large quantities during the summer, and augments consequently the intensity of the discharge at the pole.

It has been pretended that in the appearances of the aurora borealis there are secular variations; in other words, that there are epochs comprising a certain number of years during which auroras are particularly frequent, and others in which they are rare. This opinion does not appear to me to be based on documents sufficiently exact to be admitted. There may be a difference in different years, as there is a difference in temperature and humidity. But this is far from making out a periodicity in auroras: to establish such a periodicity, there ought to be the collected observations of a century, from observers at least as good, and as favourably situated with reference to the magnetic poles, as those now engaged: and this we have not. We need not therefore dwell longer on this point, only remarking that if really such a periodicity exists, it might be connected with the change in the magnetic poles, which are the centers of the aurora, and which according to the surface about them would more or less facilitate the electric circulation; for it is evident that the naked soil would afford more ready circulation than a surface covered with a great thickness of ice. But, I repeat it, the fact of the periodicity is far from proved.

Recapitulation.—1. All observations agree in demonstrating that the aurora borealis is a phenomenon taking place in our atmosphere, and that it consists in the production of a luminous ring whose centre is the magnetic pole, and having a diameter more or less large.

2. Experiment demonstrates that in causing in highly rarified air the reunion of the two electricities near the pole of an artificial magnet, a small ring of light is produced similar to that which constitutes the aurora, and having a like movement of rotation.

3. The aurora is consequently due to electric discharges taking place in the upper regions between the positive electricity of the atmosphere and the negative electricity of the earth—the electricities being separated by the direct or indirect action of the sun, principally in the equatorial regions.

4. As these electric discharges take place constantly, though with varying intensity, depending on the state of the atmosphere, the aurora should be a daily phenomenon, more or less intense, and consequently visible at greater or less distances, and only when the night is clear—which accords precisely with observation.

5. The phenomena that attend the aurora, such as the presence and form of the *cirro-stratus* clouds, and especially the disturbances of the magnetic needle, are of a kind to demonstrate the truth of the electric origin attributed by the author to the aurora—an hypothesis with which these phenomena correspond even in their minutest details.

6. The aurora australis, according to the few observations on it which have been made, presents exactly the same phenomena as the aurora borealis, and is explained in the same manner.

Result of the Astronomer Royal's Recent Pendulum Experiments; Harton Pit, South Shields.

Addressed by Professor Airey to Mr. James Mather.

Royal Observatory, Greenwich, Dec. 2, 1854.

My Dear Sir,—It will be, I am sure, matter of satisfaction to you to know that the result of the computations of the pendulum vibrations gives the highest confidence in the certainty of the results to be deduced from them. The comparison of the rates of the pendulums before and after their interchanges shows, that there is no evidence of their having undergone any mechanical change whatever, and almost positive evidence against their having undergone any change amounting, in its effect on their vibrations, to 1-20th part of a vibration in a day. The immediate result of the computations is this, supposing that a clock was adjusted to go true time at the top of the mine, it would gain 2¼ seconds per day at the bottom. Or it may be stated thus, that gravity is greater at the bottom of the mine than at the top by 1-19190th part. To go a little further into the interpretation. If there had been no coal measures or rocks of any kind between the top and the bottom, but merely an imaginary stand to support the pendulums, the gravity at the top *would have been* less than at the bottom by 1-8400th part nearly. But it *is* less by only 1-19200th part. And what is the cause of the difference? It is the attraction of the shell of matter, whose thickness is included between the top and the bottom of the mine. The attraction of that shell, therefore, is the difference between the two numbers which I have given, or is 1-14900th part of gravity nearly. But if that shell had been as dense as the earth generally, its attraction would have been 1-5600th part of gravity nearly. Therefore the earth generally is more dense than the coal measures in the proportion of 149 to 56 nearly. You will remark that all these numbers are rough, and to make their results available, some small corrections are required (to which I have not alluded) and some knowledge of the density of the different beds, &c., which I do not possess at present.

I am, my dear Sir,
Yours, very truly,
G. P. AIREY.

The Late John Lockhart.

The hand of death, though most conspicious of late in the battle-field, has not been idle in the walks of science and literature. Some, indeed of the men of note whom we have recently lost are of so great eminence that we look around among the rising generation with something like despair to find any capable of filling the gaps which have been left.

Such a one was John Gibson Lockhart, the biographer and son-in-law of Sir Walter Scott, who now lies in the same grave with him at Dryburgh. Mr. Lockhart was the second surviving son of a Scotch clergyman, of gentle descent and old family, in the county of Lanark. He was born, 1794, in the manse of Cambusnethen, whence his father was transferred, 1796, to Glasgow, where John Lockhart was reared and educated. The inheritance of genius (as in many other instances) would appear to have come from his mother, who had some of the blood of the Erskines in her veins. His appetite for reading, even as a boy, was great. Though somewhat idle as regards school study, he yet distinguished himself both at school and college, outstripping his more studious competitors, and finally obtaining, by the unanimous award of the Professors, the Snell Exhibition to Baliol College Oxford, where he was entered, 1809, at the early age of 15. Dr. Jenkyns, the present Dean of Wells, was his tutor. Before leaving the University he took honours as a first-class man. After a sojourn in Germany sufficiently long to enable him to acquire its language and a taste for its literature, he was called to the Scottish bar in 1816; but though endowed with perseverance and acuteness sufficient to constitute a first-rate lawyer, he wanted the gift of eloquence to enable him to shine as an advocate. As he natively confessed to a party of friends assembled to bid him farewell on his departure from Scotland for London, "You know as well as I that if I had ever been able to make a speech there would have been no cause for our present meeting." His wit, his learning, and extensive reading found, however, a ready outlet through the pen. In 1818 Lockhart was introduced to Scott, who in 1820 evinced his esteem and affection for him by giving him in marriage his eldest daughter. At Scott's death in 1832 he was left sole literary executor. Many of the cleverest things in *Blackwood's Magazine* (established in 1817) were written by Lockhart in concert with his friends John Wilson, Capt. Hamilton, Hogg, &c., and much ill-blood was caused among the Whigs, who from assailants, now began to be assailed by opponents of no mean skill in fence. Party warfare then ran high in Edinburgh: much ill-blood was engendered. Unfortunately, the strife was not confined to squibs, and at least one fatal catastrophe was the result. These events left a lasting impression on Lockhart's mind, and when, in 1826, he was invited to become editor of the *Quarterly Review*, he quitted Edinburgh without regret, with his family, as he received from the Government of Sir Robert Peel and the Duke of Wellington the post of Auditor of the Duchy of Lancaster. The management of the *Quarterly Review*, to which he contributed many valued papers, chiefly biographical, continued in his hands for 28 years down to 1853, when his failing health compelled him to resign the labour. The latter years of his life were mournfully darkened by domestic calamity. The deaths in succession of his eldest boy—the pet of Sir Walter, the "Hugh Littlejohn" for whose instruction he wrote *Tales of a Grandfather*—of his wife, and all the other members of Sir Walter Scott's family, were followed and wound up by that of his only surviving son, under circumstances of poignant grief to a father's heart. The vials of sorrow seemed to have been emptied upon his head. With broken health and spirits he betook himself to Rome, by medical advice, with slight hope on his own part of benefit. Having little taste for foreign travel, he returned home in the spring of the present year. He made a partial rally on his arrival in Scotland, but a very severe attack of diarrhœa in the month of October shattered his already enfeebled frame: he was removed from Milton Lockhart, the house of his eldest brother, M.P. for Lanark, under the care of his old friend, Dr. Furgerson, to Abbotsford, where he breathed his last, on the 25th of November, in the arms of his daughter, the sole survivor of the line of Scott in the second generation.—*Evening Mail.*

On the Re-Cutting of the Koh-i-Noor Diamond.

BY PROF. J. TENNANT.

