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ON SOME ANCIENT MOUNDS UPON THE SHORES OF THE BAY OF QUINTÉ.

BY THOMAS CAMPBELL WALLBRIDGE.

Read before the Canadian Institute, 3rd March, 1860.

During the early occupation of this country by the French, there existed, in what is now called Upper Canada, various artificial works of the aboriginal races, the vestiges of which, from an archæological point of view, possess a certain degree of interest at the present day. Erected at various periods, under different circumstances, and perhaps by different people, what the wear of time, the plough of the husbandman, and the spade of the curiosity seeker, have spared of these works, will scarce serve to point out the objects for which they were constructed. This is the more to be regretted since no systematic exploration of them has taken place, and the only information we have upon the subject, in many instances, is from their accidental mention in connection with other questions. In general terms, however, the antiquities of this country may be said to resemble those of the State of New York, which have been so ably described by Mr. Squier in his Aboriginal Monuments of that State; but, as most of the works explored by Mr. Squier present significant variations, an examination of the Indian works of this country would no doubt throw some additional light upon the archæology of the continent, such ruins containing the evidences of general customs and common arts among the distant tribes.

Embankments of earth styled "Indian Forts," and which are perhaps the ruins of the palisaded encampments the Hurons dwelt in, are said to be met with in the Townships of Beverley, Vaughan, Whitchurch, and the country about Lake Simcoe. The same tracts of country abound in tumuli, bone heaps, deposits of warlike stores,* and other evidences of savage life; but the lapse of more than two centuries since the dispersion of the Huron race, their probable builders, by the Iroquois tribes, has made great havoc among their perishable contents. Some of these works, especially the palisaded enclosures, have been mentioned with more or less particularity by the early writers upon this country; but we may search in vain the records of that period for any allusion to certain other antiquities, and which are now objects of greater interest than the works described by them as appertaining to the savages they encountered. It is difficult to reconcile this omission with the general character of the writings of that era, for, in some parts, the traces of a more ancient race must have formed prominent features in the landscape of the country, passed and re-passed, on their way to and from the Far West, by explorers and missionaries, among whom were many close observers of Indian character.

Perhaps the omission may be accounted for upon the hypothesis that the race who erected the works, passed over unobserved, had been exterminated at a period so remote, that those whom the early travelleres encountered possessed no tradition that would lead them to the discovery of existing ruins. In this category I place the mounds of the Bay of Quinté—the immediate subject of this paper—and which, though locally known for the last fifty years as artificial works, have not heretofore been mentioned in connection with the archæology of this Province. The similarity which the mounds occurring upon the shores of the Bay of Quinté bear to the barrows or tumuli described by American Antiquarians, and incidentally mentioned by other

* We were shewn, yesterday, a small bagful of Indian arrow heads, brought from Beaverton by Mr. Henry White. We understand that there are several cart loads in the place from which these were taken. They are all well shaped, and must evidently have been stored away in this place, at some remote period, for future use. Mr. White intends presenting the bagful to the Museum of the University of Toronto.—*The Leader Newspaper, Toronto, 10th July, 1860.*

writers, as found at intervals from the Alleghany to the Rocky Mountains, or even to the Pacific coast,* alike intermingling with the huge structures of the Mississippi and Ohio valleys, and the more humble works of the Atlantic States, may perhaps give them a degree of interest beyond their immediate locality.

Commencing at Rednerville, in the Township of Ameliasburg, they may be traced along the Bay shore to the Plains of Massassaga Point, a distance of about eight miles. In this space, including the islands of the so-called "Big Bay," upon which they also occur, perhaps one hundred distinct mounds can be counted; they are not, however, confined to these limits, for, from enquiries made with a view to ascertain their extent, it is probable they will be found at intervals following the shores, from the eastern to the western extremity of the Bay; they are likewise said to occur at a place called "Percy Boom," upon the River Trent, and perhaps by ascending to the head waters of that river they may be traced to the shores of the Upper Lakes, and thence to the most remote parts of the continent.

As far as has yet been ascertained, there is but one class or form of mounds in this part of the country, and the truncated cone is the shape they assume. In size they vary from a diameter at the base of thirty to fifty feet, to a diameter at the apex of twelve feet Each mound has a shallow basin or circular depression upon its summit, which, whatever be the size of the work, has a diameter of eight feet; and no mound under my observation possessed an altitude of more than five feet. It is a remarkable peculiarity of these works, that in almost every instance they occur in groups of two, and at irregular distances the one group from the other. Irregularity is likewise observable between any one mound and its fellow, these being sometimes found in juxta-position, and again from fifty to one hundred feet asunder.

The two of the same group are always of one size. With respect to the surrounding country they are situate apparently without design, now at the foot of a commanding hill, then half way down the side of a bank, and again so near the shore that in several instances they have been destroyed by the action of the water. Twice they have been found in very low or swampy ground, and in those cases they occur singly.

In the month of August, 1859, I caused five of the mounds upon Massassaga Point to be opened as follows:—Through the centre of

* Smithsonian Contributions, Vol. I, p. 2, and foot note.

one a cut was made thirty-three feet long, two feet wide, and three feet deep, to the original surface of the ground; after removing a few inches of mould, a heap of broken gneissoid rock was displayed, conforming to the shape of the outside of the work. The bits of rock composing the work were of various sizes and forms, and would weigh from one to twenty pounds each, but immediately under the basin, and forming the bottom of it, the bits of rock were much smaller than those constituting the general pile. All the pieces presented angular fractures, but no marks of tools were discovered upon them. Many of the bits of rock were in a disintegrated state, so much so as to crumble into coarse sand before the pick. This circumstance may perhaps be attributable to the employment of fire as an agency in preparing the stones for the builders, from the boulders of the adjacent plain. No other traces of fire were observed. In a cross section, at right angles to the former, and again passing through the centre of the basin, several small pieces of bone and birch bark were turned up; they were found a few inches from the surface, between the soil and the bed of stone. No other remains were discovered. It may be here remarked, that the presence of a few bones near the surface of a mound, is no indication of the purpose for which the work was originally built, for it is well ascertained that many of the mounds of the Western States, constructed evidently for different objects than those of sepulture, have been used by modern Indians for that purpose.*

The other mounds examined agreed in all particulars of construction with that above described, excepting in one pair where it was evident from what remained that the inside margin of the basin of each mound had been surrounded with flat stones placed vertically and touching at their edges, as if designed to prevent the earth falling into the hollow. Similar stones, perhaps used for the same purpose, were observed lying near most of the other mounds in this vicinity. The marginal stones have been displaced, it would appear, by the so-called "money-diggers," a class of superstitious beings everywhere found, the traces of whose Vandalism are not wanting upon most of the antiquities of this continent; and the absence of all remains in the works examined, can best be attributed to their operations. In several instances the builders have been forced, from the nature of the

* It is only a few years since, that two French Canadians, found drowned, were taken by the people of the vicinity, and buried upon one of the best preserved mounds upon Massassaga Point.

surrounding country, to carry their material from a distance, but to obtain the usual covering of mould for the pair of mounds last mentioned they have bared the smooth underlying rock of its scanty soil, in a well defined circle about the works.

The use of broken gneiss for a building material, to the almost entire exclusion of limestone, is a noticeable feature in the construction of these works, and it is the more remarkable when it is known that the latter could have been procured at much less labour from the immediate Bay shore, where it abounds in the form of debris. This circumstance may perhaps show the migration of the race, and with other characteristics assist in unveiling the customs and philosophy, or superstition, which obtained among them.

From the limited data before us, it would be impossible to determine the positive age of these mounds, but the usual evidences of the antiquity of such works are not wanting here, and will enable us to arrive at a proximate period. The growth of the largest sized forest trees upon the tops of them, (in one instance an oak stump eight feet in circumference, and now seen in a decaying state), place the date of their erection several centuries anterior to the first exploration of the country. It may also be inferred that the Massassaga Indians, who were found by the early French Voyageurs inhabiting the Bay region, were ignorant of the origin of the works, for previous to 1820, and whilst that tribe was still numerous and pagan, they allowed the mounds upon their favorite camping ground to be ransacked with impunity. Neither have the survivors of that tribe, and who were removed in 1830 to Alnwick, near Rice Lake, any known tradition which will assist this enquiry. The Bay of Quinté, and the River Trent, formed parts of a well-known route for war parties to pass to and from the west; and during the French occupation of this country, were frequently used by soldiers, missionaries, and traders to ascend to the Upper Lakes; and yet the writings of that period, in many other particulars so precise, are silent as to rites or ceremonies among the neighbouring Indians, which would have required such works. We must therefore look for information in some other quarter, and, as yet, the facts collected by the various writers of the present day, are expressed in such general terms that we cannot arrive at any satisfactory conclusion. The supposition, however, that a common custom prevailed in very distant parts of the continent, whether in branches of the same tribe or among various races, is no more unreasonable than to admit that the stone and copper axes, pipes, arrow heads, and coarse pottery of the same character, and which are everywhere found, were made by different tribes. Thus a race possessing a knowledge of mound building, in common with very distant tribes, may have been dispossessed by the Massassaga Indians, when they came, as tradition relates, from the Upper Lakes. But this is mere conjecture, and like all other theories depending in any manner upon imagination or Indian tradition, should be received with caution.

The theory so commonly held that certain relics of rude art, found among tribes who cannot be supposed to have made them, have been procured by barter, I think, from what is known of Indian character, not to be well founded. I am inclined to believe that the sculptured images, as well as the copper implements, are the fruits of distant wars; the tribe last possessing them have taken the articles by force from some more western or civilized people. This argument receives strength from the fact that the whole system of earth-works throughout the west shows that a terrific struggle was there waged for an existence; but with what result such heroic efforts were made to defend civilized communities against overwhelming barbarous hordes, the Cyclopean embankments of those regions are the only memorial. When we find, however, the vestiges of a wide-spread race, or monuments that point to one common idea, intermingled with works of a superior order, and meet with evidences of a certain civilization in parts equally distant, perhaps the fruit of plunder, we may form some conception of the turmoil that once agitated this continent.

A further examination of the mounds on the Bay of Quinté, undertaken in the month of August last, in company with Henry Cawthra, Esq., of Toronto, has led to the discovery in them of human remains and objects of curiosity and art. These remains clearly point out the purpose for which the works in question were erected, and prove them to belong to the class of sepulchral mounds, such as the observations of Drake, Squier, Schoolcraft, and many other writers, show to exist over a very wide range of country.

A brief description of the work in which the remains were found, with the aid of the accompanying lithographic plates, prepared from accurate sketchings taken at the time by Mr. Cawthra, will enable the reader at once to understand the nature of all the mounds in the Bay of Quinté region.

After partially opening several mounds in the vicinity of those already mentioned and with the same result as to general characteristics, we fortunately chose a mound which to all appearances had not been previously disturbed. Commencing upon the top of it and throwing out all the material from the centre of the work to the natural level of the soil beneath, we were enabled thoroughly to inspect its contents, and from very full notes made during the examination, the substance of what follows is taken. Figure 1, Plate I., presents a view of a portion of the mound, and the excavation made, with the position of a perfect skeleton, found in a sitting posture, over the head of which stands an oak stump, now measuring eight feet in circumference, but from which the tree has been felled probably thirty years. A short distance from this stump stands a red cedar one, also represented in the sketch, measuring four feet two inches in girth, and from which the tree has likewise been cut a number of years.

Figure 2, Plate I., is a diagram showing position of articles found during the examination. Figure 3, Plate I., shows a section of the mound exhibiting general features of construction.

Upon breaking the surface of this work, at a point designated by figure 10 in diagram, we came upon a flat limestone lying horizontally a few inches beneath the surface, under which were found a few fragments of human bones, and pieces of birch bark, together with a sharpened bone implement,* worn smooth by use, and in its present state nearly eight inches long.

About two feet from the surface, on removing a flat stone, three crania were exposed, in what appeared to be a rude box, composed of flat limestones. One of these crania, being uppermost, was broken by the carelessness of one of the labourers employed to excavate. It was smaller than the other two and rested upon them. Of the other heads, one laid upon its side, facing north, the body of which would lie due east and west, the feet being towards the east. The other one shewed the skull uppermost as if the body had been placed erect. On clearing away the broken stone and soil a great many bones were found, in fact almost entire skeletons; and from their positions, these evidently belonged to the heads in the box. The latter had probably been separated from them by the compression of the sides of the box

* Similar implements are mentioned in *Smithsonian Contributions*, Vol. I. page 220 Fig. 119, Nos. 1 & 3. "They were obtained," it is there stated, "from a mound in Cincinnati and were evidently formed from the tibia of the elk."

or by the intertwining roots of the overgrowing trees; and this may also to some extent account for the position of the crania. From all the circumstances connected with these three skeletons, I am led to believe that they were originally entombed in a sitting posture, back to back, having their heads merely surrounded by flat stones, which rested upon their breasts or folded arms, whilst the remainder of the bodies were covered or built up in the general material of the work.

Figure 6, marks the position of a skeleton, by the side of which was found what appeared to be the contents of a magician's or conjurer's bag. The objects of art contained in it are represented in Plate II.

Figure 8, portion of wall exposed, formed of layers of limestone rudely laid up, and which appeared from examination made at different points of the circle of excavation, to be built around the edge of the enclosure containing the relics. The wall did not form a perfect circle, but the sides of it were about seven feet asunder. This work did not contain the same proportion of gneiss as the works previously described, the flat limestones, before mentioned, and soil assisting to make up the pile.

Figure 1, Plate II., is an exact representation of the back of a comb elaborately ornamented by lines scratched upon the smooth surface of a flat piece of bone. Figure 2, fragment of a bone instrument, polished perhaps by use. Figures 3, 4, 5, 6, 7, are either the teeth of the comb (fig. 1) or awl-shaped instruments, commonly found with Indian remains. Figure 8, is a barbed arrow-blade (Schoolcraft) or the point of a fish-spear (Squier). It is made of bone and polished. Figures 9 and 10, represented half-size, are waterworn limestones, somewhat resembling the Indian foot covered with a moccasin.

The three cylindrical ornaments, at the bottom of plate II., are what Mr. Schoolcraft calls baldrics, specimens of which he found in the Indian ossuaries at Beverly, Canada West; and he remarks that "the ancient Indians formed baldrics for the body, from the hollow bones of the swan and other large birds or deers' bones, in links of two or three inches long. These were strung on a belt or string of sinew or leather." Those here represented are made of the thick parts of shells, and bear upon their outside surface a spiral groove. In some specimens the groove is not distinct, and perhaps its presence, in any case, is more attributable to necessity than design, the groove being a natural mark upon the part of the shell used for this purpose. They *are bored from end to end and polished.*

The other articles found interred with this skeleton were: 1. A number of common fossils occurring in the Trenton limestone, in the vicinity of the Bay of Quinté. 2. Several queerly shaped, waterworn stones. 3. Several fresh water shells so much decayed that they could not be preserved. 4. A few small lumps of iron ochre perhaps used for painting the face. 5. The breast bone of an eagle. 6. A bear's tusk. 7. A tooth of a beaver. It is said that Indians of other parts of the continent used beaver teeth for scraping the flesh from the hides in the process of tanning.* 8. A pair of horn-cores resembling those of a ram, a circumstance of difficult reconciliation with the undoubted antiquity of these works, unless the existence of the wild sheep of the Rocky Mountains be taken into consideration.†

The number of crania taken from this mound in a good state of preservation, is five. These are now in the possession of the writer. There were perhaps a dozen bodies originally deposited in this work.

Whatever be the origin of these remains, it is clear that the Massassaga Indians were not the builders of the works in which they are entombed, since this tribe, it is well known, buried their dead in wrappers of birch-bark, and laid them at full length a few inches beneath the surface of the soil, as the sand-hills about Belleville clearly prove. The remains found in the surface-soil of the mounds are perhaps of their interment; but the skeletons found in the sitting posture belong to some other and far earlier race. The question, to what race, is wrapt in the same mystery that overhangs the ancient mound structures which lie in the remoter regions of the West, and which of late years have been the subject of so much philosophical speculation.

* This information was obtained from Assikinack, an Odahwah chief of the Manitoulin Island, who is now aged about 104 years.

† The above list of articles corresponds in many particulars with the remains found by Dr. Drake, in a mound examined by him, in the vicinity of Cincinnati, an account of which is given in the "Biography and History of the Indians of North America," by Samuel G. Drake. 10th edition, page 41.

SOME EXPERIMENTS ON THE CONTRACTION AND EXPANSION OF ICE.

BY J. H. DUMBLE, C.E.

Read before the Canadian Institute, 10th March, 1860.

In the September number of the *Journal* of the Canadian Institute for 1858, I gave a brief statement of facts relative to the expansion and contraction of ice, as observed by me on Rice Lake.

I stated that the contraction and expansion of ice was caused by atmospheric changes; that, up to its melting point, it expands with a high, and contracts with a low temperature; that it is susceptible of expansion to a much greater extent than of contraction, that when ice is equally dense, thick, and glare, and everywhere equally acted upon by a heated atmosphere, it expands from the centre towards the circumference, and that it expands towards the line of least resistance, &c.

The observations of another winter, together with actual experiment, have confirmed the correctness of this theory, with, however, one exception. The statement that ice is susceptible of expansion to a much greater extent than of contraction, is *incorrect*. Into this erroneous conclusion I was thus led: the expansion of a large field of ice, I observed, was manifested by its encroachment on the shores of the lake, in which case the ice usually fractured at the ripple mark; when, however, the line of fracture did occur at a distance from the shore, it was evinced by the appearance of a vertical ridge, formed by the fractured portions of the ice. Such being the case, I naturally expected that when the ice field contracted it would shrink away from the fracture, whether on the shore or at a distance from it, or else that fissures or cracks would be observed somewhere in the ice field, of widths commensurate to previous "shoves."

Such evidence of contraction, either the shrinkage from the line of fracture, or the existence of cracks or fissures, of widths at all approximating to the amount of expansion was not then observed by me.

Towards the latter part of last winter I had occasion to cross Rice Lake on foot; the temperature of the previous night had been very low. A slight coating of snow lay on the ice, and in it were cracks running in every imaginable direction; these cracks penetrated the ice and were filled with water, they varied in width from one-eighth of an inch to an inch, and in the distance of a mile the number counted exceeded one hundred.