At the meeting of the British Association at Belfast, the author gave some account of this diamond, and described some of the remarkable changes which it had undergone, and on this occasion exhibited some interesting diagrams illustrating the crystalline form and cleavage of the diamond. Mr. Tennant now introduced the subject by drawing attention to the former weight of the diamond, compared with its present bulk, now reduced by cutting; and also to its mineralogical appearances. With regard to the history of this extraordinary gem, he stated that some people had actually disputed its authenticity, which caused some discussion amongst those best informed in matters of this description. At the Great Exhibition in 1851, an opportunity had been afforded, such as was never previously enjoyed by the public, of studying the substance of a vast number of foreign valuable stones, and probably of Koh-i-Noor diamond was the most attractive in that valuable collection. The rough manner in which that diamond had been cut, however, had disappointed many who looked upon it. When the sun shone on it at noon-day the stone appeared peculiarly brilliant, but when the atmosphere was dull, it had merely the appearance of a thick piece of glass. This placed it in a very unfavourable position, and caused doubts to arise in the minds of some gentlemen as to its authenticity. This diamond originally belonged to Runjeet Singh, who usually wore it upon his left arm, according to the custom of Eastern potentates; and the original mounting was now in the hands of Her Majesty's jewellers. The stone perfectly agreed with the drawing which had been made of it by Miss Eden, and also of the account given of it by the Hon. W. G. Osborne, who had published a very interesting description of the Court of Runjeet Singh, where the old man (who was blind and a cripple also) sat arrayed in a robe of simple white, wearing upon his arm the Koh-i-Noor diamond, and surrounded by his eastern nobles. On special occasions, Runjeet Singh was in the habit of decorating his horse with this precious gem, together with numerous other valuable stones, mounted upon various parts of his harness. All authentic accounts of the East proved that the nobles were in the habit of decorating their horses in this manner; and the horse of Runjeet Singh was decorated with diamonds valued at £300,000, the great Koh-i-Noor being placed on the pummel of the saddle. Lord Auckland and his sister, the Hon. Miss Eden, had this diamond sent to them for inspection, in the East Indies, and Miss Eden's drawings agreed with the appearance of the diamond on its arrival in this country Mr. Tennant stated that in 1853 he had given in a report as to the cutting of the Koh-i-Noor diamond; and after producing various models, Her Majesty fixed upon the present form, by which the widest spread of brilliancy was obtained. When the diamond was exhibited at the Crystal Palace it weighed 186 1-16 carats; its present weight, reduced by cutting, was 102 13-16 carats. The Persian diamond weighed 130 carats, and the great Russian diamond 193 carats. After giving a description of the method of cutting diamonds, and the plan adopted for cutting the Koh-i-Noor, he observed that the late Duke of Wellington had been an interested spectator of the operation, and was a frequent visitor during its progress. It was finished in September, 1852, and occupied thirty-eight days in cutting. Diamonds were usually reduced to one-half their weight in cutting; and he gave the exact weight of the Koh-i-Noor, in order to correct various erroneous statements which had been published on the subject. The finest diamond in France weighed 139 carats, and had cost £130,000; it was called the Regent, or Pitt diamond. To arrive at an estimate of the value of the Koh-i-Noor the author stated, that it was only requisite to multiply 102 (its weight) by 102, and then by 8, which would give £83,-232 as its value. This rule would not apply to stones having defects, as instanced in the celebrated "Nassuck" diamond, for which the East India Company refused £30,000, and yet this stone when submitted to public auction, fetched little more than £7,000. The Koh-i-Noor is of the purest water. The author stated, that in order to test a real diamond, and distinguish between that of a topaz, it was necessary to scratch it with sapphire (No. 9 in hardness), which would mark a topaz, but would not penetrate a diamond. He was sorry to find that so little attention had been paid to the means of testing diamonds; and instanced a ring which was recently purchased in Regent Street, London, for £2 ##, which proved to be two pieces of rock crystal, with an intermediate insertion of coloured glass. In many of our watering-places the gentry were imposed upon by parties selling pieces of glass, which they represented to be sapphires picked up on the beach.—*Athenæum.*

Surrender of the Saugeen Peninsula.

The last surrender of any considerable tract of fertile land which can take place in Western Canada is recorded in the treaty which follows. Mere isolated patches, few and far between, now remain in possession of the miserable remnants of the sons of the soil. The treaty was concluded in October last, and opens a beautiful but rather distant and inaccessible region to the adventurous settler.

Treaty Recording the Surrender of the Saugeen Peninsula.

We, the Chief-Sachems and principle men of the Indian tribes residents at Saugeen and Owen Sound, confiding in the wisdom and protecting care of our Great Mother across the Big Lake, and believing that our Good Father, His Excellency the Earl of Elgin and Kincardine, Governor General of Canada, is anxiously desirous to promote those interests which will most largely conduce to the welfare of His Red children, have now, being in full Council assembled in presence of the Superintendent General of Indian Affairs, and of the young men of both tribes, agreed that it will be highly desirable for us to make a full and complete surrender unto the Crown of that Peninsula, known as the Saugeen and Owen Sound Indian Reserve, subject to certain restrictions and reservations to be hereinafter set forth. We have therefore set our marks on this document, after having heard the same read to us, and do hereby surrender the whole of the above named tract of country bound on the south by a straight line from the Indian Village of Saugeen, to the Indian Village of Nawash, in continuation of the Northern limit of the narrow strip recently surrendered by us to the Crown, and bounded on the North-east and West by Georgian Bay and Lake Huron, with the following reservations to wit:

1st.—For the benefit of the Saugeen Indians, we reserve all that block of land bounded on the West, by a straight line running due North from the River Saugeen at the spot where it is entered by a ravine, immediately to the west of the village, and over which a bridge has recently been constructed to the shore of Lake Huron:—on the South by the aforesaid northern limit of the lately surrendered strip; —on the East by a line drawn from a spot upon the coast at a distance of about nine miles and-a-half from the Western boundary aforesaid, and running parallel thereto until it touches the aforementioned northern limit of the recently surrendered strip, and we wish it to be clearly understood, that we wish the Peninsula at the mouth of the Saugeen River, to the west of the western boundary aforesaid, to be laid out in town and park lots and sold for our benefit without delay, and we also wish it to be understood that our surrender includes that parcel of land which is in continuation of the strip recently surrendered, to Saugeen River.

We do also reserve to ourselves that tract of land called Chief's Point, bounded on the East by a line drawn from a spot half-a-mile up the Sable River, and continued in a northerly dirrection to the Bay, and upon all other sides by the Lake.

2nd.—We reserve, for the benefit of the Owen Sound Indians, all that tract bounded on the South by the Northern limit of the continuation of strip recently surrendered on the North-west by a line drawn from the North-easterly angle of the aforesaid strip, (as it was surrendered in 1851,) in a North-easterly direction. On the South-east by the Sound, extending to the Southern limit of the Caughnawaga settlement;—on the North by a line two miles in length forming the said Southern limit, and we also reserve to ourselves all that tract of land called cape Crocker, bounded on three sides by Georgian Bay, on the South-west by a line drawn from the bottom of Nochemowenaing Bay, to the mouth of Sucker River, and we include in the aforesaid surrender the parcel of land contained in the continuation to Owen Sound of the recently surrendered strip aforesaid.

3rd.—We do reserve for the benefit of the Colpoy's Bay Indians in the presence and with the concurrence of John Beattie, who represents the tribes at this Council, a block of land containing 6000 acres and including their village and bounded on the North by Colford's Bay.

All which reserves we hereby retain to ourselves and our children, in perpetuity, and it is agreed, that the interest of the principal sums arising out of the sale of our lands, be regularly paid to them, so long as there are Indians left to represent our tribe, without diminution, at half-yearly periods.

And we hereby request the the sanction of our Great Father, the Governor General, to this surrender, which we consider highly conducive to our general interests.

Done in Council at Saugeen, this thirteenth day of October, 1854.

It is understood that no Islands are included in this surrender.

(Singed and sealed.)

L. Oliphant, Superintendent General Indian Affairs.
Peter Jacobs, Missionary.

(Witnesses.)
(Signed,)
John Ross, M.P.P.
C. Rankin, P.L S., (seal.)
A. McNab, Crown Land Agent.

(Signed,) John Kadahgekwun, (seal.)
" Alexander Madwayosh, (seal.)
" John Monedaowab, (seal.)
" John Thos. Wabbahdick, (seal.)
" Peter Jones, (seal.)
" David Sawyer, (seal.)
" John H. Beatty, (seal,)
" Thomas Pababenosh, (seal.)
" John Madwashaninck, (seal.)
" John Johnston, (seal.)
" John Aunjegahbowin, (seal.)
" John Newash, (seal.)
" Thomas Wabbahdick, (seal.)
" Charles Keebick, (seal.)

Government Aid to Scientific and Literary Institutions, in Upper and Lower Canada.

			£	s.	d.
Aid to Canadian Institute, Toronto			250	0	0
Do.	do.	towards their Building	500	0	0
Do.	the Literary and Historical Society at Quebec		50	0	0
Do.	do. for their Building and Library collection		200	0	0
Do.	Natural History Society at Montreal		50	0	0
Do.	do. for their collection		100	0	0
Do.	Mechanics' Institute at Quebec		50	0	0
Do.	do.	Montreal	50	0	0
Do.	do.	Kingston	50	0	0
Do.	do.	Toronto	50	0	0
Do.	do.	London, C.W.	50	0	0
Do.	do.	Niagara	50	0	0
Do.	do.	Hamilton	50	0	0
Do.	do.	Belleville	50	0	0
Do.	do.	Brockville	50	0	0
Do.	do.	Bytown	50	0	0
Do.	do.	Cobourg	50	0	0
Do.	do.	Perth	50	0	0
Do.	do.	Picton	50	0	0
Do.	do.	Guelph	50	0	0
Do.	do.	St. Thomas	50	0	0
Do.	do.	Brantford	50	0	0
Do.	do.	St. Catherines	50	0	0
Do,	do.	Goderich	50	0	0
Do.	do.	Whitby	50	0	0
Do.	do.	Three Rivers	50	0	0
Do.	do.	Berthier, L.C.	50	0	0
Do.	do.	Simcoe	50	0	0
Do.	do.	Woodstock	50	0	0
Do.	do.	County of Peel	50	0	0
Do.	do.	Port Sarnia	50	0	0
Do.	do.	Chatham	50	0	0
Do.	do.	County of Halton	50	0	0
Do.	do.	County of Ontario	50	0	0
Do.	do.	Port Hope	50	0	0

Aid to Mechanics' Institute at Stratford			£50	0	0
Do.	do.	Peterborough	50	0	0
Do.	do.	Iberville	50	0	0
Do.	do.	Renfrew	50	0	0
Do.	do.	Mitchell, County of Perth	50	0	0
Do.	do.	Berlin	50	0	0
Do.	do.	Fonthill	50	0	0
Do.	do.	Dundas	50	0	0
Do.	do.	Oakville	50	0	0
Do.	do.	Waterdown	50	0	0
Do.	the Canadian Institute at Quebec		50	0	0
Do.	the Athenæum at Toronto		100	0	0
Do.	the Huron Library Association and Mechanics' Institute		50	0	0
Do.	Teacher Association at Quebec, for their Library		50	0	0
Do.	Library Association at Quebec		50	0	0
Do.	National Institute at Montreal		50	0	0
Do.	Canadian Institute at Montreal		50	0	0
Do.	Canadian Institute, Bytown		50	0	0
Do.	Mechanics' Institute, St. Hyacinthe		50	0	0
Do.	do.	Sorel	50	0	0

CANADIAN INSTITUTE, SESSION 1854—55.

Third Ordinary Meeting--Saturday, January 6, 1855.

The names of the following Candidates for membership were read:—

Walter McKenzie, ... Toronto.
Paul Kane .... "
Francis Boyd .... "
Joseph Robertson .... "
Dr. Allan Cameron .... "

The following donation was announced:—

"Transactions of the Literary and Historical Society of Quebec," by E. M. Meredith, V. P. Lit. & His. Soc. Quebec.

The thanks of the Institute were ordered to be transmitted to Mr. Meredith.

The following gentlemen were elected members:—

W. M. Jamieson .... Toronto.
Henry Turner, M.D. .... Galt.
E. Clarke, M.R.C.S. .... Toronto.
John Holland .... "

The Annual Address was delivered by the President.

Professor Wilson, LL.D. read a paper "On some Conchological relics of the Red Indians of Canada."

Several Conch shells, found in various parts of Western Canada, were exhibited by Dr. Wilson.

Fourth Ordinary Meeting--Saturday, January 13, 1855.

The name of the following Candidate for membership was read:—

William Glynn, ... Toronto.

The following gentlemen were elected members:—

Walker McKenzie, ... Toronto.
Paul Kane, ... "
Francis Boyd, ... "
Joseph Robertson, ... "
Dr. Allan Cameron, ... "

The following donations were announced:—

1. "The Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada:" from the Department of Public Instruction.
2. "Edicts &c., relative to the Seignorial Tenure of Lower Canada." "Titles and Documents relating to the Seignorial Tenure of Lower Canada." "Return relating to judicial officers in Lower Canada." "Relation Abrégée de quelques Missions des pères de la Compagnie de Jèsus dans la Nouvelle France." From Thomas Henning.

The thanks of the meeting were voted to the Superintendant of Education for Upper Canada, and to Thomas Henning, for their respective donations.

The Rev. Professor Irving read a paper "On the Eclipse of May 26, 1854." by Professors Cherriman and Irving.

Professor Chapman communicated a "Note on Carbonate of Lime as an Igneous Product."

A specimen of native copper from Lake Superior, containing a well characterized impression of a crystal of carbonate of lime was exhibited.

A discussion on the subject of Professor Chapman's communication followed.

The Vice President announced that at the next meeting the following papers would be read:—

1st. On the object of the Salt Condition of the Sea, by Professor Chapman.

2nd. The general Meteorological Results for 1854, by Professor Cherriman.

Fifth Ordinary Meeting--Saturday, January 20, 1855.

The names of the following Candidates for membership were read:—

James Gilbert, ... Toronto.
Secker Brough, ... "

The following donations were announced:—

Twenty-six volumes of "Bohn's *Classical*, *Ecclesiastical*, *Standard*, *Antiquarian*, *Philological*, *Illustrated* and *Scientific* Library," by H. G. Bohn, London; through A. H. Armour, Toronto.

The thanks of the Institute were directed to be transmitted to Mr. Bohn for his handsome donation.

The thanks of the Institute were also directed to be given to A. H. Armour.

The following is a list of the works included in Mr. Bohn's donation:—

Books presented by H. G. Bohn, Esq., to the Canadian Institute.

Cowper's Works, Vol. 4; conclusion of Memoir and Correspondence, with general index to the same,

Cowper's Works, Vols. 5 & 6; containing Poetical Works, complete in 2 vols., with 14 engravings on steel.

Hungary; its History and Revolutions: with a copious Memoir of Kossuth, from new and authentic sources. With fine Portrait of Kossuth.

History of Russia, from the earliest period to the present time, compiled from the most authentic sources, including Karamsin, Tooke, and Segur, by W. H. Kelly, vol. 1; with fine Portrait of Catharine the Second.

Locke's Philosophical Works; with general index and fine Portrait, vol. 2.

Defoe's Works, edited by Sir Walter Scott, Vol. 1; containing the Life, Adventure, and Piracies of Captain Singleton, and the Life of Colonel Jack.—Volume 2, containing Memoirs of a Cavalier, Adventures of Captain Carleton, Dickory Cronke, &c.

Gibbon's Roman Empire; Vols. 4 & 5: with fine Map of the Eastern Empire.

Prior's Life of Burke, new edition, revised by the Author; with fine Portrait.

Burke's Works, Vol. 1: containing his Vindication of Natural Society; Essay on the Sublime and Beautiful: and various Political Miscellanies.

The Elegies of Propertius, the Satyricon of Petronius Arbiter, and the Kisses of Johannes Secundus, literally translated, and accompanied by Poetical Versions, from various Sources; to which are added the Love Epistles of Aristocretus, translated by R. Brinsley Sheridan and H. Halhed. Edited by Walter H. Kelly.

The Geography of Strabo, translated, with copious notes, by W. Falconer, M.A., and H. C. Hamilton, Esq.; vol. 1.

Xenophon's Anabasis or Expedition of Cyrus, and Memorabilia, or Memoir of Socrates, translated with notes, by the Rev. J. S. Watson, M.A., and a Geographical commentary by W. F. Ainsworth, F.S.A., F.R.G.S., &c. Frontispiece.

Logic, or the Science of Inference, a popular Manual, by J. Davey.

India, Pictorial, Descriptive, and Historical, from the Earliest Times to the Present. Illustrated by upwards of one hundred fine engravings on wood, and map of Hindostan.

Nicolini's History of the Jesuits: their Origin, Progress, Doctrines, and Designs. With fine Portraits of Loyola, Laines, Xavier, Borgia, Acquavira, Père la Chaise, Ricci, and Pope Ganganelli.

Odericus Vitalis; his Ecclesiastical History of England and Normandy, translated with notes and the introduction of Guizot, by F. Forester, M.A.; vol. 3.

Matthew Paris's English Chronicle, translated by Dr. Giles: Vol. 3 completing the work, with index to the whole, including the portion published under the name of Roger of Wendover.

Lamb's Specimens of English Dramatic Poets of the time of Elizabeth; including his Selections from the Garrick Plays.

Marco Polo's Travels, the Translation of Marsden, edited with notes and introduction, by T. Wright, M.A., F.S.A., &c.

Florence of Worcester's Chronicle, with the Two Continuations; comprising Annals of English History, from the Departure of the Roman's to the Reign of Edward I. Translated, with Notes, by Thomas Forester, Esq.

Ennemoser's History of Magic, translated from the German by William Howitt; with an appendix of the most remarkable and best authenticated Stories of Apparitions, Dreams, Second Sight, Predictions, Divinations, Vampires, Fairies, Table-turning, and Spirit-Rapping, &c. Selected by Mary Howitt; in two volumes.

The Works of Philo Judæus, translated from the Greek, by C. D. Yonge, B.A.: vol. 1.

BOOKS FROM THE PUBLISHERS.

Lives of the Queen's of England before the Conquest, by Mrs. Matthew Hall. (Blanchard and Lea, Philadelphia.)

The American Almanac for 1855. (Phillips, Sampson & Co., Boston.)

The following gentleman was elected member:—

William Glynn,..Toronto.

Professor Chapman read a paper "On the Object of the Salt Condition of the Sea."

Professor Cherriman read a paper "On the Meteorological Results of 1854."

The discussion "On Carbonate of Lime as an Igneous Product;" with reference to Professor Chapman's note communicated at the preceding meeting, was renewed.

Sixth Ordinary Meeting--Saturday, January 27, 1855.

The names of the following Candidates for membership were read:—

Robert Bell,......................................Carleton Place.

Robert Grier,......................................Toronto.

The following gentlemen were elected members:—

James Gilbert, (Junior Member)......................Toronto.

Secker Brough,...................................... "

A paper was read by James Bovell, M.D., "On the Transfusion of Milk, as practised in the Cholera Sheds at Toronto in 1854."

A communication was made by Professor Wilson, L.L.D, "On the use of Types and Printing amongst the Romans of the Second and Third Centuries."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

WEDNESDAY, 6TH DECEMBER, 1854.

The following donations were announced:—

Some ancient Roman Coins, from W. D. Campbell.

A communication was read by Wm, A. Hollwell, in continuation of his Paper on a "New Projectile," &c., read at the last stated meeting.

A committee was appointed to make experiments for the purpose of testing the value of Mr. Hollwell's Projectile, &c.

GENERAL MONTHLY MEETING.

WEDNESDAY, 13TH DECEMBER.

The following donations were announced from Robert Symes:

1. Specimen of Iron Ore from the ore bed of the Marmora Foundry Company.
2. Specimens of Iron Pyrites from the same locality.
3. Wild Rice from Rice Lake, Upper Canada.
4. Deer Horns in the velvet state, from Marmora.
5. Eggs of the large Mud Turtle (*Crow River*).
6. Axe used in Bonaparte's Kitchen at St. Helena.

Viscount Bury was elected an Associate Member of the Society.

STATED MEETING.

WEDNESDAY, 20TH DECEMBER.

A communication on the subject of education and Model Schools was read by Frederick Boxer.

E. A. MEREDITH, *Vice-President.*

MR. BOHN'S LIBRARIES.