These fissures were, of course, the effect of contraction, and their aggregate widths fully compensated for the absence of the larger fissures, which I expected to have seen, and were quite equal to the maximum amount of expansion witnessed on any one occasion.

Thus, then, was I convinced of the error of my previous statement regarding the contraction of ice, and actual measurements since made have fully proved that the expansion equals the contraction of ice for equal changes of temperature.

The cause of ice contracting in the peculiar manner above mentioned, is owing, of course, to its unequal thickness, glariness, and density; the shrinkage being unequal throughout the mass, the lines of fracture are accordingly numerous and irregular.

Were ice equally thick, dense, and glare, it would contract uniformly towards its centre, and we would not then witness those irregular cracks and fissures just described; neither would be seen that enlargement, or piling up of fractured ice, which is the effect of expansion under ordinary circumstances.

Ice at formation is at its *greatest* or *maximum dimensions*, and although the temperature of water *may* be far below 32°, the latent heat given out during crystallization (as is well known) will instantly raise the temperature of the ice to that figure.

The formation of ice, like that of other substances, takes place at a certain fixed temperature, which is also that of its melting, and which remains constant during the process of its solidification.

The first movement in ice, therefore, after its formation, must necessarily be shrinkage or contraction; the fissures which occur on a large field during this process immediately fill with water, which is soon frozen. The field ice, be it remembered, still extends to its original limits, and is in a state of shrinkage.

Now, should the temperature rise to 32°, this ice will expand and overlap its original boundary by a distance just *equivalent* to the *aggregate widths* of the various cracks which previously represented the amount of contraction.

This revivifying or replenishing process accounts in the most satisfactory manner for the seemingly exhaustless expansive power of ice.

If we take the maximum expansion of ice, at any one point on Rice Lake, and divide the amount by the radius or diameter of the ice field, as circumstances may direct, a tolerably correct idea could thus be obtained of the amount of expansion per degree of temperature, per foot or per mile.

I have, however, been desirous to ascertain by actual measurement the exact extent of contraction and expansion of ice, not only for the sake of obtaining such information, but also for the purpose of verifying the deductions formed from general observations during previous winters. Circumstances prevented me from undertaking the experiment before the middle of January last, at which time I selected a mill-pond near Cobourg, in preference to Rice Lake, as the site of my operations.

The pond was adjacent to my dwelling, was shallow, (thereby preserving a more uniform temperature under the ice), and, being of small extent, my operations were not so liable to interruptions by a nip or a squeeze as they would be on Rice Lake.

As it was desirable to experiment on as large a scale as possible, I proceeded to cut an opening, in the thick pond ice, one hundred and five feet in length by ten in breadth, from which the old ice was hauled out and new ice permitted to form in its stead. A rough shed was erected over this opening to prevent the admission of snow. When the new ice within the shed attained a thickness of one and a-half inches, I reduced its dimensions to one hundred and three feet in length by seven in width, having it floating and perfectly isolated by a channel eighteen inches in width between it and the surrounding pond ice.

Within eighteen inches of each end of this floating ice, I inserted vertically small blocks of two inch pine plank, which, being frozen in, became firmly embedded in it. These blocks answered admirably the purpose of permanent fixtures, to one of which I attached and nailed the end of a seasoned pine or deal rod, three inches in width, one hundred feet in length, and one and a-quarter inches deep, and firmly connected at the joints.

To the other block was firmly clamped a target, through which the graduated end of the rod moved freely.

I may add that the graduated rod was an American engineer's levelling staff, and read accurately to the thousandth part of a foot; small rollers were placed under the rod to prevent its freezing to the ice.

This floating ice was kept perfectly isolated from the main field, day and night, with great care, and every precaution taken which prudence could suggest to insure accuracy of result.

Herewith is given a table of observations and readings of the graduated rod, from the 29th of January to the 1st of March.

In order the better to illustrate the ice movement, I constructed the accompanying diagram. The datum is time, the upper section shows the lineal contraction and expansion of a body of ice one hundred feet in length, as read from the graduated rod. The vertical scale is eight and a half times that of the actual movement, the better to exhibit the variations. The section immediately beneath the ice line represents the atmospheric changes, as indicated by the mercurial thermometer, (Fah.) to the same datum of time, and to a vertical scale corresponding to the latter ice movement.

Were the ice equally as sensitive to changes of temperature, and as quick to move as mercury, these lines, if applied to each other, would almost coincide. The lower line exhibits the thickness of the ice at different periods during the experiment.

It will be observed, on referring to the upper section, that the ice exhibited no movement from the 27th January to 1 p.m. on the 29th; although the temperature of the atmosphere varied considerably during this period; it was not until the ice attained a thickness of three inches that it became susceptible of atmospheric influences.

The phenomenon may be explained, I presume, by supposing the temperature of the ice, while yet thin, to be controlled by that of the underlying water.

The expansion and contraction of the ice from the 29th of January to the 9th of February is remarkably uniform, and exhibits its great sensitiveness to changes of temperature.

The average movement per degree per foot during this period is .00000 330. This ice, forming under cover, and protected from the deteriorating influences of sun, wind, rain, and snow, and not having been subjected to a high or wasting temperature, until the 5th ult., may, I think, be correctly termed *pure ice*.

The ice from noon on the 5th February until 10 a.m. on the 8th was, however, (with the exception of a short interval) subject to a temperature varying from 28° to 36° and and was consequently absorbing latent heat, which, of course, materially changed its character. The temperature on the eighth suddenly fell to zero, and the ice (as soon as its moist surface was consolidated) contracted at the rate, on an average, of .00000 765 per degree per foot, or more than twice the extent of its previous movement. The temperature again rose to 32°, and the ice expanded at the rate of its *last* contraction to its original or maximum dimensions.

From the 8th until the 29th of February the ice obeyed the various fluctuations of temperature (considerating its increasing thickness) with great regularity, ever maintaining the latter ratio of .00000 765 per degree per foot. A continuation of a high temperature from the 22nd to the 24th of February did not affect it in its uniform rate of movement; neither did the beams of the mid-day sun, at a temperature of 45°, which I allowed to act on it for some hours, cause further expansion than it manifested at a temperature of 34°.

The permanent and greatest length of the ice seemed to tally with a thermometrical reading of 34°; the thermometer was suspended about a foot above the ice level, and probably was two degrees higher than the atmospheric temperature at the surface. It will be remembered that the ice at this temperature was ever the same length, and the different ratios of movement were owing to the change in the character of the ice after the thaw of the 5th February, which gave it a greater shrinking, and consequently a greater expanding capacity.

Ice, at a low temperature, is extremely sensitive and brittle. On one occasion during my experiments, the temperature in my shed was plus four; outside the north wind read zero. Being anxious to lower the temperature within the shed, I desired my assistant to take a board off the roof. He did so, and in a few minutes the current of cold air from the north caused my ice to crack into two pieces, with a loud report. The ice at the time was perfectly isolated, and floating clear of the main field.

It has been often remarked on Rice Lake, that when ice attains a great thickness, it does not seem to move about with the same violence, or to the same extent, as it did when it was comparatively thin. It is a well known fact, that the greatest "shoves" occur when the ice is from four to ten inches in thickness. My experiments confirmed this fact. I found on my experimental ice, that when it increased in thickness it became tardy in its movements. In fact, the rapidity with which ice expands or contracts *is inversely as its thickness*. If ice three inches in thickness takes half an hour to move a given distance corresponding to a change of temperature, ice twenty-four inches in thickness will take four hours to expand to the same extent. Should the temperature not remain stationary, but change within the four hours, the action and movement of the ice would be accordingly checked and modified.

The lagging behind of the ice, and consequently its not responding readily to rapid changes of temperature, is well illustrated on the diagram by observations Nos. 55, 62, 65, 73, 84, 92, 96, 100, 120, and 158.

The atmosperic temperature, during the period of my experiment, did not fall below minus 4°. I found, however, in a range of 38°, that is, from minus 4° to plus 34°, the contraction and expansion at any degree within this range was *uniform*.

I think, therefore, that we may fairly assume that it preserves that uniformity to the lowest temperature known in this country.

In addition, therefore, to the deductions made in a former paper, may we not glean and add the following:—

That with the same change of temperature, the expansion and contraction of ice are equal.

That the fact that ice on a large field exceeds, during subsequent expansion, the limits of its first dimensions, is owing to the peculiar manner of its previous contraction.

That the rapidity of ice movement, due to change of temperature, is inversely as its thickness.

That the rate of expansion and contraction of *pure* ice (as measured by a deal rod, for which no allowance was made), is .00000 330 of its length per degree; and that of ordinary ice .00000 765.

Having brought to a conclusion these very interesting experiments, the object of which was to sustain and fully confirm the theories and conclusions previously deduced from a much larger field of observation, which it has done, with one exception, not only as regards the general theory but also with respect to the expansive *capacity* of ice, I now leave the subject with the hope that these preliminary investigations, on a body whose properties seem so little known to the scientific world, may yet throw important light on the perplexing glacier phenomena, and also with the hope that at other hands it may receive a further and more thorough investigation.

TABLE OF OBSERVATIONS, (ON ICE 100 FEET LONG), FEBRUARY, 1860.

No.	Date.	Hour.	Temperature.	Thickness of ice.	Graduated Rod.	Average per 0° per 100.	Average per 0° per foot.	Wind.	Remarks.
1	Jan. 29	1 P.M	32°	3 in.	.0110	.000344	.00000344	N W	
2	"	6 "	34	"	.0120	.000353	.00000353	W	
3	"	10 "	34	"	.0120	.000353	.00000353	W	
4	Jan. 30	9 A.M.	27	3½ in.	.0090	.000333	.00000333	N W	
5	"	12.0	26	"	.0085	.000327	.00000327	W	Clear.
6	"	2 P.M.	28	"	.0090	.000321	.00000320	W	
7	"	3 "	31	"	.0100	.000322	.00000322	W	
8	"	5 "	33	"	.0105	.000318	.00000308	W	
9	"	6 "	34	"	.0110	.000321	.00000321	W	Strong wind.
10	Jan. 31	12.0	22	"	.0075	.000341	.00000341	N	
11	"	12.30	19	"	.0065	.000342	.00000342	N	
12	"	2 P.M.	17	"	.0060	.000353	.00000353	N	Blowing a gale.
13	"	4 "	14	"	.0050	.000357	.00000357	N E	Snowing.
14	"	9 A.M.	9	4 in.	.0030	.000353	.00000333	E	Do.
15	"	12.0	8	"	.0030	.000333	.00000333	N E	Light wind.
16	"	2 P.M.	9	"	.0030	......	......	...	
17	"	4 "	8	"	.0027	.000337	.00000337	N E	
18	"	5 "	6	"	.0020	.000330	00000330	N	
19	"	7.30	6	"	.0010	......	......	E	Clear.
20	Feb. 1	1 A.M.	...	5 in.	.0000	......	......	N	(Average contraction .00000336.)
21	"	6 "	4	"	.0000	......	......	N E	
22	"	9 "	10	"	.0010	......	......	N E	
23	"	11 "	14	"	.0050	.000357	.00000357	E	
24	"	3 P.M.	16	"	.0060	.000375	.00000375	E	
25	"	5 "	13	"	.0050	.000385	.00000385	E	
26	"	11 "	12	"	.0060	.000333	.00000333	E	
27	Feb. 2	4 A.M.	10	"	.0030	.000300	.00000300	N	
28	"	6 "	14	"	.0040	.000286	.00000286	N E	Snowing.
29	"	10 "	16	"	.0040	.000250	.00000250	N E	
30	"	10.30 "	18	5½ in.	.0050	.000278	.00000278	E	
31	"	1.30 "	23	"	.0070	.000304	.00000304	E	
32	"	3 P.M.	22	"	.0070	.000308	.00000308	W	
33	"	5 "	19	"	.0060	.000316	.00000316	N	
34	"	9 30 "	16	"	.0040	.000250	.00000250	...	Calm.
35	"	11 "	12	"	.0026	.000300	.00000300	...	Calm.
36	Feb. 3	3,30 A.M	18	6 in.	.0045	......	......	...	
37	"	8 "	18	"	.0045	......	......	W	
38	"	1 P.M.	22	"	.0060	.000275	.00000275	S	
39	"	4 "	20	"	.0055	.000275	.00000275	S	
40	Feb. 4	12.0	24	"	.0070	.000292	.00000292	W	
41	"	1 A.M.	22	"	.0070	.000308	.00000308	S E	Snowing.
42	"	7 "	22	"	.0070	......	......	...	
43	"	11 "	26	"	.0080	.000308	.00000308	...	Calm.
44	"	12.0	28	"	.0090	.000320	.00000321	...	
45	"	1 P.M.	30	"	.0105	.000350	.00000350	...	Ther. 60° in the sun.
46	"	5 "	30	"	.0100	......	......	...	
47	"	6 "	28	"	.0100	.000357	.00000357	...	
48	"	7 "	24	"	.0080	.000333	.00000333	S	
49	"	9 "	26	"	.0080	.000308	.00000308	S	
50	Feb. 5	2 A.M.	26½	"	.0080	.000302	.00000302	E	
51	"	7 "	24	7 in.	.0070	.000292	.00000292	S	Snowing.
52	"	10 "	32	"	.0110	.000344	.00000344	S E	Average expansion .00000314.
53	"	1 P.M.	34	"	.0120	.000353	.00000353	S E	
54	"	5 "	34	"	.0120	.000353	.00000353	S E	
55	"	7 "	33	"	.0115	.000348	.00000348	...	
56	"	8 "	36	"	.0110	......	......	...	Water on surface ice
57	Feb. 6	2 A.M.	37	"	.0120	......	......	W	Do.
58	"	7 "	33	"	.0115	.000348	.00000348	W	
59	"	11 "	32	"	.0110	.000344	.00000344	W	
60	"	3 P.M.	30	"	.0115	.000350	.00000350	N W	
61	"	5 "	23	"	.0100	.000357	.00000357	N W	
62	"	9 "	24	"	.0070	.000291	.00000291	S W	
63	Feb. 7	12.0	28	"	.0070	......	......	S W	
64	"	2 A.M.	24	"	.0070	.000291	.00000291	S W	
65	"	4 "	22	"	.0055	......	......	...	
66	"	8 "	28	"	.0055	......	......	S W	
67	"	9 "	32	"	.0090	......	......	S W	
68	"	12.0	33	"	.0110	.000344	.00000344	...	

TABLE OF OBSERVATIONS—(*Continued.*)

No.	Date.	Hour.	Temperature.	Thickness of ice.	Graduated Rod.	Average per 0° per 100.	Average per 0° per foot.	Wind.	Remarks.
69	Feb. 7	1 P.M.	34°	7 in.	.0120	.000353	.00000353	...	
70	"	3 "	35	"	.0125	.000357	.00000357	S W	
71	"	5 "	36	"	.0130	.000360	.00000361	S W	Ice dry.
72	"	9 "	28	"	.0105	......	......	...	Calm. On the move.
73	Feb. 8	12.0	28	"	.0090	.000320	.00000321	S W	
74	"	9 A.M.	32	"	.0110	.000344	.00000341	...	Ice dry.
75	"	11 "	38	"	.0120	......	......	S W	Ice wet.
76	"	11.30 "	39	"	.0120	......	......	S W	Ice melting.
77	"	12.0	37	"	.0120	......	......	...	
78	"	3 P.M.	34	"	.0120	.000353	.00000353	W	Average, .00000341.
79	"	4 "	34	"	+.0120	.000760	.00000760	...	General average,
80	"	7 "	32	"	.0120	......	......	...	from Jan. 9 to 3 p.m.
81	"	8 "	32	"	.0120	......	......	N W	Feb. 8, (.00000330).
82	"	9 "	17	"	.0085	......	......	N W	Surface water of ice
83	"	11 "	13	"	+.0015	......	......	N W	freezing.
84	Feb. 9	12.0	8	"	—.0045	......	......	...	
85	"	3 A.M.	6	"	—.0095	.000750	.00000750	N W	Blowing a gale.
86	"	6 "	Zero.	8 in.	—.0140	......	......	N	Average contrac-
87	"	8 "	4	"	—.0110	.000750	.00000750	N	tion, .00000760.
88	"	9.30 "	6	"	—.0100	.000666	.00000666	N	
89	"	11 "	9	"	—.0090	.000550	.00000550	N	
90	"	12.0	10	"	—.0060	.000800	.00000800	N	
91	"	2 P.M.	12	"	—.0050	.000750	.00000750	N	
92	"	9 "	7	"	—.0050	......	......	...	
93	Feb. 10	1 A.M.	10	"	—.0050	.000900	.00000900	Calm	
94	"	5 "	10	"	—.0040	......	......	E	
95	"	8 P.M.	11	"	—.0040	.000909	.00000909	E	
96	Feb. 11	10 A.M.	12	"	—.0040	.000833	.00000833	E	
97	"	1 P.M.	20	"	+.0010	.000750	.00000750	...	Note 20° Temp. of
98	"	3 "	24	"	+.0050	.000791	.00000791	N	drift snow on ice.
99	"	8 "	17	"	+.0020	......	......	N	
100	"	10 "	16	"	+.0010	......	......	N	Swept off snow.
101	Feb. 12	12.0	13	"	—.0020	......	......	N	Still drifting.
102	"	2 A.M.	10	"	—.0040	.001000	.00001000	N	
103	"	6 "	9	9 in.	—.0080	.000666	.00000666	N	
104	"	9 "	13	"	—.0060	.000692	.00000692	N	
105	"	11 "	19	"	—.0010	.000684	.00000684	N	
106	"	1 P.M.	23	"	+.0030	.000739	.00000739	...	
107	"	3 "	24	"	+.0050	.000791	.00000791	W	
108	"	6 "	24	"	+.0060	......	......	S W	
109	Feb. 13	8 A.M.	26	"	+.0055	.000750	.00000750	E	
110	"	12.0	34	"	+.0120	.000765	.00000765	W	Average expansion,
111	"	2 P.M.	34	"	+.0120	.000765	.00000765	E	.00000772.
112	"	8 "	30	"	+.0120	......	......	...	
113	Feb. 14	4 A.M.	26	"	+.0030	......	......	...	
114	"	8 "	26	"	+.0060	.000770	.00000770	N E	
115	"	12.0	26	"	+.0060	......	......	...	
116	"	1 P.M.	27	"	+.0065	.000760	.00000760	...	
117	"	3.30 "	28	"	+.0080	.000786	.00000786	...	
118	"	10 "	15	"	—.0020	.000800	.00000800	...	Clear night.
119	Feb. 15	4 A.M.	12	"	—.0050	.000750	.00000750	...	
120	"	12.0	20	"	—.0000	.000700	.00000700	...	
121	"	2 P.M.	20	"	+.0010	.000750	.00000750	N W	Snowing.
122	"	5 "	22	"	+.0030	.000773	.00000773	N W	
123	"	10 "	29	"	+.0090	.000793	.00000793	S E	
124	Feb. 16	9 A.M.	18	"	+.0020	.000888	.00000888	S E	
125	"	11 "	18	10 in.	+.0015	.000861	.00000861	N E	
126	"	2 P.M.	18	"	+.0016	......	......	N W	
127	"	3 "	16	"	+.0000	.000875	.00000875	N W	
128	"	6 "	14	"	—.0020	.000850	.00000850	W	
129	"	9 "	8	"	—.0080	.000750	.00000750	W	
130	Feb. 17	6 A.M.	...	"	—.0140	......	......	...	Average contrac-
131	"	8 "	—4	"	—.0170	.000750	.00000750	N	tion, .00000788.
132	"	5 P.M.	+14	"	—.0040	.000714	.00000714	N E	
133	"	8 "	6	"	—.0090	.000833	.00000833	...	
134	"	10 "	4	11 in.	—.0110	.000750	.00000750	N E	
135	Feb. 18	8 A.M.	12	"	—.0090	......	......	...	{through roof.
136	"	10 "	12	"	—.0090	......	......	...	Snowing, drifting