We have frequently had the opportunity of recording the presentation of numerous volumes to the Library of the Canadian Institute by Mr. Bohn, the celebrated London Publisher of Literature for the People. By reference to the proceedings of the Institute which appear in the present number of this journal, it will be seen that Mr, Bohn has again transmitted a valuable donation from England of twenty-six volumes of his *Standard Library, British Classics, Classical Library, Illustrated Library, Philological Library, Antiquarian Library, Scientific Library, and Ecclesiastical Library.*

Canadians have gradually become so accustomed to the cheap Literature of this country and the United States, to the reprints of Standard works as well as of the current European literature of the day, that we are apt to forget that successful attempts have been made in England to furnish the public with the works of eminent authors, illustrated and got up in a very superior style, and at a price which places them within the reach of every reading man. Mr. Bohn is not the only British publisher of 'Literature for the People,' whose works are distributed in every quarter of the globe where the English language is spoken. It was only during the second quarter of the century that any serious attempts were made in Britain to furnish a Literature for the people. In 1825, Constable's Miscellany commenced at 3s. 6d. stg. a volume. In 1829, the Waverley Novels at 5s. a volume appeared; the *Family Library*, by Mr. Murray: *Lardner's Cabinet Cyclopædia*, by Messrs. Longman; the *Library of Entertaining Knowledge*, by Mr. Charles Knight; the *Library of Useful Knowledge*; Valpy's *Family Classical Library*: and Valpy's *Illustrated Shakspere*. In 1832, the *Edinburgh Cabinet Library*, came forth. Many of these our readers may find, perhaps, in isolated volumes or in complete series on their shelves. In 1844, Mr. Chas. Knight published, at one shilling a volume, Lord Brougham's *Statesmen*; also Mrs. Jameson's *History of Painting*. In 1844, Mr. Murray's *Home and Colonial Library*, was published at 4s. 6d. a volume. It was in the year 1846, that Mr. Bohn gave a new impetus to the publication of Literature for the people, by commencing *Bohn's Libraries*. These volumes appear at the rate of five or six every month, and up to the present date over three hundred and fifty have been issued. The price of these books varies from 3s. 6d. to 5s; they are either valuable reprints of standard works, or translations of ancient and modern authors. Many of Mr. Bohn's modern translations are of peculiar interest, and introduce the English reader to foreign literature of a high order; we have from time to time noticed at length several of these translations, among which our readers will remember the preliminary remarks of Dr. Richard Lepsius, on the result of his journey to Egypt, Ethiopia, and the Peninsula of Sinai,* which appeared at the close of the last volume of the Canadian Journal. Bechstein's Cage Birds is another illustration of instructive foreign literature, for which we are indebted to Mr. Bohn.

It has been said by an able Reviewer in the London *Times*, that "Mr. Bohn's books constitute in themselves a Library with which exclusively any man might be content to endow his son." All who are desirous of dispelling the gloom of ignorance, and while encouraging a taste for literature are anxious that the means for enjoying it should not be wanting, will be glad to know that the great project in which Mr. Bohn is engaged is no longer doubtful in its pecuniary aspect, but promises a speedy and substantial reward.

* (See Canadian Journal, Vol. II.)

Canadian Isinglass.

At a meeting of the Society of Arts in December last, Professor Owen again called attention to the supplies of Isinglass which might be expected from Canada, in consequence of the wide distribution of the Sturgeon in the lakes and rivers of this country. There can be no doubt that a profitable branch of industry might be encouraged among the fishermen of the great Lakes. In Lake Huron particularly, the sturgeon is a very abundant fish, and at certain seasons of the year, could be caught in vast numbers. The subject well deserves attention at a time when the Russian commodity is neither supposed to be accessible, or in favour.

Professer Owen "was much struck when fulfilling the duties of Chairman of the Jury on Raw Materials from the Animal Kingdom at the Great Exhibition in 1851, to find that no specimens of Isinglass were exhibited in the Canadian department.—The finest and best specimens of that commodity were exhibited in the Russian department. Isinglass of an inferior description was seen in the Indian department, and amongst the produce of South America and the West Indies. The property of Isinglass which made it most valuable for the refinement of fermented vinous liquors, was dependent upon the peculiar organization of the fibre of the air-bladder, and was not connected with its chemical nature. The air bladder of the sturgeon in particular contained that pure gelatinous material in the greatest quantity, and it was that peculiar characteristic and complex fibre which gave the material the power of catching the feculent matters, and performing all the offices required in the management of fermented vinous liquors. There were unquestionably other fishes which afforded that form of gelatine. Many such were to be found in the Ganges and the Indus, and in the fresh waters of the immense rivers of North America, but in none that he was acquainted with was that peculiar form of Isinglass so fully developed as in the sturgeon species. Looking at the geographical relations with the organic products, he should have expected to find the sturgeon in the North American rivers, and on inquiring of the chief of the Canadian department, he found that such was the fact, and that they were brought by the steamers to Quebec for food, but that the air-bladders were all thrown away. There was a source of wealth which he thought they ought to welcome. He believed the Canadian merchants were capable of affording very large supplies of Isinglass, and he had taken pains to arouse them upon the subject, and he had put the representatives of that department in communication with some of the largest Isinglass merchants in London, and he hoped by this time attention had been awakened to the matter; for he was sure that when a cargo of Isinglass from the air-bladder of the sturgeon arrived from our colonies in North America, it would meet with a pecuniary reward, which would be the best stimulus they could have."

Remarkable Low Temperature at Isle Jesus, on the 22nd and 23rd December, 1854.

(*Communicated by Dr. Smallwood.*)

On Thursday, the 21st December, 1854, at noon, the thermometer stood at 20°·2 Fahrenheit, with a S.S.W. wind, accompanied with slight snow. The atmosphere during the morning indicated a high electric state. A little before 2, p.m., the wind veered to the N.E. by N., the temperature suddenly fell, and the thermometer stood, at 10, p.m., at 14° 2 (below zero). On Friday morning, the 22d, at 6, a.m., the thermometer stood at 31°·0 (below zero).

At 8,	a.m.,	at	31°·6	(below zero).
9,	...	...	27°·0	do.
10,	...	...	19°·1	do.
11,	...	...	17°·8	do.
12,	noon,	...	16°·6	do.
1,	p.m.,	...	12°·1	do.
2,	...	...	11°·8	do.
3,	...	...	8°·1	do.
7,	...	...	23°·4	do.
8,	...	...	26°·9	do.
10,	...	...	28°·2	do.
Midnight		...	34°·8	do.
23d, at 6,	a.m.,	...	36° 2	do.
7,	...	...	36°·0	do.
8,	...	...	34°·3	do.
10,	...	...	24°·1	do.
12,	noon,	...	13°·4	do.
2,	p.m.,	...	12°·6	do.
4,	...	...	9°·1	do.
6,	...	...	12°·6	do.
10,	...	...	9°·1	do.

There was no display of Aurora Borealis on the night of the 21st, and but a faint Auroral light at the horizon on the night of the 22d. The zodiacal light was very bright, and well-defined, on the morning of the 22d.

Republication of the 1st Volume of The Canadian Journal.

The encouragement which the Council of the Canadian Institute have received from the Library Committee of both Houses of Parliament, as well as from numerous private individuals, in the publication of the Canadian Journal, and to which attention was drawn in the annual report, also in the circular addressed to the Secretaries of Mechanics' Institutes, &c., induces the Council to announce their intention of republishing a limited edition of the 1st Volume of the Canadian Journal, as soon as the number of subscribers whose names have been duly transmitted to the Assistant Secretary of the Institute shall furnish a guarantee that the sale will cover the expenses of publication. It is proposed to reprint a fac-simile of the 1st volume, sewed, with paper cover, for fifteen shillings. Members of the Institute, or subscribers desirous of obtaining a copy of the 1st volume, should intimate their wish to the Assistant Secretary, without delay.

Meteorological Results at Hamilton during 1854.

Mean Results of Meteorological Observations at Hamilton, C. W., for the Year 1854.

Communicated to the Canadian Institute by Dr. Craigie.

1854. MONTHS.	Thermometer. 9 A. M.	Thermometer. 9 P. M.	Thermometer. Mean of both.	Thermometer. Highest.	Thermometer. Lowest.	Barometer. Mean.	Barometer. Highest.	Barometer. Lowest	Rainy Days.	Sleet Showers	Dry Days.	Years. Mean Temperature.
January	26·13°	27·22°	26·675	53	3	29·671	30·20	29·00	5	10	16	1846...50·215
February	24·57	27·392	25·981	49	1	734	30·20	15	6	4	18	1847...48·163
March	35·32	35·612	35·466	61	14	608	30·10	02	5	6	20	1848...49·295
April	44·66	43·93	44·3	82	24	7225	30·18	25	4	5	21	1849...48·105
May	56·84	55·00	55·92	85	32	647	30·00	30	4	6	21	1850...48·732
June	69·00	67·50	68·25	97	52	65	29·96	37	1	6	23	1851...48·756
July	75·58	75·00	75·29	101	55	765	94	50	2	6	23	1852...48·248
August	71·35	70·03	70·69	98	53	74	92	48	2	6	23	1853...49·474
September	63·57	64·83	63·95	100	40	777	30·15	44	4	4	22	1854...49·013
October	53·032	53·00	53·016	83	32	743	30·16	28·86	3	7	21	
November	40·50	40·80	40·65	60	21	49	30·22	77	3	9	18	
December	27·967	27·967	27·967	56	2	62	30·16	98	4	10	17	Mean ...48·67
Means	49·043	48·982	49·013			29·6896			43	79	243	

NOTICES OF BOOKS.

"*Lives of the Queens of England before the Norman Conquest,*" by Mrs. Matthew Hall. Philadelphia: Blanchard and Lea, 1854; 8vo., pp. 469.

The records of the period which the authoress of the work before us enjoyed an opportunity of consulting, are so scanty, that it may well be a matter of surprise that so much could have been written on a subject respecting which so little is known. Mrs. Hall, however, has made full use of traditional tales and romantic annals, and has woven with her history many striking incidents of the age and remarkable features of character, which we may receive as true or imaginary according to fancy. We have no doubt, however, that this book will be a general favorite, as it is pleasingly written. The subject is attractive, and notwithstanding the mystery with which much of it is enveloped, will suit many tastes, although it may not inform many minds.

"*The American Almanac and Repository of Useful Knowledge, for the year* 1855." Phillips, Sampson & Co.: Boston.

This is the twenty-sixth volume of the "American Almanac," an admirable and concise exposition of the affairs of the General and State Governments of the United States; of their Public Institutions, Indian Affairs, Army and Navy, Commerce and Navigation, Revenue and Expenditure, Post-Office, Mint, Public Lands, &c., &c.

The Astronomical Department is highly valuable, having been prepared by G. P. Bond, of the Cambridge Observatory. The European portion of the work gives the several States of Europe, their form of Government, the name, title and date of accession of the reigning sovereigns, the area and population of the several countries, &c., &c.

"The American Almanac" is a work which commends itself to Canadians as well as to the people of the United States. The able critique which appeared some years ago in a Boston Journal has had a beneficial effect, and the name of Mr. Bond will be a security that errors similar to those then noticed by the reviewer will not be found in the present issue.

On the Solidification of Bodies under Great Pressure.*

Mr. Fairbairn read a Paper which contained the results of a portion of the experiments conducted by himself, Mr. Hopkins and Mr. Joule, at the request of the Association, and by means of funds supplied for that purpose by the Royal Society. At the last meeting at Hull, Mr. Hopkins alluded to these experiments, and then explained the nature of apparatus invented by Mr. Fairbairn for submitting the substances to be operated on to the enormous pressure of 90,000 lbs. on the square inch. In these inquiries the objects kept in view were, to ascertain the exact laws which govern the cohesive strength of bodies in their present physical condition, and how far a knowledge of those laws may conduce to the reduction of the metals and their subsequent solidification under circumstances whereby increased strength and density may be obtained. The experiments commenced with spermaceti, bars of which were cast and left to solidify at the same temperature, but under different pressures. When pressure was applied to these bars, the one that sustained a pressure of 40,793 lb. carried 7·52 lb per square inch more weight than one submitted to a pressure of 6,421 lb., the ratio being in favor of the more strongly compressed bar, in its power of resistance to a tensible strain, as 1 to ·876. It appeared from these experiments that bodies when solidified under pressure have not only their densities greatly increased, but their molecular structure is also materially affected, so as to increase their adhesive power. Still further to elucidate the subject, cubes of exactly one inch were carefully prepared and loaded with weights till they were crushed. The first cube, solidified under a pressure of 6,421 lb., was crushed with 213 lb. Tin was then operated on; a quantity of pure tin being melted and then allowed to solidify; first at the pressure of the atmosphere and afterwards at a pressure of 908 lb. on the square inch. The same quantity taken from the same ingot was subsequently submitted to a pressure of 5,698 lb. on the square inch. The bars after being solidified and allowed to cool for upwards of fourteen hours, were subjected to the usual tests of tensile strains. From these experiments there was derived, as nearly as possible, the same law or measure of strength in regard to the effects of pressure as obtained from the experiments on spermaceti; for with the same pressures of 908 lb, and 5,698 lb. upon the square inch, the breaking weights were 4,053 lb. and 5,737 lb. or in

* Meeting of the British Association in 1854.—*Athenæum*

the ratio of 1 to ·706, being an increase of nearly one-third on the crystalized metal when solidified under about six times the pressure. From these facts Mr. Fairbairn observed, it is evident that the power of bodies to resist strain is greatly increased when solidified under pressure; and he said he considered it highly probable that the time is not far distant when the resisting powers of metals, as well as their densities, may be increased to such an extent as to ensure not only greater security, but greater economy by solidification under pressure. He said he was borne out in these views by the fact, that the specific gravities of the bodies experimented on were increased in a given ratio to the pressure. Spermaceti solidified under a pressure of 908 lb. on the square inch had a specific gravity of 0·94859; whilst that solidified under a pressure of 5,698 lb. had its specific gravity increased to 0,95495. The specific gravity of tin solidified under a pressure of 908 lb. was 7·3063; and that solidified under a pressure of 5,698 lb. was 7·3154, which gave ·0091 as the increased density from pressure. There are further experiments in progress to determine the law that governs this increase of specific gravity, and to determine the conducting powers of bodies solidified under severe pressure. Experiments have also been made on such substances as clay, charcoal and different kinds of timber. From the experiments on powdered dry clay, it appeared that a bar of that substance 3½ inches long and 1¼ inch diameter, after being hammered into the cylinder, so as to become slightly consolidated, was reduced in bulk with a pressure of 9,940 lb. on the square inch to 2·958; with a pressure of 54,580 lb. to 2·3; with 76,084 lb. to 2·288; and with a pressure of 97,588 lb. to 2·195 inches.

A New Arithmometer, or Calculating Machine.*

BY M. T. DE COLMAR, PRESENTED BY THE ABBÉ MOIGNO.

As the Abbé spoke English with difficulty, he requested Professor Wilson to explain the machine to the Section. The machine, which was very beautifully executed, consisted of an oblong box, about thirty inches long by six inches wide. On the face, the machine was furnished with a handle to turn round a number of small holes, at which the digits of the common arithmetic scale, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, made their appearance as the machine worked, and which finally gave the answer. In this machine they were eight in number, but they might be extended to any number. To each of these was an index to be set to the required digit, engraved on a small attached vertical scale, and a small ivory ball to be moved along its scale according to certain simple rules, as the operation to be conducted by the machine varied from addition to multiplication, &c. Upon drawing out the sliding bottom of the machine, the machinery was exposed to view. This, though simple, could not be intelligibly explained without the machine or diagrams. The chief part of it consisted of eight cylinders so arranged that, as they turned, the digits, enamelled on a circle at their upper parts, came in succession to the holes in the face; while by a number of indentations arranged spirally round them the digit to which the index was set would be stopped at the hole on the face at the digit corresponding to that at which the index was set; while by a set of pinions a connexion was given to them something similar to that in the common bank-note machine, so that addition could be performed and the result appear on the face:—thus by turning the handle once, the number itself appeared; by turning a twice every digit in it was doubled, and the result appeared above it twice the number originally set, and so on with any multiple of the number so set; then by moving the ivory ball any simple multiple of 10 times, 100 times, 1,000 times, and so the number set could be obtained and added to those previously obtained, and thus the operation of multiplication performed of any number by any number to the extent the machine could give, in this case up to 99,999,999 or nearly 100,000,000. The Professor then exemplified this, by setting a large number and multiplying it by a number which consisted of three digits. He then explained how the other operations were to be performed, showing that the machine could add, subtract, multiply, divide, raise to an integer power, or extract the square or cube root with precision and rapidity. The price of the machine exhibited was £50.

On the Cause of the Phenomena exhibited by the Geysers of Iceland.*

BY DR. STEPHENSON MACADAM.

These Geysers were singled out, because our knowledge of them is such as to entitle us to speculate on the force at work; but, at the same time, it is highly probable that a theory which will explain the Iceland Geysers will also account for those found in California. These Geysers are essentially intermittent hot springs from which, at intervals, there issue successive jets of water, and thereafter immense volumes of steam. When these have been ejected, the Geysers remain quiescent for a longer or shorter time, In endeavouring to account for the phenomena in question, the author assumes that there exists in connexion with each Geyser a subterranean chamber, the floor of which is of a roundish form, and at a temperature of not less than 340° Fahr. At or near the roof there are fissures communicating with springs or reservoirs of water, by which the latter may be allowed to flow into the caverns,—the tube which passes from the cavity to the surface of the earth taking its rise from the side of the chamber and very near the lowest part. Without entering into details, the author assumed this tube (as other writers on the Geysers have done) to be somewhat like an inverted syphon; the shorter limb of which communicates with the chamber, whilst the longer limb, pursuing a tortuous course upwards, forms the exit or omission tube of the Geyser. Water finds access by the fissures into the cavity, where, from the high temperature of the matter it falls upon, it is immediately compelled to assume the spheroidal condition; its temperature while in that state being 205·7° Fahr The water gradually accumulates, till at last so much has entered the cavity that the heated floor can no longer keep the liquid in the spheroidal state, the water in consequence touches the mineral surface; its temperature is almost instantly raised to 212° Fahr.; and large volumes of steam are generated. This steam, in its passage to the mouth of the Geyser, encounters a body of water which it raises to the boiling point, and thereafter when no more steam can be condensed it forces the heated water from the conduit. The propelling agent having thus cleared a path for itself, the steam escapes in large volumes, with a rushing sound more or less violent. The author, by means of diagrams, illustrated the various forms which the Geyser might be suppposed to present in its internal mechanism. He considered it quite possible that the details given might require to be modified. What he wished to bring prominently forward was, that the spheroidicity of water afforded a means of accounting for the intermittence of the hot springs.

On the Silurian Anthracite of Cavan.*

BY DR. WHITTY.