TABLE OF OBSERVATIONS—(*Continued.*)

No.	Date.	Hour.	Temperature.	Thickness of ice.	Graduated Rod.	Average per 0° per 100 feet.	Average per 0° per foot.	Wind.	Remarks.
137	Feb. 18	12.0	18°	11 in.	—.0060	......	......	N E	
138	"	2.0	18	"	—.0040	......	......	...	
139	"	6 P.M.	16	"	—.0010	.000812	.00000812	...	
140	Feb. 19	9 A.M.	10	"	—.0080	.000600	.00000600	...	
141	"	5 P.M.	16	"	—.0030	.000689	.00000689	...	
142	"	9.30 "	10	"	—.0065	.000750	.00000750	E	
143	Feb. 20	8 A.M.	26	"	+.0030	......	......	..	
144	"	9.30 "	27	"	+.0050	......	......	W	Moves slowly.
145	"	12.30 "	30	"	+.0070	......	......	E	
146	"	2.30 "	32	"	+.0100	.000750	.00000750	W	
147	"	6 P.M.	34	"	+.0120	.000765	.00000765	W	
148	Feb. 21	8 A.M.	20	12 in.	+.0010	.000750	.00000750	E	
149	"	12.0	34	"	+.0120	.000765	.00000765	...	
150	"	2 P.M.	38	"	+.0120	......	......	...	
151	"	4 "	37	"	+.0140	.000757	.00000757	...	Ice dry.
152	Feb. 22	12.0	37	"	+.0120	......	......	...	
153	Feb. 23	12.0	32	"	+.0110	.000750	.00000750	...	
154	Feb. 24	12.0	30	"	+.0100	.000800	.00000800	...	
155	Feb. 25	12.0	24	"	+.0005	.000600	.00000600	...	
156	"	5 P.M.	24	"	+.0005	.000600	.00000600	...	
157	"	10 "	17	"	+.0004	.001060	.00001060	...	
158	Feb. 26	8 A.M.	12	"	—.0072	.000600	.00000600	N E	
159	"	9.30 "	22	"	—.0060	......	......	...	
160	"	5 P.M.	30	"	+.0070	.000700	.00000700	...	
161	Feb. 27	8 A.M.	34	"	+.0120	.000765	.00000765	S W	
162	"	12.0	45	"	+.0120	.....	......	...	Exposed ice to sun.
163	Feb. 28	12.0	34	"	+.0120	.000765	.00000765	S W	Average expansion, .00000741. General average, .00000763.

ON THE INTRUSIVE ROCKS OF THE DISTRICT OF MONTREAL.*

BY T. STERRY HUNT, F.R.S.

CHEMIST AND MINERALOGIST TO THE GEOLOGICAL SURVEY OF CANADA.

At the close of my Report for 1856, I had occasion to call attention to the composition of some varieties of intrusive rock, occurring n the vicinity of Montreal, and locally known as white traps. These rocks, which are sometimes compactly crystalline, at others are porphyritic, the base being dull and earthy in aspect, and enclosing crystals of feldspar. My analyses showed these rocks to be essentially composed of a feldspar approaching orthoclase in composition, with occasional admixtures of a silicate of alumina and alkalies decomposable by acids, together with carbonates of lime, magnesia, and oxyd of iron. These carbonates were sometimes entirely wanting, but in other varieties of the rock equalled five or six per cent. In

* From the Report of Progress for the year 1858.

like manner certain varieties gave to muriatic acid only traces of alumina from the decomposable silicate, which in other specimens equalled five or six per cent. and in one case from 36·0 to 46·0 per cent. and had the composition of natrolite, gelatinizing with acids; the insoluble portion in this as in the other cases consisted of a feldspar resembling orthoclase. This rock which contained besides, about seven per cent. of carbonates, I described under the name of phonolite. (Report for 1856, p. 490.)

The feldspathic residue from these white traps contains from 60·0 to 66·0 per cent. of silica, and only traces of lime, with from 10·0 to 13·0 per cent. of alkalies, in which potash sometimes predominates, while more often soda makes up the larger portion, a fact observed in many orthoclase feldspars, especially those from trachyte; for to this class of rocks the white traps are for the most part to be referred, as already indicated by Sir W. E. Logan when describing as a trachytic porphyry, the feldspathic trap from Chambly, whose analysis is given at page 486 of the Report just cited. (See also Sir William Logan's Report for 1847, p. 17.)

Under the title of trachytes, lithologists have included a large class of igneous rocks, generally more or less rough to the touch (as the name indicates,) white or of pale colors, and composed essentially of orthoclase or a closely related feldspar, with small portions of mica, hornblende and more rarely pyroxene. Some varieties contain disseminated grains of quartz. The typical trachytes have an uncrystalline base, which is sometimes porous and at others compact, generally dull and earthy in aspect; the base is sometimes vitreous and passes into obsidian and pumice, while in others it is finely crystalline. These varieties often become porphyritic from the dissemination of crystals of glassy feldspar and other minerals, passing into the so-called argillophyre or clay porphyry. The base is sometimes highly silicious and becomes a sort of petrosilex, which is probably nothing more than an intimate mixture of quartz and feldspar; through such trachytes, and those which contain disseminated quartz, we have a passage to true granites, which consist of orthoclase feldspar mingled with quartz and mica. There are not wanting trachytes whose whole mass is coarsely crystalline, constituting granitoid and even gneissoid trachytes. Such are some of the rocks about to be described, which are only distinguished from true granites and syenites by the absence of quartz. The analyses of other trachytic rocks show them to consist of orthoclase mingled with more basic feldspars, or with hydrated silicates like natrolite, thus passing into phonolites. The accidents of structure which are supposed to characterize this class of rocks are however so little dependent upon chemical composition that in many of the so-called trachytic rocks of Hungary and Guadaloupe the predominant mineral is a basic feldspar like labradorite, containing large amounts of lime and soda, with but little potash.

Among the trachytic rocks of Lower Canada, I have met with none which are porous or vitreous The white trachytic dykes at Lachine are finely granular, and sometimes earthy in texture; they occasionally assume a concretionary structure, and are often porphyritic from the presence of crystals of feldspar. The reddish-gray trachytic porphyry of Chambly offers an example of well-defined feldspar crystals in a paste consisting of finely lamellar orthoclase with a slight excess of silica and small portions of mica. Several dykes about Montreal consist of a trachytic porphyry with large feldspar crystals in a compact purplish or lavender-gray base of a waxy lustre, which effervesces with acids from an admixture of carbonates, and closely resembles in appearance certain trachytes from the Siebengebirge upon the Rhine. Other varieties can hardly be distinguished from the so-called domite, the trachyte of the Puy de Dôme, and exhibit small drusy cavities. The presence of carbonates in trachytes has generally been overlooked; Deville, however, found seven per cent. of carbonate of lime in a trachytic rock from Hungary, and I have observed it disseminated in some of the trachytes of the Siebengebirge.

In my report already referred to, I have shown that some of the trachytes of our vicinity apparently contain carbonates of magnesia and iron, and perhaps of manganese, in addition to carbonate of lime. Many of these rocks weather to some depth of a reddish-brown from the peroxydation of the iron. One of this kind, which forms a large dyke in the limestones at the Mile-End Quarries, is remarkable for its large proportion of carbonates. It is grayish-white with dark gray spots, granular, sub-vitreous in lustre, and has the aspect of an impure quartzite. It loses by ignition 11·0 per cent. of its weight; reduced to powder it effervesces freely with nitric acid, disengaging carbonic acid, which when heat is applied is mingled with nitrous fumes from the peroxydation of the iron. 100 parts of the rock gave in this way to the acid 4·84 of alumina, besides lime, magnesia and iron, which represented as carbonates equalled carbonate of lime 11·60, carbonate of magnesia 3·58, carbonate of iron 3·82=19·00; a small portion of these bases was perhaps united with the alumina in a silicate. The insoluble residue gave as follows:

	I.
Silica,	61·62
Alumina,	21·00
Lime,	2·69
Magnesia,	(traces)
Potash,	4.66
Soda,	5·35
Volatile,	2·37
	97·69

It will be seen that this residue is near to orthoclase, or rather to oligoclase in composition; as I have suggested in a previous Report, the decomposition of a portion of the feldspar, which has been converted into a hydrated silicate of alumina with loss of the alkalies and a portion of silica, will explain the presence of water and an excess of alumina, not less than the deficiency of silica and alkalies in the feldspathic matter of the more earthy of these trachytes.

These trachytic rocks occur in dykes cutting the dolerites and melaphyres of the Mountain of Montreal, and constitute the little island known as Moffatt's Island, but the most remarkable exhibition of them is met with in the mountains of Brome and Shefford. The former occupies an area of about twenty square miles in the township of Brome and the western part of the township of Shefford, and consists of a great mass of trachyte rising into several rounded hills, of which Brome and Gale Mountains are the principal, and may have an elevation of about 1000 feet above the surrounding plain, from which the intrusive rock rises boldly. It shows divisional planes, giving it the aspect of stratification, and is divided by other joints into rectangular blocks. Another similar mass, covering an area of about nine miles, is met with in the township of Shefford a little to the N.W., and distant in the nearest point only about two miles from the last. These masses of rock, as Sir W. E. Logan has shown in his Report for 1847, break through the slates and sandstones of the upper portion of the Hudson River group, which in that vicinity, although on the confines of the metamorphic region, are but little altered.

The rock of these two mountainous areas presents but very slight differences, being everywhere made up in great part of a cleavable feldspar with small portions of brownish-black mica or of black hornblende, which are sometimes associated. The proportion of these two minerals to the mass is never above a few hundredths and often less than one-hundredth. The other minerals are small brilliant crystals of yellowish sphene and others of magnetic iron, amounting together probably to one-thousandth of the mass; in some finer grained varieties rare crystals of sodalite and nepheline are met with.

These rocks never contain quartz, but being made up entirely of cleavable grains of feldspar without any cementing material, are very friable and subject to disintegration; so that for some distance around the mountains, the soil is almost entirely made up of the disaggregated crystals of feldspar, which however show but little tendency to decomposition, and retain their lustre. The rock is sometimes rather finely granular, but is often composed of cleavable forms, which are from one-fifth to one-half of an inch in breadth and sometimes nearly an inch in length. The cleavages of the feldspar are those of orthoclase. The lustre is vitreous and in the more opaque varieties pearly, but the crystals never exhibit that eminently glassy lustre nor the fissured appearance which characterises the feldspar of many foreign trachytes, identical with these in composition. The colour of the feldspars of these mountains is white, passing to reddish on the one hand, and to pearl or lavender-gray on the other.

Specimens of the rock of Brome Mountain were taken from the side near the village of West Shefford; it was coarsely crystalline, lavender-grey in colour, and contained a little brown mica, sphene and magnetic iron, but no hornblende. The density of fragments of the mass was found to be 2·632—2·638. Selected grains of the feldspar had the specific gravity of 2·575 and did not yield anything to the action of hydrochloric acid. The analysis was effected in the usual way by fusing with an alkaline carbonate. The alkalies were determined from another portion, which was decomposed by ignition with a mixture of carbonate of lime and muriate of ammonia. The analyses of two portions from different specimens gave as follows:

	II.	III.
Silica,	65·70	65·30
Alumina,	20·80	20·70
Lime,	·84	·84
Potash,	6·43	....
Soda,	6·52	....
Volatile,	·50	....
	100·79	

A specimen from the south side of Shefford Mountain was next examined. A little above the place where it was collected, the rock was a coarse greyish-white feldspar with a little black mica, and closely resembled that just described, but the portion selected contained a little black brilliant hornblende in crystalline grains about the size of those of rice. with very small portions of magnetite and yellow sphene, disseminated in a base, which although completely crystalline, was more coherent and finer grained than that of Brome, rarely exhibiting cleavage planes more than one-fourth of an inch in length. Its colour was yellowish-white, and it was sub-translucent with a somewhat pearly lustre. Fragments of the rock gave a specific gravity of 2·607—2·626—2·657. By crushing and washing the mass, the white feldspar grains were separated from the heavier minerals, and had in powder a specific gravity of 2·561.

The composition of this feldspar is almost identical with that from the trachytes of Brome and Chambly. For the sake of comparison, the analysis of the crystals from the latter is subjoined. (A.) See Report for 1856, p. 486.

Analysis gave for the feldspar of Shefford:

	IV.	A.
Silica,	65·15	66·15
Alumina,	20·55	19·75
Lime,	·73	·95
Potash,	6·39	7·53
Soda,	6·67	5·19
Volatile,	·50	·55
	99·99	100·1

Going westward from the mountains of Brome and Shefford, which from their proximity and their identity of composition may be looked upon as forming but one great trachytic mass, we meet with a series of intrusive masses, less extensive, but similar in attitude, and which, as Sir Wm. Logan has remarked, are placed along the line of an anticlinal, traceable as a gentle undulation for 180 miles across the country as far west as the Lac des Chats on the Ottawa. The hills lying to the west of Brome and Shefford are in the order of their succession, Yamaska, Rougemont, Belœil, Montarville, Mount Royal and Rigaud, all of which are intruded through Lower Silurian strata. A few miles to the south of Belœil is Mount Johnson or Monnoir, another intrusive mass, which although somewhat out of the range of those just mentioned, apparently belongs to the same series. The mineral composition of these intrusive masses varies considerably, not only for the different mountains; but for different portions of the same mountain.

Yamaska Mountain.—The greater portion of this mass is a granitoid trachytic rock, which differs from that of Brome and Shefford in being somewhat more micaceous and more fissile. The dark brown mica is in elongated flakes, and hornblende is absent in the specimens collected, which however hold small portions of magnetite and minute crystals of amber-yellow sphene; these seem to be disseminated in veins of segregation, which are of a lighter colour than the mass.* The feldspar grains which make up this rock are brilliant, of a vitreous lustre, and often yellowish or reddish-gray in colour. Separated by washing from the crushed mass, the crystalline feldspar in powder had a density of 2·563, and gave by analysis as follows (V.) Another specimen of this granitoid trachyte, having been crushed and separated by a sieve from the greater portion of the mica, gave for the composition of picked grains (VI.):

	V.	VI.
Silica,	61 10	58·60
Alumina,	20·10	21·60
Peroxyd of iron,	2·90	2·88
Lime,	3·65	5·40
Magnesia,	·79	1·84
Potash,	3·54	3·08
Soda,	5·93	5·51
Volatile,	·40	·80
	98·41	99·71

The south-eastern part of the mountain offers a composition entirely different from the last, being a diorite made up of a pearly white crystalline translucent feldspar, with black brilliant hornblende, ilmenite and magnetic iron. This rock is sometimes rather fine grained, though the elements are always very distinct to the naked eye, while in other portions large cleavage surfaces of feldspar half an inch in breadth are met with, which exhibit in a very beautiful manner the striæ characteristic of the polysynthetic macles of the

* For an examination of the sphene of the Yamaska Mountains see the Report for 1851, p. 119. By an error of the press, the determined specific gravity is said to be 2·76 instead of 3·76.

triclinic feldspars. The associated crystals of hornblende are always much smaller and less distinct, forming with grains of feldspar a matrix to which the larger feldspar crystals give a porphyritic aspect. Finer grained bands, in which magnetite and ilmenite predominate, traverse the coarser portions, often reticulating; while the whole mass is also occasionally cut by dykes of a whitish or brownish-gray trachytic rock, which is often porphyritic. If, as is not improbable, these dykes belong to the great trachytic portion of the mountain, it would show that here as in Mount Royal, the trachytes are more recent than the dolerites or diorites, but the relations of these different ro ck have yet to be made out.