The author described this deposit as a bed of soft anthracite or culm, about 4 feet thick, occurring in dark grey clay-slate, dipping 80° south-east, with an average strike of 37° west of north. The slaty rock occurs alternately with beds of shale and conglomerate, much altered by metamorphic action. The bed of anthracite varied its direction, but seldom more than a few degrees; it appeared to have suffered much by compression and dislocation, diminishing in a short space to a few inches in thickness, or giving off spurs into the slate rock; portions of the slate were also included in the culm. Its composition was carbon, 77·61; water, 4·35; ash, 18·1. For burning it required mixture with wood or turf. It might be worked like the cornish mines, being nearly vertical, and the water brought out by an adit, without pumping. The value of culm in Cavan was 8 to 10 shillings per ton; of coal, 24 shillings per ton; the culm would be of value for lime-burning.—Dr. Griffiths stated that he had not met with anthracite elsewhere in the grauwacke of Ireland; if this bed could be traced at the surface for a long distance it might be worked like a mineral vein.—Prof. Harkness said, that the attempt to work Silurian anthracite in Scotland had been unsuccessful.

COLONIAL POSTAGE.—There are now thirty-three British colonies, to and from which the letter postage has been reduced to 6*d*. In fourteen of these colonies the postal arrangements are under the control of the local colonial authorities, viz., Ceylon, Trinidad, Barbadoes, Bermuda, Canada, Nova Scotia, Newfoundland, Prince Edward's Island, St. Helena, the Gold Coast, New Brunswick, New South Wales, South Australia, and Victoria; in the remaining nineteen colonies the posts are controlled by the British Postmaster-General, viz., Hong-Kong, Antigua, Gibraltar, Granada, Malta, Berbice, Honduras, Demerara, Bahamas, Cariaco, Jamacia, Tobago, St. Vincent, Montserrat, St. Lucia, Nevis, St. Kitt's, Tortola and Dominica. The whole of the 6*d*. private-ship letter rate belongs to the British post-office for letters to or from the latter-mentioned colonies; and on letters to and from the other colonies the 6*d*. private-ship letter rate is divided equally between the local, colonial and British Governments.

* Meeting of the British Association in 1854.—*Athenæum*.

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Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—December, 1854.

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	29·611	29·393	29·458	29·438	24·1	34·0	28·6	28·7	— 2·1	0·115	0·155	0·146	0·129	·86	·78	·84	·79	W S W	W S W	W N W	11·81	...	0·2
2	·680	·716	·578	·656	11·2	26·2	23·3	20·9	— 9 6	·052	·083	·094	·079	67	56	74	66	N b W	N b E	N E	6·84	...	3·0
3	·195	·148	—	—	25·2	24·9	—	—	—	·123	·123	—	—	88	89	—	—	E b S	N E	—	17·58	...	3·0
4	·274	·202	·230	·241	15·4	19·1	13·4	15·3	— 14·5	·069	·066	·063	·064	75	62	75	70	N N W	NWb N	N N W	23·21	...	3·5
5	·209	·250	·218	·226	12 0	19·0	22·3	17·9	— 11·5	·065	·079	·092	·080	86	74	75	77	W b N	W N W	W S W	16·09	...	...
6	·016	28.918	28·934	28·954	20 5	26·2	26 9	24·8	— 4·3	·098	·128	·131	·120	86	87	88	87	S W b W	W S W	W S W	13·33	...	2·0
7	·153	29·312	29·572	29·377	15·8	14·3	5·4	11·2	— 17·4	·064	·060	·042	·052	68	68	69	66	N N W	N N W	N N W	15·41	...	0·2
8	·780	·899	30·014	·918	- 1·1	17·9	6·1	8 6	— 19·8	·036	·073	·053	·059	77	71	85	81	N	NWbW	Calm	4·43	...	...
9	30·021	·912	29·787	·887	17·2	31·5	29·1	26·6	— 1·6	·086	·055	·143	·133	85	88	89	89	Calm	S	Calm	4·17	Inap.	...
10	29·650	·721	—	—	33·0	37·7	—	—	—	·142	·143	—	—	75	61	—	—	Calm	W	—	7·15	...	...
11	·720	·751	·805	·760	29·1	28·4	20·8	24·7	— 2·9	·143	·121	·089	·111	89	76	77	79	W N W	NWbN	NWbW	9·92	...	0·1
12	·690	·773	·654	·708	17·6	27·1	24·8	23·2	— 4·1	·080	·111	·102	·098	79	74	75	76	W N W	N N W	S W	10·33	...	0·1
13	·369	·328	·487	·402	34·5	40·6	37·3	37·5	+ 10·4	·165	·193	·193	·181	82	77	87	81	SW bW	W S W	W b S	7·78	...	...
14	·551	·499	·420	·484	30·6	40·9	36·3	35·3	+ 8·4	·147	·136	·183	·163	86	54	86	80	Calm	W S W	S S W	4·68	...	..
15	·352	·302	·315	·323	37·3	41·8	37·0	38·3	+ 11·5	·204	·234	·198	·208	92	89	91	91	S W b S	Calm	Calm	5·40	·030	...
16	·391	·532	·611	·529	28·7	27·6	18 7	24·9	— 1·7	·120	·089	·084	·101	75	58	80	74	N N W	N b W	N b E	10·82	...	0·4
17	·655	·590	—	—	11·1	12·6	—	—	—	·070	·061	—	—	91	75	—	—	N E b N	N E	—	8·02	...	2·5
18	·633	·670	·770	·694	6·5	13·8	0·0	6·5	— 19·7	·051	·058	·038	050	79	67	81	79	Calm	NWbW	Calm	3·52	...	...
19	·812	·770	·740	·779	- 2·7	10·1	- 5·9	2·0	— 24·1	·043	·057	·033	·016	98	77	92	88	N N W	Calm	NWbN	4·06	...	...
20	·615	·489	·372	·48.	14·2	24·9	23·3	20·8	— 5·1	·076	·092	·106	·092	86	67	81	79	Calm	SW bW	SW bW	8·57	...	0·6
21	·364	·559	·788	·591	17·6	22·4	4·9	14·6	— 11·2	·087	·092	·048	·073	85	74	81	79	W b N	N b W	N	11·94	...	...
22	·964	30·070	30·179	30·084	- 2·1	4·5	6·7	3·3	— 22·4	·036	·043	·057	·046	84	75	89	81	N b E	N N E	N N E	6·46	...	Inap.
23	30·191	30·109	29·923	30·054	18·3	17 0	28·0	21·8	— 3 7	·091	·065	·140	·102	88	65	90	81	E S E	N E	Calm	7·06	·030	1·6
24	29·732	29·681	—	—	34·5	37·7	—	—	—	·186	·189	—	—	94	84	—	—	S W b S	SW b W	—	5·98	...	...
25	·717	·630	—	—	36·3	38·8	—	—	—	·197	·191	—	—	93	81	—	—	SW b W	SW b S	—	8·36	...	Inap.
26	·700	·628	·468	29·594	38·8	36·3	36·6	37·2	+ 11·9	·218	·190	·202	·204	93	89	94	92	Calm	E N E	E	5·78	·135	...
27	·469	·606	·675	·588	35·5	39·6	37·0	36·8	+ 11·5	·198	·191	·198	·190	95	79	91	88	Calm	N b E	Calm	2·67	·065	...
28	·448	·187	·334	·323	36·3	39·1	30·0	34·5	+ 9·3	·197	·221	·136	·179	93	93	81	87	E S E	E	NWbW	18·96	·330	Inap.
29	·630	·751	·918	·780	17·0	16·5	7·2	12·5	— 12 7	·082	·057	·047	·061	83	59	72	74	NWbW	N N W	N b W	13·13	...	Inpa.
30	·870	·670	·740	·752	3·6	25·6	26·9	19·2	— 6·0	·043	·119	·133	·098	76	85	89	82	N N W	S S W	Calm	0·92	...	...
31	·844	·849	—	—	27·7	31·6	—	—	—	·123	·117	—	—	80	66	—	—	Calm	E N E	—	4·10	...	...
M	29·581	29·572	29·599	29.587	19·0	25·8	21·0	21·9	— 5·2	0·101	0·115	0·110	0·109	83	74	83	80	9·39	10·78	7·07	8·66	0·590	17·2

Highest Barometer...... 30·245, at 10 a. m. on 23rd } Monthly range:
Lowest Barometer....... 28·917, at 4 p.m. on 6th } 1·328 inches.
Highest registered temp'ture +44°·8, at p.m. on 15th } Monthly range.
Lowest registered temperature —7°·0, at p.m. on 19th } 51°·8.
Mean Maximum Thermometer.............. 29°·46 } Mean daily range:
Mean Minimum Thermometer....... ...... 14°·38 } 15°·08.
Greatest daily range ....31°·2, from p.m. of 21st to a.m. of 22nd.
Warmest day........ 15th. Mean temperature ..... 38° 28 } Difference,
Coldest day......... 19th. Mean temperature.......... 2°·02 } 36°·26.
Greatest intensity of Solar Radiation, +52° 0 on p.m. of 14th } Range,
Lowest point of Terrestrial Radiation, —11°·8 on a.m. of 19th } 63° 8.
Aurora observed on 1 night: viz. 29th.
Possible to see Aurora on 7 nights.
Impossible to see Aurora on 24 nights.
Raining on 5 days. Raining 19·0 hours: depth, 0·590 inches.
Snowing on 12 days. Snowing 63·0 hours: depth 17·2 inches.
Toronto Bay was frozen over on the 2nd December, and it continued permanently frozen during the month. Skaters and Pedestrians crossed on the ice from the St. Lawrence Market to the Peninsula Hotel on the 8th.

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

North.	West.	South.	East.
3101·02	3156·48	995·16	873·50

Mean direction of the Wind, W 43° N.
Mean velocity of the Wind, 8·66 miles per hour.
Maximum velocity, 38·2 miles per hour, from 10 to 11 a. m. on 4th.
Most windy day, the 4th; mean velocity, 23·21 miles per hour.
Least windy day, the 30th; mean velocity, 0·92 " "

This month has been marked by an unusually early setting in of winter, the thermometer having fallen below zero on the 7th, and the Bay frozen over on the morning of the 2nd. The mean temperature of the month has been 4°·3 below the mean of the last fifteen Decembers, and is the lowest of all but those of 1845, 1850 and 1851. The 19th was the coldest day of the year but one,—January 28th the mean of which was 1°·58.

The depth of rain fallen is nearly an inch below the average, and that of snow 4·2 inches above. The month is also remarkable as having been the most windy month of the whole series of 8 years—the mean velocity being 2 26 miles per hour above the average December velocity; on the 4th the mean of the whole day was 23·21 miles per hour, which much exceeds anything previously recorded.

The change of mean temperature from day to day has been excessive in several instances—thus from the 8th to 9th it rose 18°·, from 19th to 20th it rose 18°·8, and from 22nd to 23rd it rose 18°·5, and from the 28th to 29th it fell 22°.0. Between 10 p.m. on the 19th and 2 p.m. on the 20th there was a rise of temperature of 30°·8.

Comparative Table for December.

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	24·3	—1·9	41·0	— 4.4	45·4	3	Inap.	18	...	...	
1841	28·7	+2·5	45·5	+ 2·4	43·1	7	6·600	5	...	1·38	lb.
1842	24·7	—1·5	40·3	+ 3 8	36·5	3	0·880	17	...	0·61	lb.
1843	30·0	+3·8	41·1	+ 2·7	38·4	6	1·040	8	8·1	0·53	lb.
1844	28·2	+2·0	48·9	— 0·8	49·7	6	*Impf*	6	4·2	0·40	lb.
1845	21·1	—5·1	37·6	— 2·7	40·3	2	Inap.	12	4·7	0·70	lb.
1846	27·5	+1·3	49·2	+ 3·7	45·5	5	1·215	9	6·0	0·57	lb.
1847	30·1	+3·9	50·0	+ 6·6	43·4	7	1·185	8	6·8	4·55	Miles.
1848	29·1	+2·9	49·1	+ 0·6	48·5	7	2·750	7	16·5	5·44	Miles.
1849	26·5	+0·3	41·3	— 5 2	46·5	5	0·840	12	9·6	6·23	Miles.
1850	21·7	—4·5	48·3	— 9·7	58·0	2	0·190	18	29·5	7·40	Miles.
1851	21·5	—4·7	43·8	—10·5	54·3	6	1·075	15	10·7	7·37	Miles.
1852	31·9	+5·7	51·0	+13·9	37·1	7	3·995	10	20·1	6·54	Miles.
1853	25·3	—0·9	42·2	— 5·2	47·4	4	0·625	13	22·3	4·98	Miles.
1854	21·9	—4 3	41·8	— 5·9	47·7	5	0·590	12	17·2	8·66	Miles.
										0·69	lbs.
M'n.	26·17		44·74	—9·71	45·45	5·0	1·499	11·3	13·0	6·40	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—December, 1854.

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 Inch.	Snow in Inch.	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.			6 A.M.	2 P.M.	10 P.M.
1	29·858	29·791	29·711	10·6	13·1	12·1	·082	·083	·090	.88	·82	·94	W N W	W N W	W N W	2·03	7·00	0·64	...	..	Str. 10.	Str. 9.	Clear.
2	·819	·914	·996	7·2	10·9	10·7	079	077	072	88	83	78	W	W	W	2·55	4·02	6·37	...	...	Clear.	Clear.	Do.
3	·916	·812	·741	8·9	16·0	17·0	080	092	097	89	85	85	N E b E	N E	N E	3·20	10·38	12·00	...	...	Cir. Str. 10.	Cir. Str. 10.	Cum. Str. 10.
4	·273	·249	·060	16·5	20·1	15·0	096	114	102	83	87	95	N E b E	N E b E	N b W	10 17	19·56	7·04	...	4·60	Snow.	Snow.	Do. 8.
5	·066	·100	·214	4·0	11·0	10·6	038	082	077	61	88	83	W b N	W N W	W N W	11·75	11·70	9·02	...	0·10	Cir.CumStr. 4	Do.	Cir. Cum. 4.
6	·239	·221	·252	12·2	23·2	22·0	090	136	151	94	96	96	W S W	S S W	S W	5·75	1·40	2·88	...	Inap.	Cir. Str. 4.	Sl'gt snow.	Str. 10.
7	·287	·330	·447	25·0	31·5	16·0	138	191	098	37	95	88	S b W	S b W	W b N	1·62	Calm	2·50	...	3·16	Cum. Str. 10.	Snow.	Snow.
8	·699	·840	30·068	7·1	10·5	1·8	078	069	048	80	79	95	N W b W	N W b W	W N W	11·25	12·28	10·32	...	1 00	Sl'tSnow.	Clear.	Clear Au.Bor.
9	30·195	30·189	30·112	- 3·1	8·0	12·1	038	058	070	88	80	78	W	W	E N E	3 26	Calm	0·31	...	...	Clear.	Str. 2.	Str. 10.
10	29·940	29·911	29·894	16·4	82·1	84·6	093	167	186	82	84	87	E N E	E N E	W b S	0·43	0·67	2·19	...	1·00	Str. 10.	Sl'gt snow.	Do. 10.
11	·899	·831	·895	32·0	80·6	16·0	196	197	098	96	95	88	W	W b N	N W	0·16	3·74	7·16	...	...	Do. 10.	Cum. Str. 4.	Do. 10.
12	·965	·992	·999	- 2·0	9·9	0·5	041	068	047	96	93	95	N W	N W	N W	11·25	0·30	Inap.	...	...	Clear.	Clear.	Clear.
13	·601	·650	·650	17·2	85·0	85·0	106	203	203	90	91	91	W b S	W b S	W b S	5·46	2·37	4·00	...	0·81	Snow.	Cir. Str. 4.	Cir. Str. 8.
14	·882	·717	·799	14·0	82·1	14·1	091	182	097	87	91	93	E b N	E b N	E b N	5·31	Calm	Calm	...	...	Cir. Str. 4.	Do. 8.	Str. 8.
15	·682	·500	·505	17·5	83·1	25·6	106	189	147	90	90	92	E b N	E b N	E b N	Inap.	Calm	Calm	...	...	Do. 8.	Clear.	Clear.
16	·615	·642	·846	27·4	83·2	7·9	167	197	063	99	95	93	E b N	E b N	E b N	Calm	Calm	4·17	...	...	Cum. 4.	Cir. Str. 4.	Do.
17	30·081	30·074	·956	- 9·5	- 2·4	- 4·0	029	036	038	94	84	95	E b N	E b N	E b N	2·25	3·43	6·15	...	...	Clear.	Str. 10.	Do.
18	29·814	29·849	·910	- 1·0	5·5	- 5·3	043	058	036	95	91	94	N E b E	N b E	N W b W	15·79	1·34	1·99	...	0·70	Snow.	Cir. 2.	Do. ft. A. L't.
19	·940	·990	·992	-20·3	- 2·1	-12·7	017	036	025	89	90	90	N W b W	N W b W	W N W	Inap.	Calm	Calm	...	...	Clear.	Clear.	Clear.
20	·976	·810	·714	-23·6	5·8	1·0	010	051	043	57	79	85	S W	S	N b E	Calm	Calm	Calm	...	...	Do.	Do.	Str. 10.
21	·612	·662	30·110	12·0	16·1	-14·2	076	084	021	90	84	84	S S W	N E b N	N E b E	0·55	0·87	8·46	...	2·90	Snow.	Snow.	Clear.
22	30·200	30·386	30·482	-31·0	-11·8	-28·2	008	017	010	66	67	84	N E b E	E N E	E N E	3·31	Calm	Calm	...	...	Clear.	Clear.	Do. ft. A. L't.
23	·589	30·594	30·400	-36·2	-12·6	- 9·1	000	008	029	06	30	90	N E b E	N E b E	N E b E	Calm	Calm	2·21	...	...	Do.	Do.	Do.
24	·066	29·910	29·800	5·0	31·0	21·0	053	171	126	85	89	93	N E b E	N E b E	N E b E	6 00	Calm	1·55	...	4·20	Snow.	Snow.	Sleet.
25	29·782	·940	·999	36·0	35·8	32·6	212	210	181	92	91	89	W	W N W	W N W	3·07	0·62	0·14	...	...	Str. 10.	Clear.	Clear.
26	·997	·997	·990	33·7	41·9	23 0	195	263	127	90	89	88	W	N N W	N E	Calm	Calm	Calm	...	...	Clear.	Do.	Cir. 4.*
27	·811	·857	·876	34·1	41·0	36·2	210	253	210	99	92	91	S E b S	S E b S	W b S	1·62	Calm	Calm	0·11	...	Rain.	Str. 10.	Str. 8.
28	·935	642	·451	29·0	35·7	38·0	177	203	230	98	91	94	E b N	E	S	Calm	0·45	1·67	...	...	Fog.	Cir. Str. 10.	Str. 10.
29	·600	·792	·954	22·0	11·0	0·6	120	077	042	84	83	84	W b N	W b N	W b N	11·45	10·62	7·00	...	...	Cir. Str. 4.	Str. 10.	Clear.
30	30·055	30·050	29·942	-12 1	6·3	2·5	021	052	081	77	79	95	W b N	W b N	W b N	1·12	Calm	Calm	...	...	Clear.	Clear.	Cir.Cum.Str.4
31	30·109	30·214	30·252	0·0	20·0	5·0	067	105	053	95	87	89	W b N	W b N	W b N	Calm	Calm	Calm	...	...	Do.	Do.	Cir. Str. 10.