A portion of the coarse grained diorite selected for examination, contained besides the minerals already enumerated, small portions of black mica, with grains of pyrites, and a little dessemi- nated carbonate of lime, which caused the mass to effervesce slightly with nitric acid. The macled feldspar crystals, sometimes half an inch in length and beautifully striated, were so much penetrated by hornblende that they were not fit for analysis, but by crushing and washing the rock a portion of the feldspar was obtained which did not effervesce with nitric acid, and contained no visible impurity except a few scales of mica. The specific gravity of the powdered feldspar was 2.756—2.763. It was attacked by hydrochloric acid with separation of pulverulent silica, but the complete analysis by this means was somewhat difficult, a portion of the mineral escaping decomposition, so that the ordinary method of fusion with an alkaline carbonate was had recourse to. Two analyses gave as follows:—

	VII.	VIII.	B.
Silica	46.90	47.00	47.40
Alumina	31.10 }	32.65	30.45
Peroxyd of iron	1.35 }		.80
Lime	16.07	15.90	14.24
Magnesia	.65	....	.87
Potash	.58	....	.38
Soda	1.77	....	2.82
Volatile	1.00	....	2.00
	99.42		98.96

This feldspar then approaches closely in composition to anorthite, which although formerly regarded as a rare species, has recently been shown by Deville, Damour and Forchammer to enter into the composition of the volcanic rocks of Iceland and Teneriffe, and Scott has lately described a coarse-grained diorite from near Bogoslowsk in the Urals, which contains a feldspar of specific gravity 2.72, composed of silica 46.79, alumina 33.16, peroxyd of iron 3.04, lime 15.97, potash 0.55; soda 1.28=100.79. It is associated with a greenish-black aluminous hornblende, containing some soda and titanic acid, together with a little mica and some quartz. (*Phil. Mag.* (4,) xv. 518). Quartz was also observed by Delesse in the orbicular diorite of Corsica, the feldspar of which contains according to him silica 48.62, and lime 12.02, approaching to anorthite in composition. In all of these feldspars however, the proportion of silica is somewhat greater than in pure anorthite, which contains only 43.2 per cent. of silica. I have already in a previous Report discussed the question of the composition of these feldspars, and my reasons for regarding them as mixtures of two or more species. (Report for 1853-56, p. 383, and *Phil. Mag.* (4) ix. 262.) I may here call attention to my analysis of the Bytownite of Thompson from near Ottawa; this is a granular feldspar, forming with occasional grains of hornblende a diorite, and having a specific gravity of 2.732, which in my Report for 1850, p. 39, I described as an impure anorthite. Its analysis is for comparison placed along side of that of the feldspar of the Yamaska diorite, and marked B.

Mount Johnson or *Monnoir*, is composed of a diorite which in general aspect greatly resembles that of Yamaska except that it is rather more feldspathic; the finer grained varieties are lighter colored and exhibit a mixture of grains and small crystals of feldspar with hornblende, brown mica and magnetite. Frequently however the rock is much coarser grained, consisting of a mixture of feldspar grains with slender prisms of black hornblende often half an inch long and one-tenth of an inch broad, and numerous small crystals of amber colored sphene.

In this aggregate there are imbedded cleavable masses of the feldspar often an inch long by half an inch in breadth. At the southern foot of the mountain large blocks of the coarse grained diorite are found in a state of disintegration, affording detached crystals of feldspar with rounded angles, and weathered externally to an opaque white from partial decomposition. Near the base of the mountain a coarse grained variety of the diorite encloses small but distinct crystals of brown mica, and a fine grained micaceous variety near the summit contains sphene.

The feldspar in all the specimens of which I have examined appears uniform in its character; it is white, rarely greenish, or grayish; lustre vitreous inclining to pearly. In its cleavages it resembles oligoclase, to which species it is shown to be related by its specific gravity and chemical composition; but I have never seen among its crystals the polysynthetic macles so common in triclinic feldspars. The specific gravity of a carefully selected fragment was 2.631, of another specimen in powder 2.659. The analyses of two different specimens gave as follows:

	IX.	X.
Silica	62.05	62.10
Alumina	22.60	
Peroxyd of iron	.75	
Lime	3.96	3.69
Potash	1.80	
Soda	7.95	
Volatile	.80	
	99.91	

Belœil or Rouville Mountain.—The specimens which I have examined from this mountain may be described as a micaceous diorite. The feldspar, which predominates so far as to give a light grey colour to the rock, is in white translucent vitreous cleavable grains, with small distinct prisms of black hornblende and scales of copper-colored mica. Magnetic iron is also disseminated, and the rock resembles the micaceous portion of Yamaska. A portion of the feldspar separated by washing, still retained a little mica, and gave by analysis:

	XI.
Silica	58.30
Alumina, Peroxyd of iron	24.72
Lime	5.42
Magnesia	.91
Potash	2.74
Soda	6.73
Volatile	.50
	99.32

It will be seen that this feldspar approaches very closely to that from Yamaska numbered VI., and there is much resemblance between the two rocks.

Montarville or Boucherville Mountain.—The collection of specimens from this intrusive mass offers two or three remarkable varieties of rock not met with in the mountains already described; and characterized by the presence of augite and olivine. The first variety consists almost entirely of coarsely crystalline black augite, with small scales of brown mica, and rare grains of white feldspar; others of calcite are also scattered throughout the mass, and their removal by solution has left numerous little pits on the weathered surface; it may be described as a highly augitic dolerite. Another and remarkable variety appears to form the greater part of the mountain; it consists of olivine in rounded crystalline masses, from one-tenth to half an inch in diameter, associated with a white or greenish-white crystalline feldspar, black augite and a little brown mica and magnetic iron. The augite appears both in the form of small grains, and of well defined crystals, often an inch in length by half an inch in diameter, and partially coated with a film of brown mica; the olivine is evidently the predominant mineral.

An average specimen of this olivinitic dolerite was reduced to powder; it did not effervesce with nitric acid, and when ignited lost only 0.5 per cent. When heated with sulphuric acid the olivine was readily decomposed with a separation of silica, and by the subsequent use of a dilute solution of soda, followed by hydrochloric acid, and a second treatment with the alkaline ley, 55.0 per cent. of the mass were dissolved. The dissolved portion consisted of,

	XII.
Silica	37.30
Magnesia	33.50
Protoxyd of Iron	26.20
Alumina	3.00
	100.00

Another portion of the same pulverized specimen was gently warmed with dilute sulphuric acid, and the silica being removed from the residue by a solution of soda, some grains of olivine which still remained, were decomposed by a repetition of the process. The undissolved portion equalled 44·7 per cent., and appeared to consist of feldspar and pyroxene, with some mica and a little magnetite. The acid solution gave a quantity of magnesia equal to 18·0 per cent. of the rock.

Selected grains of the olivine were now submitted to analysis.

The powdered mineral gelatinized with hydrochloric acid even in the cold, and was almost instantly decomposed when warmed with sulphuric acid diluted with an equal volume of water, the silica separating for the most part in a flocculent form, and enclosing small grains of undecomposed mineral, which were left after dissolving the ignited silica. One or two hundredths of silica were however retained in solution, and were precipitated by ammonia with the oxyd of iron. Two analyses of separate portions of the olivine gave as follows, after deducting the undecomposed mineral :

	XIII.	XIV.		Oxygen.
Silica,	37·13	37·17	=	19·82
Magnesia,	39·36	39·68	=	15·87
Protoxyd,	22·57	22·54	=	5·10
	99.06	99.39		

If we suppose the 18-0 per cent. of magnesia found above to correspond to olivine containing 39-5 per cent. of magnesia, we shall have 45-5 per cent. of olivine in the rock examined. The silicates not attacked by sulphuric acid were decomposed by fusion with an alkaline carbonate, and gave as follows :

	XV.
Silica,	49.35
Alumina	18.92
Protoxyd of iron	4.51
Lime	18.36
Magnesia	6.36
Loss (alkalies ?)	2.50
	100.00

A crystal of the black cleavable augite from the olivinitic dolerite had a hardness of 6.0 and a density of 3.341; its powder was ash-gray. Analysis gave,

	XVI.
Silica	49.40
Alumina	6.70
Lime	21.88
Magnesia	13.06
Protoxyd of iron	7.83
Soda with traces of potash	.74
Volatile	.50
	100.11

In some portions of the dolerite of Montarville, the feldspar is more abundant and appears in slender crystals, with augite and a smaller proportion of olivine than the last. A specimen of this variety crushed and washed, gave 3.9 p. c. of magnetic iron, and 10.0 p. c. of a mixture of ilmenite with olivine. The feldspar was obtained nearly pure, in the form of slightly yellowish vitreous grains having a density of 2.731–2.743. Its analysis gave the composition of labradorite:

	XVII.
Silica	53·10
Alumina	26·80
Lime,	11·48
Peroxyd of iron,	1·35
Magnesia,	·72
Potash,	·71
Soda,	4·24
Volatile,	·60
	99·00

Rougemont.—The rocks from this mountain offer very great varieties in composition and appearance. Some portions are a coarse grained dolerite in which augite greatly predominates; grains of feldspar are present, and a little disseminated carbonate of lime. In some specimens the augite crystals are an inch or more in diameter, with brilliant cleavages, and grains of pyrites are abundant, with calcite, in the interstices. This rock approaches closely to the highly augitic dolerite of Montarville. The olivine which characterises the latter mountain is also very abundant in two varieties of dolerite from Rougemont. One of these consists of a grayish-white finely granular feldspathic base, in which are disseminated well defined crystalline grains of black augite and amber coloured olivine, the latter sometimes in distinct crystals The proportions of these elements vary in the same specimen, the feldspar forming more than one-half the mass in one part, while in the other the augite and olivine predominate. By the action of the weather the feldspar acquires an opaque white surface, upon which the black lustrous augite and the rusty-red decomposing olivine appear in strong contrast.

Another variety of dolerite from this mountain may be described as a fine grained grayish-black basalt enclosing a great number of crystals of dark bottle-green translucent olivine, which appear in high relief upon the weathered surfaces, and are often half an inch in diameter.

In Sir Willam Logan's notes upon this mountain it is remarked that dykes of a fine grained granitic trap cut the augitic mass; and I find among the collections from this locality specimens of a light gray rock which is made up of a white crystalline feldspar with small prisms of black hornblende and scales of brown mica, resembling somewhat the finer grained diorite of Mount Johnson, while others more micaceous approach to that of Belœil.

Mount Royal or Montreal Mountain.—A large portion of this mountain consists of a dolerite in which augite greatly predominates, resembling the highly augitic varieties of Rougemont and Montarville. The white crystalline feldspar, which is often very sparsely disseminated, is at other times more abundant, and occasionally predominates in bands, which traverse the dark coloured rock and appear to be veins of segregation. At the east end of the mountain a variety of dolerite containing olivine occurs; it consists of a base of grayish-white granular feldspar, which constitutes in the specimen before me about one-half the mass, and incloses crystals of a brilliant black augite, and others of semi-transparent amber-yellow olivine. This rock closely resembles the feldspathic olivine rock of Rougemont described above, but the imbedded crystals are somewhat larger, although much smaller than the crystals of the same mineral in the dolerite of Montarville. A portion of the feldspar freed as much as possible from augite, gave by analysis the following result, which shows that it approaches labradorite in composition:

	XVIII.
Silica,	53·60
Alumina,	25·40
Peroxyd of iron,	4·60
Lime,	8·62
Magnesia,	·86
Alkalies, by difference,	6·12
Volatile,	·80
	100·00

The Silica contained 1·60 of matter insoluble in carbonate of soda, apparently titanic acid from intermingled ilmenite, from whence a portion of the oxyd of iron is also derived.

Rigaud Mountain.—This, the most western of the series of intrusive masses under consideration, is in great part made up of a rock which approaches in character those of Brome and Shefford, being an aggregation of large crystalline grains of what appears to be a reddish orthoclase, often without any cementing medium; at other times the feldspar crystals are imbedded in a fine grained grayish base, and the rock closely resembles the trachytic porphyry of Chambly. Quartz and hornblende are both however sometimes present, the rock passing into a granite or syenite. These rocks are cut by thin veins or dykes of a hard reddish-brown jasper-like feldspathic rock.

A portion of Rigaud Mountain however consists of a rather coarse grained diorite, which is made up of a crystalline feldspar, white or greenish in colour, with small prisms of brilliant black hornblende *and crystals of black mica, in some specimens the feldspar and in* others the hornblende predominating. These diorites resemble closely those of Belœil and Rougemont.

The rocks of all these mountains, and especially of Montreal and Rigaud, still demand a great deal of study, and these observations and analyses are to be looked upon only as preliminary to a more extended examination, which shall determine the mutual relations of the trachytes, diorites, dolerites and olivinitic rocks above described, as well as their probable relations to the stratified deposits of more ancient periods.

The eruption of these augitic and olivinitic rocks was evidently antecedent to the deposition of the Lower Helderberg rocks, since in the dolomitic conglomerate of that age we meet with fragments of augite, olivine and mica identical with those found in the dolerites just described (Report 1857, p. 202.)

The metamorphic action exerted by these intrusive masses upon the Silurian strata in their immediate vicinity appears to have been very local, but it is not less worthy of study, inasmuch as its results on a small scale resemble those produced by the wide-spread action which has altered such vast areas of similar rocks in the Green Mountain chain, far removed from the influence of intrusive rocks.

Among the sandstones and shales of the Hudson River group which surround Rougemont, there occur beds of those highly ferruginous dolomites so often met with in this formation, and similar to those which I have described in previous Reports.

In one of these, which is conglomerate or concretionary in its structure, the paste has been converted into a dark greenish crystalline hornblende, which retains its colour on the weathered surfaces, while the nodules of buff coloured dolomite have become reddish-brown and pulverulent.

In another specimen of this rock, also from Rougemont, and made up of thin layers of white crystalline red-weathering dolomite with others of a compact greenish-gray mineral, are interposed layers of blackish green crystalline hornblende from one-sixth to one-fourth of an inch in thickness; like the other bands they are variable in thickness and interrupted. Occasionally the cleavages of the hornblende, which are nearly perpendicular to the beds, are seen cutting through thin layers of the dolomite, which as before, weathers reddish-brown.

A portion of the rock free from hornblende was attacked with effervescence by warm dilute nitric acid, which dissolved 54.0 per c. of carbonates of lime, magnesia and iron. The soluble portion had the following composition:

Carbonate of lime	38.9
" magnesia	31.2
" iron	29.9
	100.0

Minute grains of pyrites were disseminated through the rock, which gave to the acid traces both of copper and nickel. The residue decomposed by fusion with carbonate of soda was found to contain— silica 65.40; alumina 10.10; lime 0.56; magnesia 2.05; protoxyd of iron 4.80; titanic acid 7.30; volatile 2.20; loss (alkalies?) 7.59 = 100.00.

The fossiliferous limestones around the mountain of Montreal appear to have suffered very little change from the proximity of the igneous rocks. In one instance a portion of the limestone for the distance of five or six inches from the dolerite was seen to be whitened, and intermixed with a portion of a greenish matter having somewhat the aspect of serpentine. Nitric acid dissolved from the crushed rock carbonate of lime with some alumina and a trace of magnesia, and the residue dried at 212° F., gave by analysis, silica 40.20; alumina 9.30; protoxyd of iron 5.22; lime 36.40; magnesia 3.70; volatile 0.20 = 95.02. The insoluble matter of these limestones is generally aluminous, and contains only traces of earthy protoxyd bases. A portion of the gray fossiliferous limestone from the vicinity of the mountain left by the action of a dilute acid a residue black with carbonaceous matter, which became white by ignition, and equalled 12·8 per cent. of the rock. It was an impalpable powder which gave to dilute soda ley, 9·5 per cent. of its weight as soluble silica, while the residue had nearly the composition of a potash feldspar; analysis giving me silica 73·02, alumina 18·31, lime 0·98, magnesia 0·87, potash 5·55, soda 0·39 = 99·57. (See Report for 1857, p. 198.) It would appear that under the influence of the heat of the intrusive rock this argillaceous matter combines with lime, magnesia and oxyd of iron to form the silicate whose analysis has been given above, a portion of alumina being set free in a soluble form.

REVIEWS.

A New History of the Conquest of Mexico, in which Las Casas' Denunciations of the Popular Historians of that War are fully Vindicated. By Robert Alexander Wilson, Counsellor at Law, Author of "*Mexico and its Religion,*" &c. Philadelphia: James Challen and Son. 1859.

The idea implied by the designation of a *new history* of the Conquest of Mexico is set forth in unmistakeable language in the volume now before us, ere we have even got the length of the preliminary chapter. It is a book written mainly to show the fallacy of Prescott's work on the same subject, though the author has a higher aim before himself than that of a mere eradicator of previous errors. He is prepared not only to displace, but to replace; and, having reduced the fancied Aztec civilization of Ancient Mexico to a fable, its sovereign cacique, Montezuma, to a mere Indian chief, and his Aztec hosts to a horde of Indians, little, if at all, in advance of the famous Iroquois league that withstood Champlain and the chivalry of France in the seventeenth century; he next proceeds to establish an ante-Columbian civilization in the New World, the direct product of Phœnician civilization, and consequently dating back to centuries far beyond the reach of Aztec or Toltec traditions. In a letter to his publishers, attached to the volume as "the Author's Explanation," he refers to the death of the distinguished historian of the Conquests of Cortes and Pizarro, and adds:—"The most kindly relations existed between us in his lifetime, though ever taking diametrically opposite grounds on all Spanish questions; he assuming that the books and MSS. sent to him from Madrid were reliable authorities, while I insisted on the lawyer's privilege of sifting the evidence—a labour he was incapable of performing from a physical infirmity." The assumption here made that, because from the temporary deprivation and long weakness of sight, which compelled Prescott to pursue his historical labours with the aid of a reader and amanuensis, he was therefore incapable of sifting the evidence on which his historical deductions were based, is a very extraordinary one, and will be acquiesced in by few among the admirers of the great American historian. But the feelings of dissent from the basis thus set forth for a relative estimate of the merits of the two histories of the Conquest of Mexico, will not be diminished by a critical perusal of the author's arguments; though in one respect he enjoys a great advantage over Prescott, in speaking of the incidents of the Conquest, with a personal knowledge of many of the localities where its chief events transpired. But Mr. R. A. Wilson has this grand qualification for "the lawyer's privilege of sifting the evidence," that he is a famous doubter. He disbelieves Cortes, he denies the very existence of Bernal Diaz, the most valuable of hitherto accredited authorities; and as for Spanish bishops, priests, and missionaries, he can scarcely find words strong enough to express his contempt for them. Torquemada, Sahagan, and Herrera are alike "filled with childish trash," "monkish ideas distilled through Indian brains," and exhibitions "of the besetting sin of Spaniards, the monk's evil, lying;" and after describing the history of Fernando de Alva—whom he contemptuously styles the *quadroon,*—as only the counterpart of the fabulous picturings by Cortes, "with a few additions drawn from Scripture History, Moorish Romances, and the Arabian Nights;" he thus closes his critique on that ingenious native historian of Aztec civilization:—"We now take leave of Fernando de Alva de Ixtlilxochitl, with the remark that an epithet, too common at Mexico, cannot with justice be applied to him—*he lies like a priest;* for if he does state what he knew to be untrue, he has done it far more elegantly than any of the priestly historians whose works we shall discuss." Such, it need scarcely be said, is a lawyer's mode of sifting evidence such as the historian of the "Conquest of Mexico" was incapable of performing, and however consistent with the partizan tone of a Counsel in his address to a jury, is not the most promising for the impartial verdict of the judge.