Barometer ....
- Highest, the 23rd day 30 594
- Lowest, the 4th day .... 29·060
- Monthly Mean .... 29·540
- " Range .... 1·534

Thermometer.
- Highest, the 26th day .... 41°·9
- Lowest, the 23rd day .... —36°·2
- Monthly Mean .... 7°·35
- " Range .... 78°·1
- Mean Humidity .... ·850

Greatest Intensity of the Sun's Rays .... 116°·9

Rain fell on 1 day, amounting to 0·11 inches. Raining 4 hours, 30 minutes.

Most prevalent Wind, N.E.b E. Least prevalent Wind, E.

now fell on 10 days, amounting to 18·67 inches. Snowing 44 hours 31 minutes.

Most Windy Day, the 4th day; mean miles per hour, 22·25.

Least Windy Day, the 30th day; mean miles per hour, 0.0

Aurora Borealis visible on 3 nights. Might have been seen on 10 nights.

Winter fairly set in 4th day.

The lowest temperature observed here was on the 23rd day, at 6 a.m., and was -36.2.

Zodiacal Light very bright frequently during the month.

The Electrical state of the atmosphere has indicated generally a high tension, and during the great storm on the 4th day indicates a very high tension of Negative Electricity, and continued with little decrease in intensity during the whole of the storm, reaching very frequently to 500°. in terms of Volta's No. 1 Electrometer

Ozone was present very frequently during the month

* Lunar Halo, diameter 45°·6.

Monthly Meteorological Register, Quebec, Canada East, December, 1851.

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.				Humidity 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.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·563	29·514	29·452	29·510	16·5	14·6	12·6	14·6	0·074	0·078	0·076	0·076	76	78	93	82	N W	N W	N W	8·8	8·8	6·2	...	...	
2	·501	·622	·761	·628	8·9	14·8	9·7	11·1	·059	·056	·070	·062	85	78	77	80	W N W	W	N W	11·3	17·9	7·2	...	...	
3	·792	·760	·681	·745	5·0	16·6	17·6	13·1	·049	·091	·091	·077	83	93	90	89	S	E N E	E N E	3·8	11·3	42·5	...	0 6	3rd. Lunar Halo at 10 p.m.
4	·281	28·931	28·668	28·961	18·4	21·1	26·3	22·9	·099	·126	·138	·121	94	95	96	95	N E	N E	N E	70·0	56·7	8·0	...	4·5	4th. Barometer very unsteady, varying occasionally 0·1 inch.
5	28.608	28·753	28·860	28·741	16·8	12·7	11·2	13·6	·099	·078	·072	·083	100	93	91	96	W	W	W	11·3	22·7	11·3	...	0·4	
6	29·037	29·102	29·127	29·089	6·8	11·9	21·1	13·3	·059	·077	·096	·077	92	96	81	90	N W	Calm.	Calm.	11·3	0·0	0·0	...	1·5	
7	·158	·198	·237	·198	21·6	25·5	24·1	23·7	·115	·119	·132	·122	95	85	100	93	Calm.	N	Calm.		2·0	0·0	...	2·0	
8	·253	·431	·765	·483	22·0	15·5	5·4	13·6	·091	·051	·052	·069	75	57	85	72	W	N W	N W	8·0	13·4	5·2	...	...	
9	30·060	30·195	30·105	30·120	– 1·8	7·6	9·7	5·2	·042	·056	·067	·055	96	85	93	91	N W	N N W	Calm.	6·2	7·2	0·0	...	1·2	9th. Lowest point of Terrestrial Radiation.—8°.
10	29·929	29·737	29·734	29·800	15·0	27·3	29·3	23·9	·087	·124	·151	·121	95	83	93	90	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	1·1	
11	·665	·516	·588	·590	32·2	31·8	16·1	26·7	·162	·163	·080	·135	89	92	84	88	Calm.	S W	W	0·0	2·0	11·3	...	1·9	
12	·713	·751	·806	·757	7·4	9·8	4·6	7·3	·061	·062	·053	·059	92	86	90	89	N W	W	W	5·2	3·8	5·2	...	...	
13	·628	·346	·408	·461	3·4	15·5	21·2	14·4	·053	·089	·127	·090	95	95	95	95	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	3·5	
14	·676	·726	·637	·680	14·5	15·5	17·6	15·9	·074	·082	·092	·083	83	88	91	87	Calm.	E	Calm.	0·0	3·8	0·0	...	...	
15	·622	·489	·452	·488	23·2	33·5	33·4	30·0	·117	·169	·171	·152	91	89	91	90	Calm.	Calm	Calm.	0·0	0·0	0·0	·033	0·6	
16	·314	·344	·676	·415	33·1	34·0	13·5	26·9	·170	·146	·065	·127	90	74	76	80	S W	W b S	W b S	3·8	3·8	3·8	...	...	16th. Auroral light observed.
17	·859	·933	·886	·926	3·2	0·5	0·8	1·5	·038	·046	·	·	71	95			S	E	N E	2·0	11·3	16·0	...	...	
18	·753	·635	·634	·674	– 0.6	6·0	2·8	2·7	·042	·059	·016	·019	93	94	84	90	N E	N E	Calm.	19·7	11·5	0·0	...	3 2	
19	·815	·781	·841	·812	– 9·1	– 3·8	– 7·8	– 6·9	·027	·036	·030	·031	87	90	89	89	W	W S W	Calm.	7·2	5·2	0·0	...	...	
20	·817	·687	·550	·685	–14·0	– 2.3	4·0	– 4 0	·023	·036	·019	·036	92	84	85	87	W	W N W	Calm.	2·0	5·2	0·0	...	1·0	
21	·430	·465	·939	·611	8·2	12·0	–12·6	2·5	·060	·055	·018	·043	87	68	59	71	Calm.	N W	N W	0·0	7·2	5·2	...	2·9	
22	30·169	30·298	30·423	30·297	–17·8	–11·0	– 8·6	–12·5	·013	·017	·023	·018	66	57	72	65	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	22nd and 23rd. A heavy fog over the River St. Lawrence. 23rd. At 10¼ a.m., Barometer 30·621 inches.
23	30·653	30·513	30·381	30·482	–16·0	– 4·8	– 2·1	– 7·6	·013	·021	·040	·025	56	53	91	67	Calm.	Calm.	Calm.	0·0	0·0	0 0	...	...	
24	30·165	29·869	29·637	29·890	6·2	18·2	23·4	15·9	·061	·094	·124	·093	95	91	96	94	Calm.	E	Calm.	0·0	3·8	0·0	0·40	3·8	
25	29·584	·659	·667	·637	26·7	31·2	32·6	31·2	·142	·159	·170	·157	97	79	93	90	Calm.	S W	Calm.	0·	5·2	0·0	...	...	
26	·755	·872	·917	·848	29·8	32·0	26·1	29·3	·162	·162	·127	·150	93	90	87	90	Calm.	S W	Calm.	0·0	3·8	0·0	...	...	
27	·753	·661	·797	·737	26 9	29·8	31·2	29·3	·135	·162	·174	·157	90	97	100	96	E N E	E N E	Calm.	7·2	2·0	0·0	...	1·5	
28	·832	·658	·387	·626	22·8	30·0	29·6	27·5	·112	·162	·157	·144	88	96	96	93	Calm.	N E	N E	2·0	11·3	13·9	0·50	0 8	
29	·212	·456	·727	·465	32·2	16·4	5·2	17·9	·179	·076	·055	·103	98	78	90	89	Calm.	W S W	W S W	0·0	12·9	11·3	...	...	29th. Halo round Moon 20° in diameter.
30	·891	·911	·890	·897	– 0·8	2·4	– 0·8	0·3	·041	·037	·042	·040	91	85	93	90	W S W	W S W	W S W	12·4	5·2	8·8	...	...	
31	·915	·987	30·128	30·020	– 3·8	5·4	4·0	1·8	·038	·056	·057	·050	95	90	100	95	S	E N E	Calm.	3·8	3·8	0·0	...	0·2	31st. Heavy fog at 10 p.m.
	29·653	29·642	29·670	29·655	10·87	15·34	13·01	13·08	0·082	0·090	0·088	0·087	85	87	89	87				6·32	7·74	5·09	123	30·7	

Maximum Barometer, 10¼ a.m. on the 23rd	30·621
Minimum Barometer. 6 a.m. on the 5th.,	28·608
Monthly Range	2·013
Monthly Mean	29·655
Maximum Thermometer on the 16th	36°.6
Minimum Thermometer on the 22nd	–19°·2
Monthly Range	55·8
Mean Maximum Thermometer	19·39
Mean Minimum Thermometer	4·17
Mean Daily Range	15·21
Mean Monthly Temperature	13·08

Greatest Daily Range of Thermometer on 16th	33°·4
Least Daily Range of Thermomter on 17th	3°·3
Warmest Day, 25th. Mean Temperature	31·2
Coldest Day, 21st. Mean Temperature	—12·5
Climatic Difference	43·7

Possible to see Aurora on 10 Nights.
Aurora visible on 4 Nights.
Total quantity of Rain, 0·123 inches.
Total quantity of Snow, 39·7 inches.
Rain fell on 3 days.
Snow fell on 17 days.