But besides this duty of a lawyer-like sifting of evidence, which our author specially takes credit for, he has the more valuable qualities of an eye-witness, and steps into the witness box to tell us what he has himself seen, amid scenes rendered famous by events which historians have located on the lofty table-lands of Mexico, and which owe some of their most characteristic incidents to the peculiar natural and artificial features of the country. An extract will best suffice to illustrate his mode of turning his own personal observations to account; and for this purpose we select his description of Cholula, because, as he says in diverse forms throughout the work, his faith was shaken at Tlascala, and Cholula extinguished it. It is surprising, indeed, to find how narrow a basis sufficed to furnish a firm footing for his original doubts. "The discovery of a common flint arrow-head," he remarks at page 78,—" an indispensable part of the usual weapons of a North American Indian—upon the pyramidical mound of Cholula, first aroused suspicion, and set the author upon this inquiry into the pretended civilization of Montezuma and his Aztecs. The investigation has resulted in his conviction that a large portion of the narrative of Cortes was designedly untrue, and written purposely to impose upon the Emperor; and, further, that all the subsequent additions to that author are pure fabrications. He was, moreover, led to believe that the narrative, bearing the name of Bernal Diaz, was written for the purpose of sustaining other histories already needing a more ample foundation than that furnished by Cortes. It is probably nothing more than the story of Gomora, with the absurdities pointed out by Las Casas partially deducted." The author repeats in a foot-note that his first suspicions of the civilization of the Indians of the Table-land was the discovery of this arrow-head. He is evidently not aware that flint arrow-heads are by no means rare at Marathon and elsewhere in Greece, occur on Italian sites, and have been found abundantly in France and Britain; or would he consider that such discoveries furnished equally cogent grounds for lawyer-like doubts about the civilization of any, and every prior historical period? This, however, is the mere starting point. The following extract combines historical criticism with the results of personal observation. Having stated his views of the Tlascalan war, he thus proceeds :—

The scene now shifts to an adjoining tribe, one bearing the familiar name of Cholula, in common with a mud-built village, and an immense earthen mound, which distinguished it, then, as now, among all the villages of the table-land. For once we shall follow the standard historians, and afterwards add our own observations. That famous cut-stone pyramid of Cholula, a print of which used to adorn every school geography of our country, had never other than an imaginary existence. The reality is an earthen mound, differing from the common sort only in its enormous size. We are indebted to fiction for all else that it possesses.

The Spanish inventors of Indian traditions made Cholula the Mecca of the Anahuac, where of old an annual fair was held, the resort of merchants and pilgrims from all parts of the table-land; there, say they, sacrifices were offered and vows performed, while exchange and barter engrossed a busy multitude in its bazaars, and at the foot of the great *pyramid.* Cholula, by these apocryphal traditions, was in the time of Indian *paganism!* sacred to Quetzolcoatl, "the god of the air," who, during his abode on earth, had taught mankind the use of metals, the practice of agriculture, and the arts of government. Other Spanish authors, presuming these traditions true, saw in them the mission of the Apostle Thomas to the Anahuac, and hence styled him the reformer of that people; and thus accounted for the cross, the Madonna, and the incense-burning, pictured on the temple-ruins of the hot country, Thus have hypotheses been piled upon each other, to account for the striking similarity that seems to have existed between antique paganism and Romish idolatry.

The account which Cortez gives of Cholula is even more extravagant than his description of Tlascala. According to him, the village of Cholula was a rich and opulent city of forty thousand houses. He says he counted "from a mosque, or temple, four hundred mosques, and four hundred towers of other mosques." He says, too, "the exterior of this city is more beautiful than any in Spain." Diaz, more moderate in the use of numerals, reduces the eight hundred to one hundred very high towers, the whole of which were *cues*, or temples, on which the human sacrifices were offered, and their idols stood. The principal *cu,* here, was even higher than that of Mexico, though the latter, he says, was magnificent, and very high. "I well remember when we first entered this town, and looking up to the elevated white temples, how the whole place put us completely in mind of Valladolid." Other historians go yet further, and represent Cholula not only as the Mecca and commercial centre, but also the seat of learning for the whole *Anahuac.* Here, say they, the Indian philosophers met upon a common footing with Indian merchants.

Its government, like that of Tlascala, was republican; so that upon these plains, according to Spanish authors, more than three hundred years ago there flourished two powerful republics, Tlascala and Cholula, the first the Lacedæmon, the second the Athens of the Indian world. When united, they had successfully resisted the arms of Montezuma; but Aztec intrigue was too powerful for the American Athens, and the polished city of Cholula was subdued by those arts with which Philip of Macedon won the sovereignty of Greece—a combination of intrigue and arms. Tlascala was left alone to resist the whole force of the Aztec empire, now aided by the faithless Cholulans. Yet Tlascala, undismayed by the new combination, did not readily listen even to the proposals of Cortez; and only after the terrible experience she received of his strength, did she admit the value of his alliance. Let us contemplate the simple truth.

The ordinary representations of the city and republic of Cholula are all in a style of magnificence commensurate with the foregoing outline. Such statements only had the author seen, when he undertook its survey. He had not then heard or read of the suggestion of Torquemada, though copied into one of the notes of Robertson. "The large mound of earth at Cholula, which the Spaniards dignified with the name of temple, still remains, without any steps by which to ascend, or any facing of stone. It appears now like a mound, covered with grass and shrubs, and possibly it was never anything more." The striking resemblance of this to the mounds scattered through the country of our northern tribes, satisfied us of their common origin, and that this, like the others, was but an Indian burying place, formed by the deposition of earth upon the top of a sharp conical hill, as often as fresh bodies were interred, and this is probably the fact. Its greater size is doubtless attributable to its situation in the midst of a most fertile plain, [*vega*] where from generation to generation a dense popolation must have dwelt, who used this as the common receptacle of their dead. The appearance of that structure, which Humboldt and other Europeans have considered a monument of antique *art*, is readily explained by opposing facts familiar only to Americans, to the scientific speculations of foreigners! But to this one there is now no question: an excavation having been made into the side of the mound, it revealed that truth which we only surmised. The only ruins at Cholula are those of several Spanish convents, abandoned by the *religious* for others in the more congenial, because more polluted atmosphere of *Puebla*, six miles distant. The village is a collection of *adobe* huts, such as it doubtless was in the time of Cortez, and all the appearance of art about "the py id" is the modern church upon its crest.

There is one reference here to which we would direct the reader's attention as of no slight importance. Torquemada, a Provincial of the Franciscan order, visited the New World about the middle of the sixteenth century, and was in close intercourse with many who had personally shared in the dangers and the triumphs of Cortez. He resided in the country for fifty years, and as the zealous chronicler of all that related to Mexican antiquities, he must have been an observant witness of any remarkable native monuments that came under his notice. If, then, the "suggestion of Torquemada" copied by Robertson, and repeated by our author, with careful references (Torquemada, Liber III., c. 19. Note to Robertson, No. 194,) be correct, there is an end to the matter as far as the pyramid of Cholula is concerned. If Torquemada, whose whole history is written to sustain the narratives of Cortes and Bernal Diaz, nevertheless admits that in the sixteenth century the Cholula pyramid was a mere earth-mound, it does not require the authority of a traveller of the nineteenth century to assure us that it is no more now. But, Torquemada's original volumes not being accessible, we have had the curiosity to refer to Robertson's notes. In one (note 37) the historian states the dimensions of the Cholula pyramid, on the authority of Torquemada, as above a quarter of a league in circuit at the base, and forty fathoms high; and his reference substantially corresponds to the one given above: *Mon. Ind. Lib. III. c.* 19. But the quotation which accompanies this reference to ancient Spanish authority in the subsequent note, No. 39, gives the words—not of Torquemada, who wrote from personal observation, in the sixteenth century,—but of the modern author, a Scottish divine and historian of the eighteenth century, who did not pretend that he had ever seen the mound, or indeed crossed the Atlantic. In other words the author quotes at second hand, and furnishes a note of Robertson, written at Edinburgh, about 1777, under the belief that he is quoting what Torquemada wrote at Mexico before 1600! Whatever may be the "lawyer's privilege of sifting evidence," this must be confessed to be rather a loose way of exercising it.

Again, it does not seem to have occurred to the critical author that the modern Church, which is now the only appearance of art about the earth-mound of Cholula, may have something to do with the absence of art elsewhere. For if the Monks found that mound cased, like those observed by Stephens in Central America, with cut-stone steps and facings, there can be little doubt they would go no further to seek a quarry for their intended Church; and if, moreover, the ruins of several Spanish Convents surround the modern Cholula, the only chance of finding traces of the ancient city, if it ever existed, must be in some stray sculptures and carvings betraying native art, on the materials built into the later Spanish structures. But it may be doubted if such evidence would be received by our author, for he tells us: "At Cholula, I was so fortunate as to procure one of the images of Quetzalcoatl, cut in stone, with curled hair and Caucasian features. This I afterwards compared with the great image found at Mexico, not without strong suspicions that both were counterfeits; for in this country, even the most sacred records are open to such suspicion." This, it must be confessed, is carrying out the principle of doubting in a most impartial and uncompromising spirit. The zeal of the old Spanish conquerors in traducing the Indians was so great, that, according to our author, they actually invented and carved idols, to bury them, for the confounding of future generations by their discovery! This is an extent of critical suspicion it would be difficult to surpass.

Whilst, however, we thus indicate the tone of writing in this new History, as differing widely from that which we generally look for in the impartial and unprejudiced historian; and the *authoritative* criticism as carried out in a fashion very different from what we might justly expect in the work of a le d Counsellor at Law, who has undertaken to supplement the defects of Prescott, and sift the evidence which—literally as well as metaphorically,—he had *blindly* followed; nevertheless, while this "New History of the Conquest of Mexico," will not supersede Prescott's fascinating story of the triumphs of Cortes, there are points in it well worthy of the notice of the students of History. In testing the narrative of Cortes by the physical evidence which the scene of his chief triumphs and reverses supplies, Mr. R. A. Wilson has availed himself of the American Army Survey of the Valley of Mexico, and undertakes, on seemingly satisfactory ground, to demonstrate that the Mexico of Montezuma was not built on an island in the lake of Tezcuco, nor surrounded by its waters; but that it stood nearly as now, enclosed by marshy ground, through which its causeways were formed, merely by throwing up the earth from a ditch or canal on either side. This appears to be proved by the present relative levels of the lake and the surrounding country, which show that the water, if standing at a height sufficient to reach the city, would drown much of the land which formed the chief theatre of Cortes's deeds on *terra-firma*. Still further, our new historian discredits the possible existence of Montezuma's fabled capital, by affirming that no building of any magnitude can be erected in Mexico, in consequence of its marshy site, except on piles. Here is a specimen of the fashion in which he demolishes "the fables of Cortes and Bernal Diaz:"

"In the beginning of the dry season, November 8, 1519, Cortez made his formal entry into the city, and lodged in one spacious enclosure the whole of his little army. Here both Cortez and Diaz turn aside to paint wild figments of the magnificence of the capital of Montezuma. Oriental story, in its richest flights, has hardly ever reached the extravagance of their tales. Were either narrating a public reception of the Caliph of Cordova, in the zenith of his glory, or the triumphal entry of those of Bagdad, they could not have pictured scenes comparable to these described, as actually transpiring *in their presence in this* Indian metropolis. The enormity of the fiction is not, after all, its most striking feature. It lies rather in the credulity—not of the Spaniards, whose belief was regulated by authority—but in that of the whole civilized world, which credited these remarkable narrators without either scrutiny or evidence. The violation of natural laws, which their statements involved, may not have been readily detected when philosophy hardly existed as a science. But how shall we account for that blinking of the gross discrepancies between them? Is a love of the marvellous so inveterate in man that critics, even, shut their eyes to the most palpable contradictions?

"Could Mexico have then been seen as it now appears—a modern city, built on an antique pattern—our authors might well have painted it in oriental colours, and almost fancied, too, some lingering resemblance to the great cities of the Moorish caliphate within its time-marked palaces. As the occupants of some chamber upon a house-top, in the day season, they might dream themselves, perhaps, in such a capital as they have fabricated for Montezuma. Domes, and minarets [steeples], and elevated battlements cast strange shadows in the rarified atmosphere, by moonlight, and make a picture so unreal that the visitor of to-day might almost fancy the actual existence of such a world as Cortez only figured. Untrue in fact—untrue even in fancy—his wild assertions have grown almost realities by passing so long unquestioned. Generation after generation allowed their taste and their architectural plans to be influenced by an imagined resemblance to something that had graced the spot before, and uncontradicted fabrications thus became almost truths.

"This valley at the sea-level would have been for ever jungle, a dwelling-place for wild beasts, for the screech-owl and the bittern to enjoy unmolested; and that such a spot, perpetually on the verge of inundation,—where the difference between land and water can be measured by inches,—should be occupied by a large city, demonstrates both the purity of the atmosphere and the uniformity of evaporation, which for centuries has maintained this slight elevation. But the proximity of the two surfaces produces disagreeable results—stagnation and decomposition—the festering evils of an undrained valley, though neutralized in its lower levels by salt and sterility. Sewerage is necessarily upon the surface—the drains of the city cess-pools are its street ditches, or *canals*. All poetic illusion vanishes, when from moonlight on the housetop we descend to the sober reality of day. Since the time of Cortez, the resources of engineering have been exhausted in attempts to establish any material change, without tunnelling the mountain, so as to drain Tezcuco *laguna*. These very defects fulfilled the Indian idea of a stronghold, as they at all times insured them that security which a circumvallation of mud and water could not furnish. Beyond this, we will not affirm the famous capital of the Aztecs differed materially from an ordinary Indian village of the first class."

This may serve to illustrate our meaning in characterising the new Historian as a famous doubter. He doubts everything; and at times he carries his reader along with him in his doubts. "I have presumed," he says, "to doubt that water ever ran up hill; that navigable canals were ever fed by 'back-water;' that pyramids *(teocalli)* could rest on a foundation of soft earth; that a canal, twelve feet broad by twelve feet deep, mostly below the water level, was ever dug by Indians with their rude implements; that gardens ever floated in mud; or that brigantines ever sailed in a salt-marsh; or even that 100,000 men ever entered the mud-built city of Mexico by a narrow causeway in the morning, and, after fighting all day, returned by the same path at night to their camp; or that so large a besieging army as 150,000 men could be supported in a salt-marsh valley, surrounded by high mountains." Gaining courage as he proceeds, he doubts if human sacrifices were ever practised among the Mexicans. The whole is a mere lying version of the barbarian practise of the Red Indian torturing his prisoner. He doubts if picture-writing existed among the Mexicans; and regards the whole costly volumes published by Lord Kingsborough, as reprints of "pious frauds" of the priests. One of their collectors, Boturini, is "the very personification of imposture and credulity;" another, Veytia, is his match in credulity, and seemingly worse in morals; a high authority on Mexican History, Clavigero, is the interpreter of a mere valueless waif of "the manufactured antiquities;" Bernal Diaz, as we have already said, was "a myth," never fought, never existed, except by virtue of the creation of a lying Monk's pen. Dr. Robertson, the Historian, and "principal of the University [High School] of Edinburgh," takes "as his authority a Jesuitical author," and writes "unmitigated nonsense about the Iroquois." The bracketed explanation that the University of Edinburgh and its *High School*, are identical is also the author's own! And finally, he thus settles the merits of the greatest of America's Historians: "Thus stand the literary monuments Mr. Prescott has constructed. They are castles resting upon a cloud, which reflects an eastern sunrise upon a western horizon!"

So far, then, we see that Mr. R. A. Wilson is an unmitigated doubter; nay, an open and avowed unbeliever in all the canonized worthies of the Calendar of Letters. But it must not be supposed he is therefore devoid of all faith. On the contrary, he has a very decided creed of his own. He believes in an extinct Phœnician Empire in Central America; finds in the cruciform ornaments of the ruins of Palenque, the emblem of Astarte; in the Turtles sculptured at Uxmal, a Tyrian symbol; in the river-wall of Copan, a counterpart of the famous sea-wall of Tyre; recognizes in one of the sculptures figured in Stephens' Central America, "the patron of the city of Palenque, the Phœnician Hercules;" and in another, engraved by Dupaix, the "American Isis or Astarte;" and, in short, proves once more that nobody is so credulous as your unbeliever.

As a new History of the Conquest of Mexico, we cannot commend this volume of Mr. R. A. Wilson as one calculated in any respect to supersede the singularly fascinating work of Prescott. As a critique, however, upon that and other Mexican Histories, written by one who has explored the localities where the principal scenes of Cortes's triumphs and reverses took place, and who has reconsidered the unquestionably exagerated narratives of the earlier Spanish authorities, with reference to the possibilities and probabilities suggested by the actual scene of historical events: the book may be read with interest and profit by the historical student. Prescott by no means overlooks the exagerative spirit of even the best of his old Spanish authorities. In one passage, for example, when speaking of Tlascula, which Cortes, in his letter to the Emperor, compares to Granada, he adds:—"The truth is, that Cortez, like Columbus, saw objects through the warm medium of his own imagination, giving them a higher tone of coloring and larger dimensions than were strictly warranted by the fact." But the charm of Prescott's version of the old highly toned narratives leaves an impression of reality which is scarcely affected by such guarded warnings of their dubious character; and such a book as the one under review has its value in drawing attention, and giving weight and due importance to them. A less ambitious name than that of "A New History of the Conquest of Mexico," would have more correctly described what is in reality only notes and reflections of a Mexican Tourist, upon the History of the Conquest and the Antiquities of the country. Such a designation of the work would, moreover, have disarmed criticism, and have admitted of a fairer estimate of the actual merits of the work than it has hitherto received. As it is, the author cannot complain, if the comparison with the carefully elaborated, and singularly fascinating volumes of Prescott, lead to a depreciation of the New History, even by those who believe as we do, that with all his candour and laborious diligence in the recovery and collation of original authorities, the high colouring of Prescott's magnificent scenes of the Conquest, not unfrequently partakes of the seductive charms of romance. D. W.

Geological Survey of Canada. Report of Progress for the year 1858. Montreal: Printed by John Lovell. 1859.

Our notices of the various Reports issued by the Geological Survey, may appear to distant readers to be somewhat after date; but these Reports, it must be observed, are not made public, at least in a complete shape, until after their formal presentation to the Legislature, a proceeding which necessarily involves a very considerable delay. Owing to this circumstance, however, portions of the Annual Reports are frequently published, in advance, in scientific journals, in order to claim priority for the discoveries and researches of their authors; and thus, our own Journal has been honoured, on more than one occasion, by communications of this kind from officers of the Survey.

Although the Report for 1858 is filled with numerous details of much local importance, it offers, perhaps, less matter of general interest than some of those which have preceded it; but, to be properly understood and appreciated, it must be considered in connexion with the earlier explorations and researches of the Survey, as well as with those which are now being carried on. In addition to an elaborate Report from the Director of the Survey, Sir W. E. Logan, it contains communications from Mr. Murray, Mr. Richardson, and Mr. Hunt; together with valuable lists, by Mr. D'Urban and Mr. Bell, of the animals and plants met with in special districts of the Lower Province. These, with other lists of the same kind previously published, although forming at present merely isolated contributions to our knowledge of the Fauna and Flora of the country, will be found ultimately of great use. We miss, in this Report, the usual communication of Mr. Billings; but the subject matter of the Palæontological Report for the year in question, comprising a monogram on the Devonian Corals of Western Canada, has already appeared in the pages of the *Canadian Journal*, and will be published, we understand, with additional matter, in one of the forthcoming issues of the Survey.

Sir William Logan's Report contains the details of an extended exploration of the bands of crystalline limestone in the counties of Argenteuil and Ottawa, examined by him, in part, during the preceding year. These details are chiefly, and necessarily, of local interest, but they contribute much to a correct knowledge of both the geographical and geological features of that portion of the Province. In addition, for example, to the accurate delineation of about twenty miles of the River Rouge, beyond the area at present surveyed, the position and form, to quote from the Report, of thirty-two tributary lakes of various sizes were determined, some being upwards of six miles in length. But nothing can demonstrate more effectively the value of our Geological Survey, than the following observations—

shewing, amongst other things, how large an expense may be avoided, by a preliminary examination of the geology of the country, in opening up roads in districts in which Laurentian rocks prevail:

"By this modification of the distribution of the limestone as given in the Report of 1856, a great addition is made to that part lying in Harrington and Wentworth in the neighbourhood of Gate, and Sixteen Island Lakes, a large portion of which supports a surface well adapted for the purposes of agriculture. The best present access to this agricultural tract is by the road which runs along the east margin of the calcareous outcrop on the west side of the trough. The site of this road is judiciously chosen, for while the calcareous valley affords a pretty even grade, it gives also much land capable of settlement along the line, and will thus facilitate the keeping of the road in repair. Some years since a road was opened by the Government to the limestone land in the north-west part of Wentworth, from the settlement on the West Branch River, in the front of the township. But a line having been chosen as near to a straight one as practicable, over the rugged surface of the gneiss, it happens that while the grades are difficult, there is little land fit for settlement along the road. The road, in consequence, is little used; a second growth of timber will very probably be allowed to spring up on it, and the expense of opening it will be entirely thrown away. If a road is required on the west side of Wentworth, it is probable that a better line might be obtained along the limestone on the east side of the trough. In general, throughout the Laurentian region, the bands of limestone will be found to afford the best guide for the lines of roads."

At the close of Sir William Logan's Report, some valuable information is given respecting the copper deposits of the metamorphic region on the south side of the St. Lawrence. As so much attention is now being directed to this mineral district, we are induced to transcribe this portion of the Report in a complete form:

"In the Reports of the explorations made by the survey on the south side of the St. Lawrence, in 1847 and 1849, it was stated that indications of the pyritous and variegated sulphurets of copper were observed in many localities, usually in the vicinity of certain bands of dolomite, serpentine, soapstone, and other magnesian rocks, which in various forms characterise a group of strata lying at the top of the Hudson River formation, and intermediate between what have occasionally been called the Richelieu Shales and the Sillery Sandstones. They are equivalent to the rocks of Quebec and Point Levi, and, affected by undulations, range through the country between Cape Rosier and Lake Champlain in a very irregular manner, being distributed in long, narrow, synclinal forms, which carry their outcrops in stretches backward and forward, in a general north-east and south-west direction, bending, however, in some parts, towards north and south, and in others towards east and west. Proceeding from the St. Lawrence, in a south-east direction, the formation is thus found to be repeated a great many times in a transverse distance, which, opposite to Quebec, would equal nearly fifty miles, whilst at each repetition the strata, which on the north-east are of a sedimentary nature and show characteristic fossils, become more and more crystalline, and ultimately lose all traces of their organic contents.

"When the indications of copper ore in these rocks could be traced continuously to any distance, they, in every instance that came under my observation, preserved a direction coinciding with the stratification. In three instances the quantity of ore appeared sufficient to justify the recommendation of crop trials, one being in Upton, another in Ascott, and a third in Inverness. In the first, which occurred on the fifty-first lot of the twenty-first range of the township mentioned, the copper ore, consisting of pure pyrites, was in a mass of greyish-white and reddish-grey, compact, sub-crystalline, yellowish-weathering limestone, which it intersected in reticulating veins of from one quarter of an inch to an inch in thickness, always inclosed between walls of highly crystalline calc spar, associated occasionally with a little quartz. These reticulating veins constituted bunches, and several of these bunches could be traced in succession in the strike of the limestone. These reticulating veins of copper pyrites did not differ essentially in their arrangement from the thin veins of quartz which vary frequently, and thin veins of titaniferous, specular, and magnetic iron ores which less often, have been found intersecting the magnesian limestones of this formation in various places, and, I presume, must be regarded as veins of segregation, filling up fissures which do not pass beyond the limits of the limestone.

"A bed of breccia or conglomerate, of which both the fragments and the matrix are calcareous, appears to overlie the greyish-white limestone, and, like it, is marked by copper pyrites. A reddish-grey limestone, quarried in the neighbourhood, is supposed to underlie the greyish-white rock, though not seen in contact with it. This, towards the top, was interstratified with yellowish-white beds, and towards the bottom with red shale: no copper ore was observed in the reddish-grey limestone. The breadth across the whole of the beds may be about a quarter of a mile. The general dip is towards the south-east, and the inclination varies from ten to twenty-seven degrees, but the data are not sufficiently clear to establish the total thickness.

"In one of the Reports in question, it was indicated that this band of limestone appeared to hold a course from its position in Upton, through the northern portion of Acton, into Wickham, where, on the twenty-sixth lot of the last range of the township, it was again marked by the occurrence of copper ore. The bearing of the band in this course would approach to north-east; and about ten miles south-eastward from it, another range of calcareous exposures exists in a nearly parallel course, one of the exposures occurring on the thirty-eighth lot of the seventh range of Acton, and another on the eighteenth lot of the ninth range of Wickham, where additional indications of copper ore exists. A third north-eastward run of the same description of limestone extends from the thirty-second lot of the third range of Acton, to the fourteenth lot of the tenth range of Wickham, and on both these lots the rock is again marked by copper ore, as well as on the thirty-second lot of the fifth range of Acton, which is intermediate between the other two positions. All these calcareous ranges, it was there explained, most probably belong to one and the same band—the first and third being on the opposite sides of a trough-like form, which stretches from the neighbourhood of the St. Francis River to Farnham; while the second is due to an anticlinal axis which divides this general trough into two subordinate synclinal parts. Other synclinals present themselves further to the south-eastward, a general description of which was given in the Reports.

"The existence of the copper ore on the thirty-second lot of the third range of Acton, was, I believe, discovered by Mr. H. P. Merrill; and at the request of Mr. Cushing, the proprietor of the land, Mr. Hunt visited the locality in August last. As then seen, before any excavation had been made, the surface presented an accumulation of blocks of copper ore, evidently in place, and covering an area of about sixteen paces in length by ten paces in width. The masses consisted of variegated sulphuret of copper, intermingled with limestone and silicious matter, without anything like veinstone, and evidently constituted a bed subordinate to the limestone, whose strike was about north-east, with a dip to the north-west at an angle of about forty degrees. In continuation of this bed for about seventy paces in either direction, the limestone was observed to hold little patches and seams of variegated ore and yellow pyrites, with stains of the blue and green carbonates of copper. The limestones in the immediate vicinity presented several veins of quartz crossing the strike, but containing only traces of copper.

"During Mr. Hunt's visit, a small amount of excavation was made with pick and shovel, and a further extent of work has been done since; but though this has not added materially to the information at first obtained, there can be no doubt, even should the limits of the deposit extend no further than those above indicated, that there is here an unusually rich bunch of copper ore.

"In the other two instances in which crop trials were recommended, the gangue was opaque white quartz, from one to two feet in thickness, in which was disseminated the pyritous sulphuret in Ascott and the variegated sulphuret in Inverness. The rock in both cases was described as chloritic and talcose slate.

"Subsequent explorations in the township of Inverness and Leeds, by different individuals, have led to the disclosure of a considerable number of localities marked by cupriferous indications. Several of them have been tested in various degrees, by the Megantic Mining Company and others, by shafts and excavations of moderate depths; and at the present time an efficient trial is in progress at Harvey's Hill, in Leeds, by the English and Canadian Mining Company, who are pushing their work with considerable vigour, under the management of Mr. Herbert Williams. At Harvey's Hill there occurs, on the seventeenth lot of the fifteenth range of the township, nine courses, composed chiefly of quartz, with various proportions of bitter spar, chlorite, and calc spar, and all holding in greater or less quantities the pyritous, variegated, or vitreous sulphurets of copper. The width of these courses varies from a few inches up to seven feet in the thickest part of some of them. In the trials on the surface, some of them, after yielding quantities of copper ore that seemed encouraging, have gradually thinned, both horizontally and vertically, and disappeared. To prove their character more thoroughly in a downward direction, an adit is now being driven on the north side of the hill, at a level which is thirty-seven fathoms below the summit. This will intersect nearly the whole of the courses, and until it is completed it would be premature to pronounce any positive opinion upon the success of the enterprise.

"The rock of the hill is such as has usually been called *talcose slate*; but though unctuous to the touch, analyses by Mr. Hunt of slates of a similar character in other parts of the vicinity of Harvey's Hill, have shown that instead of magnesian they are aluminous, and that they should rather be designated micaceous, or, as he has called them from their lustre, nacreous slates. They are in general whitish, or light grey, and are often thickly studded with chloritoid. These slates are interstratified with bands of a darker colour, more resembling clay slates, and the darker appears to prevail over the lighter colour at the mouth of the adit. The dip of the strata appears to be from N. 10 W. to N. 65 W. with an average slope of between fifteen and nineteen degrees. The bearings of eight of the quartz courses are from N. 15 E. to N. 35 E. while one of them runs N. 75 W. They all underlie to the westward at angles varying from fifty to nearly ninety degrees, and it would thus appear that none of them coincide with the strata either in dip or strike.

"During the present year (1859), Mr. Cushing has made an arrangement for the working of the copper ore on his property, and under it Mr. Louis Sleeper, of Quebec (who has heretofore been engaged in mineral explorations in the County of Megantic, and in testing for different mining companies by trial-shafts and other excavations, various quartz courses marked by copper ore in the townships of Inverness and Leeds), commenced mining in the Acton copper ore, on the 23rd of September last. After several weeks had been spent in the excavations, I had an opportunity of visiting the mine, and of spending several days in the examination of the facts observable in the natural exposures of rock in the neighbourhood, as well as those brought to light by the excavations.

"The mine is just half a mile to the south of the Acton Station of the Grand Trunk Railway. The road to it is over a marshy piece of ground, and it is crossed by one or two low mounds of yellow sand. At the end of the road, a hill rises to the height of about 105 feet above the marsh, and descends to a marsh on the other side. It stands on a base of a quarter of a mile in width, and for nearly one half the distance is composed of a sub-crystalline magnesian limestone dipping to the north-west, with an inclination varying from thirty to forty degrees. The limestone is light grey in fresh fractures, and weathers to a dull pale yellowish tint on the exterior. It is in some parts studded with concretionary nodules, consisting of concentric layers of carbonate of lime, with a transverse fibrous structure. The exterior of these is of a botryoidal form, and the layers are in some places partially replaced by chert, preserving the fibrous structure. These nodules very much resemble corals, but they also resemble some concretionary forms of travertine, and the occasional intercolation of magnesian layers in the nodules makes it probable they are the latter. As stated by Mr. Hunt, the limestone of the hill is intersected by several small veins of quartz; and one of them, more conspicuous than the rest, carries traces of the yellow sulphuret of copper and of galena. The mass of limestone visible, extending a short distance beyond the summit of the hill, has a thickness of about 270 feet. It is divided into heavy beds, in which irregular masses of chert are disseminated in unequal quantities in different places, being most abundant towards the bottom.

"The summit of the limestone from the north-eastern corner of the lot, proceeds south-westward for about thirty chains, and in the succeeding 300 yards turns gradually south, and ultimately a little to the east of south, before becoming concealed. In the other direction, after running some distance, it sinks beneath a marsh on the thirty-first lot of the third range, and again makes its appearance on the railroad, which it crosses about three-quarters of a mile to the east of the Acton Station, meeting and crossing the Black River about 220 yards north of it.

"The rock underlying the limestone is concealed, but that which immediately overlies it at the mine, appears, from partial exposures, to be a lavender-grey shale or slate, with a cleavage independent of the bedding. In this slate there appears to be irregularly distributed large masses of a harder rock, which is internally of a light olive-green, uniformly and finely speckled with darker green spots, looking like serpentine, many of which are surrounded with a bluish-grey film. The rock, under atmospheric influences, becomes light yellowish-brown on the surface, and, in its weathering, strongly resembles some of the serpentines of the eastern townships. Some of the masses measure fifty yards in length by twenty in breadth; and on the north side of the railroad there is one of twice those dimensions, apparently sunk into the top of the limestone. Thin layers of the rock occasionally appear to be interstratified evenly among the slates. In thick masses, spots of calc spar are sometimes disseminated, giving the rock a cellular and somewhat trappean aspect; but there is no evidence that it is intrusive, and it occasionally assumes the character of a sandstone, with small quartz pebbles running in the direction of the beds. In the speckled part of the rock, very thin partitions, of the same colour and hardness as the darker green spots, run in several directions. These partitions, on analysis, prove to be a ferruginous chlorite, and the whole rock may be described as a hydrous silicate of alumina, with much iron and magnesia.

"These slates and harder masses have a thickness of about eighty-five feet. They are succeeded by isolated masses of limestone of various sizes and somewhat rounded or lenticular forms, some of them attaining magnitudes of thirty yards in length by twenty in breadth, and even eighty yards in length by ten in breadth. As seen on the surface, they present a succession of protruding lumps, which run in a line parallel with the summit of the limestone, turning with it to the southward at the south-western part of the exposures. These calcareous masses consist of grey limestone, made up of irregular and apparently broken beds and rounded forms, and hold irregular and ragged pieces of chert in more or less abundance, with strings and spots of calc spar. The serpentine-like rock sometimes appears to surround these calcareous masses.

"The copper ore appears to occupy a position immediately near the isolated masses of limestone, and very little of it to penetrate into the serpentine-like rock or the slate. Indications of it occur on both sides of the calcareous masses, and in some places can be traced as if surrounding them; but the chief part appears to be beneath them, and intermediate between them and the slates and the serpentine-like rock. The ore consists of the pyritous, variegated, and vitreous sulphurets of copper, the second species being the most abundant, and the third more abundant than the first. The green carbonate also occurs, but it must be regarded as a secondary product, formed at the surface and in cracks. The chief excavation has been made in a cross-cut, running S. 45 E., which is at right angles to the strike. The depth excavated is from four to eight feet, and the following is the succession of masses met with in the cross-out, given in a descending order, and reduced to vertical thickness from horizontal measurement:

		Feet.
1.	Limestone; this may be a boulder deeply sunk in the soil, but it is supposed to be in place, and to belong to one of the isolated masses of the stratification	3
	Concealed	3
	Limestone in place, belonging to one of the isolated masses; small irregular spots of the pyritous sulphuret of copper occur in the rock. This is probably part of the same mass as the first three feet, and the concealed *three feet would also be a part, making the whole eight feet*....	2
2.	Variegated sulphuret of copper, enclosing numerous angular fragments of limestone in irregular aggregations. This mass dipped with the stratification, but thinned out, and terminated downwards	2
3.	Limestone broken into various sized angular fragments, by a number of reticulating cracks of from one quarter of an inch to three inches in width, and filled with variegated sulphuret of copper, with spots of white crystalline calc spar, and occasional crystals of transparent quartz.	15
4.	Breccia or conglomerate, with a paste composed of variegated and vitreous sulphurets of copper, mingled with fine grained silicious matter, enclosing fragments of limestone, some angular and some rounded; some of them almost wholly calcareous, and others largely silicious. The sulphurets of copper run in parallel clouded streaks, the clouded character being occasioned by the presence of more or less silicious matter, mingled with the steel-grey and the purple of the two sulphurets	4
5.	Limestone....	2
6.	Copper breccia or conglomerate, of the same characters as before	4
7.	Limestone	3
8.	Slate, with traces of copper (green carbonate on the surface)	12
9.	Serpentine-like rock	14
10.	Slate, with traces of copper (green carbonate on the surface)....	25
	Feet....	93

"The thickness of fifteen feet given to the brecciated limestone of No 3 is deduced from a horizontal measurement of ten yards across-the strike, and a supposed slope of thirty degrees, which is about the dip of the bed and of the strata where it can be made out in the vicinity. But no clear indication of bedding is visible in the body of the breccia, and as the excavation across it is yet only two feet deep, it may hereafter be proved that, by some irregularity, the slope is less than thirty degrees; in that case the thickness would have to be reduced in proportion to the diminution of the slope. If the slope should be eighteen degrees, the thickness will be ten feet.

"The two breccia or conglomerate beds, numbered 4 and 6, contain the great body of the copper ore. *On the strike, these beds are exposed for about eight* yards to the south-west. There is then an interruption, by the presence of a wall of the serpentine-like rock, which crosses the strike in the shape of a slender wedge, coming to a point north-westwardly, and gradually spreading out into the strata in an opposite direction. A farther quantity of copper conglomerate, however, exists on the opposite side of this wedge-shaped wall. The condition of the rock to the north-east of the cross-cut has not yet been sufficiently ascertained to give any description of it, except from an excavation at the distance of about forty-five yards. Here a mass of ore has been mined for about two fathoms on the strike, commencing with a breadth of nine feet, and irregularly diminishing to the north-westward. Beyond the excavation, it appears to diminish farther, and probably thins out. On the north-west side, this mass was limited by limestone belonging to the line of isolated masses; and on the south-east by a mass of the serpentine-like rock, the face of which stands in a nearly vertical attitude.

"In costeening pits, which have been carried across the strike of the upper part of the ore, at distances of about eighty yards on one side of the cross-cut and 110 yards on the other, indications of ore continue to exist in the stains of green carbonate and small masses of the sulphurets, but the work done is not sufficient to give facts that bear upon the mode in which the ore is connected with the rock.

"In so far as the facts ascertained by the present condition of the excavations enable an opinion to be formed, it appears to me probable that the copper ore, mingled with silicious matter, constitutes the paste of a breccia or conglomerate, the *fragments* of which have been accumulated in a depression in the surface of the argillaceous and silico-magnesian sediments forming the slates and their associated harder masses, while the sulphurets of copper have been deposited from springs bringing the metal in solution from some more ancient formation. The whole condition of the case appears to bear a striking resemblance to those of the copper deposits of the Urals, as described by Sir Roderick Murchison, except that in Russia the ores are carbonates instead of sulphurets.

"However this may be, there is no doubt the mass of ore is a very important one. Already, after but nine weeks' work, not far from 300 tons have been housed, supposed to contain about thirty per cent. of pure metal. The value of this quantity would be about $45,000; while, exclusive of lordship, the mining expenses and those necessary to carry the ore to market will be comparatively small. The quantity of ore excavated appears to have produced but a moderate impression on the total mass in sight.

"Whether such another bunch of copper ore will be met with, associated with the limestones, it is impossible to say; but even should one exist, it would perhaps be too much to expect that it would be found immediately at the surface.

"Many of the facts connected with the mode in which the copper ore of the conglomerate is related to the fragments, were ascertained by slitting a slab of the rock by means of a lapidary's wheel, and polishing the surface. The same test has been applied to a block of the Upton conglomerate, and it is found that there is some analogy in the two cases, except that the Upton ore is altogether pyritous sulphuret, and much more thinly distributed among the fragments.

While large blocks of the Acton conglomerate give thirty per cent. and upwards of pure metal, the best blocks obtained by me from the conglomerate of Upton do not yield more than five per cent. But this, if the quantity of rock with such a per centage were large, and the masses not too widely scattered, would constitute a valuable mine. It would, however, require a careful crop trial to determine whether the quantity is available.

"On a recent visit to the Harvey's Hill Mine, I was informed by Mr. Williams that, after sinking on the incline N. 80 E. <75°, on Fremont's lode, near the top of the hill, for forty-five feet, the underlie changed to S. 80 W. <75°, and the shaft being then sunk vertically for seventy-five feet more, a bed of three inches, holding disseminated copper ore, was met with at the depth of twenty-five feet; and another of six inches, of the same character, fifteen feet further down—the latter constituting the top of a six-feet bed of soapstone. In this an opening was made for thirty feet each way in the slope of the bed, which met Fremont's lode in the rise, and continued beyond it. At the bottom of the incline a level was driven in the bed for nearly thirty-two feet. The copper ore was continuous the whole of the distances, and may be said to have thus been proved over an area of nearly 2,000 square feet in the plane of the bed.

"The shaft being full of water at the time of my visit, I had not an opportunity of inspecting the work; but descending another shaft, at a distance of about ten chains from the last, in a direction which is nearly in the dip of the strata, I examined what there is little doubt must be another bed. This occurs at a depth of ninety feet from the surface; and allowing for the fall in the surface between the two shafts, its position would be very nearly twenty fathoms above the upper bed in Fremont's shaft. An opening has been made in the bed of about seventy feet in length by twelve feet in width, partially on the strike, but gradually turning up to the full rise of the strata. In this opening, the thickness of the bed, as measured by myself, varies from nineteen to thirty inches. The rock is a nacreous slate, and the copper ore is distributed in the bed in patches generally of a lenticular form. They are usually thin, but sometimes attain from one-half to three-quarters of an inch in the thickest part: and occasionally present in the section, lines of six inches or even a foot in length. These patches interlock, one overlapping another, with variable distances between, while many single crystals and small spots of ore are disseminated throughout the whole thickness. In some parts the pyritous, and in others the variegated sulphuret, prevails, and the quantity *of metallic copper in the mass may range from about three to about* five per cent, producing an average of about four per cent. The estimate, however, has been made by the eye and not by assays. Supposing the bed to average two feet in thickness, a cubic foot to weigh 180 pounds, the produce to be five per cent., and one-fifth of the copper to be lost in dressing the ore up to twenty per cent., then each square fathom of the bed would yield 1.10 tons of dressed ore of the above produce, the value of which in Swansea would be about $110. If the produce were four per cent., the value of a fathom would be $88; if three per cent., $66. It is only by an experiment on a large quantity of ore, in the way of dressing, that the true produce of the bed can be determined.

"The mode in which the copper ore is distributed in the nacreous slates of

Leeds, precisely resembles that in whi it occurs in the bituminous slates of Germany, and it is only the circumstance that the facts known in connection with the Canadian deposits are yet too few to give entire confidence in the persistence of similar conditions over a great area, which should moderate the expectation of an important result. As the copper in the beds is probably contemporaneous with them, it would of course be antecedent to that associated with the courses of quartz, the fissures holding which, it is unnecessary to state, must have been formed subsequent to the strata in which they occur. The copper in the courses was probably derived from that in the beds, and though the former, not only in Leeds but in other parts, may in many cases prove to be economically unavailable, it may yet be serviceable as an index to the position of available beds, and materially aid in their discovery. The copper-bearing quartz courses, from contrast of colour, are much more conspicuous than the copper-bearing beds; and though the latter, from the undulations in the strata, might be brought to the surface in many places, they would not readily attract the eye, unless from marks connected with the strata more prominent than the copper ore itself, which at the surface will often have disappeared from the influence of the weather. At Harvey's Hill, the soapstone underlying the lower cupriferous bed, might prove a serviceable mark by which to trace the copper ore on the surface. The soapstone known to crop out at a certain distance beyond Fremont's shaft, though its accompanying ore has not been remarked, could, in all probability, be followed for a considerable distance on the strike, with very little difficulty. Should the cupriferous character of the upper part prove continuous, which appears to me very likely, the existence of a valuable copper ore deposit might thus be established as probable at a very small expense. Cupriferous beds would, of course, be subject to the accidents of dislocation affecting the strata in which they are enclosed. One of these appears to affect the Harvey Hill bed, where the lower shaft intersects it. At this spot the copper ore suddenly ceases, and a mass of quartz presents itself, cutting a part of the stratification in a nearly vertical direction; while a little to the eastward, the inclination of the copper-bearing bed suddenly increases from nineteen to thirty-nine degrees. These circumstances combined, appear to me to indicate a dislocation, with a down-throw to the northward.

"The discovery of copper ore, subordinate to the stratification of the magnesian group in Upton, Acton, and Leeds, of which the last two instances, and perhaps the first, afford quantities economically available, invest the traces so widely spread in connection with this group in Eastern Canada, with more importance than they previously possessed. These traces are not confined to the more crystalline and altered parts of the deposit, but extend to the portion which is so far unchanged as to be marked by characteristic fossils, and the ores being found to occur mingled with the original sedimentary matter of the beds, there is no geological reason why such traces may not lead to the discovery of economical quantities of the ore at Quebec and Point Levi, as well as in other parts. There are dolomites, however, in a lower part of the Silurian series than this group, and both these dolomitic groups are found to exist below Quebec, on the St. Lawrence, —the one on the north side, at Mingan; and the other on the south side, all the way to Cape Rosier, and in various islands near both sides; and the fossils being the only sure guide by which the one group can be distinguished from the other, the study of these becomes an important part of the investigation."

The Report furnished by Mr. Murray embraces the details of a very extensive examination of the coast of Lake Huron, with the back country, around the Bruce Mines. The wide area thus included in Mr. Murray's explorations, lies between the Thessalon and Mississagui rivers, and presents many features of geological interest. One of the most striking, perhaps, not only in a scientific, but probably also in an economic point of view, is the discovery of a large fault running roughly parallel with the Thessalon River, and probably with the coast line generally, between that stream and the mouth of the Mississagui. To quote from the Report,—

"Chert beds, very similar in aspect to those just described, are met with on the north-east side of the small lake which is tributary to Walker Lake. Between those and the nearest approach to the previous beds. [dipping N.E.,] there is a distance of no more than a quarter of a mile. They dip to the southwest with a slope of thirty-five degrees, and they might well be supposed to be the same beds on the opposite side of a synclinal axis. There is some suspicion, however, as will be seen from the sequel, that they are higher strata on the north side of a great downthrow fault.

"These beds, in the attitude above mentioned, are seen along the north-east side of the lake for a distance of a quarter of a mile; they are followed northward by a mass of greenstone, and that again by a great display of white quartzite, both running parallel with the chert beds. Three quarters of a mile south-eastward, chert beds again appear, dipping to the south-west, with greenstone coming out from beneath them, and in this relation they can be traced for two miles to the south-east. Here the chert beds are within eight chains of the south-west corner of Thessalon Lake, and the greenstone lies between them and the margin. This position is about half a mile from Salter's side-line, but the farther progress of the chert beds towards the side-line appears to be interrupted by a mass of white quartzite.

"The low ground on Salter's side-line, mentioned as occurring to the north of the chert ridge first described, forms a hollow of a few chains in width, beyond which the mass of white quartzite just alluded to rises pretty sharply, constituting a hill which fills the space between the hollow and the lake, with the exception of a narrow mass of greenstone at the waters edge, and overlooks the low ground on the south margin of Lake Thessalon to the east.

"On this low ground there is an interval of marsh, but beyond the marsh there is a point about half a mile above the outlet of the lake, where the strata make their appearance. They consist of yellowish chert interstratified with impure limestone, and they dip S. 37 W. > 19°. The band is about a quarter of a mile wide, and it can be traced without much difficulty in a pretty straight line for upwards of eight miles down the river to the higher fall, dipping in the same direction and nearly at the same inclination the whole way. In this course the band obliquely crosses in succession the terminal edges of all the divisions which have been described on the south-east side of the river to the middle of the upper slate conglomerate, its relation to which has already been pointed out.

"At the point which has been mentioned on the south side above the exit of Thessalon Lake, the chert band proceeding north-westward enters the lake, but some uncertainty exists as to the position at which it leaves it. On the north-east side of the peninsula of Otter-tail Lake, there is at the base of the chert band a bed of a red and yellowish fine grained sandstone. A similar bed is seen at the upper end of Thessalon Lake with a bed of yellowish chert resting on it, and it is probably here that the band again enters upon the land; but the dip at the spot is irregular, and the band has not been traced beyond it. There is no doubt, from the sequence of the rocks beneath the band, that it is equivalent to the one overlying the white quartzite on Salter's side-line; and should it, on farther investigation, be found to continue westward from the upper end of Thessalon Lake, then the south-west dipping chert band which faces the first described one, would necessarily occupy a higher stratigraphical place, and would prove the continuance of the fault which no doubt reaches Salter's side-line. The extent of this downthrow is not quite certain, but it appears to me it cannot be less than 1500 feet at this part.

"The rock which would lie between these two chert bands is seen in a hill forming a point north of the south-west corner of Thessalon Lake. It occupies three quarters of a mile across the stratification and consists of white quartzite. A dip of eighteen degrees would give to this a thickness of near 1500 feet, to which, if 200 feet be added for the upper chert band, the dislocation would appear to approach even 1700 feet on Salter's side-line.

"The downthrow, however, if the dislocation result from a vertical movement, must be progressively much greater to the south-east, for the chert band terminating near the upper fall against the middle of the upper slate conglomerate, would there shew a displacement equal to the whole volume of strata between, which, according to the thicknesses given in the list of strata, would be 9,320 feet additional, or upwards of 11,000 feet. * * * * The examination of the area connected with the Mississagui has not yet been sufficiently extended to determine the relation between the copper-bearing veins of the Grand Portage and the physical form to which they are subordinate. The veins of the lower part of the river are evidently related to the anticlinal existing there. Those of the south part of Echo Lake also belong to an anticlinal; so do those of the Bruce and Wellington mines; and it would almost appear as if the importance of the metalliferous indications rose with the sharpness of the fold. But whatever be the cause of the dislocations in which metalliferous minerals are secreted, it would seem to be a probable supposition that in a metalliferous district the greater the dislocations the greater the chances of valuable metalliferous lodes. If this be the case, the great dislocation of the valley of the Thessalon would become invested with much importance. But though there is no doubt whatever that it is a master fault, it would, I fear, be a somewhat expensive affair to prove or disprove that it is a master lode, for although the proximate position of it has been more or less examined for upwards of fifty miles, never in any place have I been so fortunate as to find the rocks on the opposite sides of the fault in juxtaposition. On arriving at the spot where a junction was expected there was always a swamp, a marsh, prairie, river, lake, or some flat surface covered over with drift. The only mode of proving the matter would be by costeening, and it is probable that the thickness of the covering would cause this to be attended with much outlay."

The agricultural capabilities of the Huronian country, in the district examined by Mr. Murray, greatly surpass, we are happy to observe, the ordinary belief—large tracts of good land occurring in many of the more inland localities. Respecting this, Mr. Murray states :—

"It has been remarked in former Reports that the north coast of Lake Huron, in many parts picturesque, appears too rocky near the margin to be suited for agricultural settlement, though likely in time to become of importance to the Province by the development of the metalliferous ores, which the geological formation of the region is known to contain. But while this description is applicable to the coast line and the margins of some of the rivers and larger lakes of the interior, it is by no means so to the country in general. On the contrary there are in many parts, especially in the valleys of the Thessalon and its tributaries, extensive tracts of the finest lands, covered with a luxuriant growth of hard wood interspersed with stately pine trees, probably equal in average size to any of the same species known in the Province.

"In the immediate neighbourhood of the Bruce and Wellington mines and thence to Portlock Harbour, the country is for the most part broken by low rocky ridges, the flat land between which is in general densely cover· with thickets of spruce, balsam, or in marshy parts with tamaracks; but occasional patches display a stout growth of maple and white birch. In many parts the low grounds open out into extensive prairies or marshes, usually well covered with wild grass, and prettily dotted with clumps and little groves of small tamaracks or bushy spruce. The timber on the wooded flats is certainly not such as in general is supposed to indicate a very fertile soil, but much of the surface is nevertheless susceptible of cultivation, and there can be little doubt that with successful mines to produce a market for surplus produce, farming to a considerable extent might be advantageously followed. Admirably adapted for grazing, the prairies might also supply an ample stock of winter fodder for cattle, while nearly all the ordinary spring crops might be raised from the arable portions of the land."

Mr. Richardson's explorations relate to the Gaspé peninsula, and form a continuation of his previous researches in that district. They extend over a wide area, comprising examinations of the valley of the Marsouin, the coast line between the Marsouin and the Great Metis, the valleys of the latter river, the Patapedia and the Restigouche, and the country between the Metis and the Rivière du Loup. Numerous details of local interest on the geographical features and geology of these localities, together with a useful map, are given in

Mr. Richardson's Report. The rock formations met with, comprise various beds belonging to the Lower, Middle, and Upper Silurian series, with the so-called Gaspé sandstone (a Devonian formation) the drift, and some eruptive rocks. The lowest recognised strata consist of graptolitic shales and sandstones of the age of the Hudson River Group. On the Patapedia river, the beds (probably Upper Silurian) exhibit well marked cleavage lines, independent of the bedding, and in places are greatly contorted. On the river Matanne in drift clay and sand, forming a terrace fifty feet above the sea level, *Mya arenaria, Tellina Grœnlandica,* and *Mytilus edulis*, were found. The same species were seen at a similar level on the east side of the Metis river, whilst on the west side, at a distance of about two miles, and at a height of about 130 feet above the sea, Mr. Richardson met with *Mya arenaria,* and *Saxicava rugosa.* Eight miles up the river Metis, also, he observed the latter species with *Natica clausa* and *Balanus Hameri,* 245 feet above the sea. Many terraces, containing shells of these and other existing species, were found likewise on the Ste. Anne river and to the east of the Rivière du Loup. The economic substances observed by Mr. Richardson in his explorations are described in the following extract from his Report:—

"The substances capable of economic application met with in the course of my investigations, were bog iron ore, wad or bog manganese, copper ore, chromic iron, serpentine, roofing slates, tile stones, flagstones, building stones, limestone for burning, mill stones, shell-marl, peat, and the water of mineral springs.

"*Bog iron ore.* This ore was abundant in the second concession of the seigniory of Green Island, on the land of Mr. Félix Avril. About the middle of his lot it occurred in patches of from three feet up to eight feet in diameter, and from twelve to twenty inches thick. Between these patches there were intervals of thirty or forty paces. With a breadth that was not observed to exceed a hundred yards, the length of the area over which these patches were disseminated extended across ten lots, in the bearing S. 27 W., and half a mile, in rather less abundance, in a contrary direction.

"In the seigniory of Cacouna at the village of La Plaine, on the lot belonging to Mr. Stanislaus Roy, a patch of the ore was seen, measuring fifty feet by fifteen feet, with a thickness of four inches. On the adjoining lot to the east, another patch of about the size of the previous one was met with; yellow ochre occurred in the same place in small quantity.

"Another locality was in the seigniory of Villeray, about three miles west from Green Island River. On the land of Mr. Narcisse Marquis there is a patch of the ore about 270 feet long, and from twenty to thirty feet wide, with a thickness of from six to twelve inches. The ore was likewise observed on several adjoining farms in smaller quantities, but, from the information I obtained from the farmers, it appeared not unlikely that the spread of such patches of the ore is considerable in the neighbourhood.

"Traces of the ore were seen in several other places in the seigniories of Green Island, Villeray, Cacouna, and Rivière du Loup, as well as in the townships of Viger and Whitworth, but the quantity was too small to require particular mention. As a whole, the ore-bearing tract is about twenty-four miles east and west by about five or six north and south. Whether the ore can be found in sufficient abundance to warrant the establishment of a smelting furnace is perhaps, as yet, doubtful. From the wooded character of a great part of the country to the south of the tract, charcoal for smelting purposes could be procured easily for many years to come.

"*Wad or bog manganese.* This ore was found in the seigniory of Cacouna, on the lot of Mr. Stanislaus Roy already mentioned, in a patch measuring twenty-five feet by twenty feet; it occurs in nodules of from a half to a quarter of an inch in diameter, imbedded in sand, and forming a layer of the thickness of four or five inches.

"*Copper ore.* Notwithstanding the great area over which the limestones and limestone conglomerates of the same age as the copper-bearing rocks of Upton, Acton and Leeds were examined, the only traces of copper ore met with were near the mouth of the Great Capucin River. Here, as already has been mentioned, the pyritous sulphuret is disseminated in small specks in a bed of greyish green quartz, interstratified in red shale, while the green carbonate invests some of the cracks in the two inches of thickness containing the sulphuret.

"*Chromic iron.* On the summit of Mount Albert, near the second station established by Mr. Murray for his measurements, chromic iron was strewed in abundance on the surface among the fragments of serpentine. It occurred in loose masses, weighing from a few ounces to twenty pounds. It was almost all quite free from rock, and the masses, continuing for a little over half a mile in a bearing N. 44 E., gave indication that this was the probable direction of its run, though the bed itself was not seen. The loose masses were so abundant that in a few hours a ton of the ore might have been collected by a single person; and their cleanness leaves little doubt that there must be a rich deposit close to the surface beneath the moss and soil.

"About four miles to the north-east of this, a bed of the ore, of about one inch thick, was observed in the serpentine; but the ore was not so pure as the masses on the summit of the mountain. The bed was traceable in the strike of the serpentine for about fifty paces.

"*Serpentine.* The serpentine of Mount Albert, occupying an area of not less than ten square miles, would yield an inexhaustible supply of material capable of economic application. The rock appears to be unusually solid, and in several places vertical cliffs of several hundred feet in height shew nothing but bare serpentine; while masses of eight and ten feet in diameter, fallen from them lie at their base. The general colors, as far as observed, were green, or green mottled with red, and mahogany-brown striped with red; occasionally a blueish tint was mingled with the other colors. The distance of the locality from the St. Lawrence by the valley of the Ste. Anne River is thirty-four miles. By the valley of the north tributary branch of the Ste. Anne and the valley of the Marsouin the distance is twenty-four miles. In either direction roads could be easily constructed, while a great part of the way is well adapted for settlement.

"*Roofing slates, tile stones, and flagstones.* The best roofing slates were observed on Henley's Brook. The nearest exposure of the rock yielding them is about two miles and a half above the junction of the brook with the Marsouin, or about four miles from the St. Lawrence, and it prevails for a breadth of two and a half miles up the valley of the brook. The slates might be obtained in thicknesses varying from an eighth to a quarter of an inch, and in slabs of eight or ten feet square, with very smooth surfaces. Some parts of the rock gave thicker slabs, measuring from two to three inches, and would serve as excellent flagstones. The color of the rock is a dark blueish-grey or black. Some bands of the slate are calcareous, and these, for roofing purposes, should be avoided.

"The same rock comes out in the strike upon the Marsouin River, from seven to nine miles from the St. Lawrence, and would here give a material of much the same character.

"Allusion has already been made in the geological description to the flagstones of the Metis. They occur about twenty-six miles and a half from the mouth of the river, and consist of calcareous sandstones weathering to a light drab. Slabs might be obtained of two feet square, with thicknesses ranging from two to four inches.

"Another locality for flagstones is on the Awaganasees Brook, about thirty-four miles and a half from the mouth of the Patapedia. They so much resemble those of the Metis River that they are supposed to be of the same geological formation. The slates, however, were of larger dimensions, some of those seen being two feet square, and others four by eight feet, the thicknesses being from one to two inches. Another exposure about a mile lower on the Awaganasees would yield as large but thinner slabs, which would form excellent tile stones.

"Another locality of the same description of material was met with on the Patapedia, about seventeen miles and three quarters from the mouth. Here good tile stones might be obtained.

"On the Rimouski River below the fall, on the twenty fourth lot of the sixth range of Duquesne, flagstones might be obtained of a character so similar to those of the Metis, that they are supposed to have the same stratigraphical place. The dimensions observed, as already stated, were two by three feet, and four by six feet, with thicknesses varying from one to four inches.

"*Mill stones.* On Lake Matapedia the white sandstones which underlie the Gaspé limestones would answer the purpose of mill stones. When I passed the lake, Mr. Pierre Boucher shewed me a stone which he had prepared from the rock to be used in a mill about to be erected by him. The rock is undoubtedly hard and solid enough for the purpose, but wants the small cavities required for mill stones of the best description.

"*Building stones.* From the grey calcareous sandstones of group B, excellent building stones may be obtained, and so many localities in which these sandstones occur have been named in the geological description, that farther allusion to them is unnecessary. The more solid beds at the base of the Gaspé limestones, as they appear on the Middle Metis Lake and Lake Matapedia, would give good building stone.*

"*Lime.* In the limestone conglomerates of group B masses of the rock are found, in most localities, which yield stone of sufficient purity for burning into quick-lime. At Metis a single boulder of dark grey limestone imbedded in one of the conglomerate bands was calculated to weigh twenty-five tons. It was being quarried for lime-burning at the time of my visit to the place. Pretty good stone for burning might be obtained from the base of the Gaspé limestones as far as they were traced.

"*Shell-marl.* About five miles below the Matanne River, just over the bank of the St. Lawrence, on the lot of Mr. Denis Gougé, there occurs a deposit of fresh-water shell-marl. It is at the outlet of a swamp, and where dug through it had a thickness of fifteen inches. I was informed that on an occasion when the swamp became dry in summer, the deposit had been seen in other parts of it. The swamp has an area of between fifty and sixty acres.

"The only other locality in which shell-marl was observed was on the Lower Lake Metis. In the upper part of this lake wherever the dredge was used it always brought up shell-marl, but the thickness of the deposit is uncertain.

"*Peat.* A large area in the seigniory of Rivière du Loup is covered with peat. The locality is called the Savanne de la Plaine. The exact boundaries were not ascertained, but the area cannot be less than nine or ten square miles. It stretches along both sides of the river from the third to the sixth mile, and to the eastward it has a length of three miles, diminishing to the breadth of a mile at the east end. Its length on the west side of the river I was not able to ascertain.

"Peat was observed in abundance on the first and second concessions of Green Island Seigniory, and from a point two miles below the Rimouski River there is a belt of it extending nearly all the way to Metis River, a distance of over twenty miles. The northern edge of the belt approaches in some places to within a quarter and in others to within half a mile of the St. Lawrence, and its width is from a quarter of a mile to a mile. The thickness of the deposit where observed was from one to six feet.

"The swamp which has been mentioned on the Rimouski, in the third range of Duquesne, is underlaid with peat; from within half a mile of the Rimouski it extends two miles to the east in Duquesne, and from one to two miles more in Macpes. Its breadth is about three quarters of a mile, and its thickness from five to twelve feet. Where tried by me, a pole was sunk in it nine feet; but I was informed by one of the inhabitants that a pole had been sunk in it to a depth of thirty feet on Bouchette's road."

The report of Mr. Sterry Hunt, comprises a series of communications of great scientific interest on the Intrusive Rocks of the Montreal and Grenville districts, respectively; together with analyses of chloritoid and epidote from the altered Silurian rocks of the Eastern townships; and the results of an examination of the green colouring matter of certain sandstones belonging to the Quebec group. This latter substance is found to be a hydrated silicate of alumina, protoxide of iron, magnesia, and potash: the alumina thus replacing, in great part, the oxide of iron of the green grains so abundant in many Cretaceous deposits. Mr. Hunt's Report concludes with a long and very elaborate review of the formation of magnesian limestones, in continuation of his previous communications on that subject. The results of various ingenious experiments, involving numerous analyses and a great amount of patient research, are given in connexion with this enquiry, one of the most important perhaps, undertaken of late years, in the department of Chemical Geology. As it is impossible to do justice to these contributions by mere extracts, we have inserted one of them in an entire form, in another part of the journal. The one selected is the first alluded to above, a paper of much value, on the trachytic and other eruptive compounds of Montreal and the adjoining metamorphic district south of the St. Lawrence. Apart from the interest attached to these rocks as remarkable examples of eruptive products occurring on Canadian soil, Mr. Hunt's investigation of their characters and composition tends greatly to clear up the obscurity which still prevails respecting the true relations and subdivisions of the intrusive rocks generally.

E. J. C.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

ADDITIONAL FOSSIL TRACKS IN THE POTSDAM SANDSTONE OF CANADA.

The celebrated fossil foot-tracks of Beauharnois, Vaudreuil, and other neighbouring localities, constitute, it is well known, one of the most remarkable characteristics of our Potsdam formation. They have been referred by Professor Owen, under the generic name of *Protichnites*, to an unknown crustacean of which no other traces have been met with. During the course of last year, Dr. James Wilson of Perth (Canada West), discovered in some quarries of Potsdam Sandstone, in the vicinity of that town, some still more remarkable impressions. These, which are associated with the tracks of *Protichnites*, have been recently figured and described in full, in the *Canadian Naturalist*, by Sir W. E. Logan. They consist, to quote from Sir William Logan's description, "of a number of parallel ridges and furrows something like ripple marks, which are arranged (transversely) between two narrow continuous parallel ridges, giving to the whole impression a form very like that of a ladder, and, as the whole form is usually gently sinuous it looks like a ladder of rope." One of the impressions is about thirteen feet in length; and the average breadth of those at present obtained is about six inches and three-quarters. In some, a central ridge runs longitudinally between the two side ridges, but not always parallel with them.

Sir William Logan has bestowed upon these new tracks the name of *Climactichnites Wilsoni* in honour of their discoverer, Dr. Wilson of Perth, long known as one of our most zealous and successful labourers in the field of Canadian Geology. The generic appellation has reference to the ladder-like form of these remarkable impressions.—For figures and more ample details, the reader is referred to the *Canadian Naturalist* for August 1860, in which also will be found some valuable papers by Mr. Billings, Mr. D'Urban, and other writers.

SKETCH OF THE GEOLOGY OF HASTINGS COUNTY, CANADA WEST.—BY E. J. CHAPMAN.

The following brief notice was drawn up for publication in the Hastings Directory. Being intended for general readers, it contains in a condensed form, a few explanatory details that would otherwise have been omitted. These, it is thought, however, may prove serviceable also to some of the readers of our Journal.

The rock formations present in Hastings County, comprise, in an ascending order: (1) The Laurentian Series of Sir William Logan; (2) Some of the Lower Silurian rocks; (3) The Drift Formation; and (4) certain recent deposits of local occurrence.

1. *The Laurentian Formation:*—The rocks of this division constitute the most ancient deposits hitherto recognised on the continent of North America. They extend from Labrador along the North shore of the St. Lawrence, to within a short distance of Quebec, from whence they continue inland, and cross the Ottawa above the city of that name. West of this point, their outcrop sub-divides (so to say) into two branches, one of which passes towards the south-east, crossing the St. Lawrence at the Thousand Isles, and forming the wild district of the Adirondack Mountains in the state of New York. The other branch sweeps broadly towards the north-west, and its southern edge runs through the south limits of the Townships of Elzevir, Madoc, and Marmora, in Hastings County, and, continuing its course, strikes Georgian Bay near the mouth of the Severn.

The Laurentian rocks form also the greater portion of the north shore of Lake Superior, and cover an enormous area throughout the northern part of the Province generally. In popular language they are often, though incorrectly, called *granite*. True granite never occurs in beds or strata, but always in irregular, and generally intrusive masses, or in veins; whereas our Laurentian rocks are always stratified. They are looked upon as altered sedimentary deposits, and belong chiefly to the rocks known as micaceous and hornblendic (or syenitic) gneiss. Micaceous, or common gneiss, is composed of quartz, feldspar, and mica, and has usually a grey or red colour, but is sometimes almost black. Hornblendic or syenitic gneiss consists of quartz, feldspar, and hornblende, and possesses in general a well-marked green colour; or is, otherwise, red and green, or red and black. These rocks, in layers or strata of different colours, alternate with one another, and occasionally by the absence of feldspar, pass into mica slate and hornblende slate. They are frequently traversed by broad bands and veins of white quartz; and in some localities are interstratified with beds of white, pink, and greyish crystalline limestone or marble. A bed of this substance occurs at the village of Bridgewater, or Troy, in Elzevir Township; and others of fine quality lie in Barrie Township, a little beyond the limits of the county. Marble is likewise found in the Townships of Madoc and Marmora; but white quartz it should be mentioned is sometimes mistaken for it. Attempts have even been made by persons ignorant of the nature of quartz, to burn that substance into lime. It may not, therefore, be out of place to point out the more salient, distinctive characters of the two, as in the following table:—

Marble.	*Quartz.*
Dissolves with effervescence in diluted hydrochloric or nitric acid.* Does not scratch glass, but may be easily scratched by a knife.	Not attacked in any way by acids. Scratches glass easily, and does not yield to the knife.

These Laurentian or gneissoid rocks constitute also the great iron-holding rocks of Canada. This metal occurs in Hastings County in the form of the Black or Magnetic Iron ore, a compound of the oxide and the sesqui-oxide of iron containing in percentage values, Iron 72.4, Oxygen 27.6. This valuable mineral forms thick beds, interstratified with the gneiss, in the Townships of Madoc and Marmora; but the ore used at the Marmora smelting works, when these were in operation, came chiefly from the south shore of Crow or Marmora Lake, in the adjoining Township of Belmont. When the ore contains small shining specks or particles (Iron Pyrites) of a brass-yellow colour, it should be made up into heaps and roasted, and afterwards subjected for some time to the action of the atmosphere, before being taken to the furnace.—The masses of ore broken out of the rocks and mixed up with the Drift of this locality, are abundant in some places, and of excellent quality, the pyrites having become decomposed, or oxidized, by long exposure to atmospheric agencies.

In the north part of Elzevir Township, as well as in adjoining townships beyond the limits of the county, some of the green or hornblendic beds of gneiss, contain numerous garnets in well-defined twelve-sided crystals, or rhombic dodecahedrons, of a brownish-red colour. These, however, are only of value as mineralogical specimens.

The Laurentian rocks described above, occur in highly inclined strata, dipping generally (at least along their more southern outcrop,) towards the north-west. The succeeding or overlying Silurian strata, on the other hand, lie on the upturned edges of the Laurentian rocks, in almost horizontal beds. A good section, exhibiting these relations, may be seen on the river banks at Marmora village.†

Although, as a general rule, where Laurentian rocks prevail, the country is not favourably adapted for agricultural occupation, many acres of good and fertile

* Hydrochloric acid is the muriatic acid or spirit of salt of the stores. For testing limestone rocks it should be diluted with an equal bulk of water, and kept in a small bottle provided with a glass stopper.

† The reader interested in these details, may consult also a sketch of the stratification near the village of Bridgewater, in Elzevir Township, given in a paper by the writer of this notice, in the *Canadian Journal* for January, 1860, [New Series, vol. V.]

land occur upon this formation in Hastings County. The more rocky portions also, if useless in other respects, will probably constitute available grazing lands, as the country becomes gradually cleared.

2. *The Lower Silurian Formation:*—This formation is sub-divided from the upper part downwards, into the following subordinate groups:

5. The Hudson River Group.
4. The Utica Slate.
3. The Trenton Group.
   - The Trenton Limestone.
   - The Black River Limestone.
   - The Bird's-eye Limestone.
   - The Chazy Limestone.
2. The Calciferous Sand Rock.
1. The Potsdam Sandstone.

In Hastings County, the three lower members of the formation are alone present; and of these, the Potsdam Sandstone and Calciferous sand-rock are more or less blended together, and are also but slightly developed. Their common representative appears to be a calcareous sandstone of a few feet in thickness, occurring immediately above the Laurentian rocks, or at the extreme base of the Silurian formation. This sandstone is of a light greenish colour above, passing into pale red, or pale red with irregular greenish spots below. It may be seen in horizontal position, or dipping almost imperceptibly toward the south-west, on the river banks at the village of Marmora, and also on the banks of the river Moira at Tweed village, in Hungerford township, as well as at other places near the outcrop of the Laurentian rocks. It is apparently destitute of fossils. The succeeding Trenton group, properly so called, is, on the other hand, largely developed, and constitutes the foundation rock of the whole of the South Riding of the County, and also of the southern portion of the North Riding. At its base in the North Riding a band of fine grey limestone, available as a lithographic stone, is met with. This is succeeded by (in general) a thick-bedded limestone, poor in fossils; and the latter is again followed, in ascending order, by thin-bedded and shaly limestones, containing fossils in very great abundance. A list of these fossils comprising various corals, brachiopods, &c., collected around Belleville, may be seen in a paper by the writer, published in the Canadian Journal for January, 1860, [New Series, vol. V.] The Trenton limestone is well displayed along the banks of the Trent, Moira, and Salmon Rivers, and in many places on the shores of the Bay of Quinté. It yields excellent lime; and building stones of good quality are obtained from some of the thick beds, as at Ox Point, near Belleville, and elsewhere. Some care, however, is required in their selection, as many of them are apt to crack from minute flaws; but properly selected blocks appear to resist the action of frost remarkably well.

3. *The Drift Formation:*—An accumulation of clay, sand, and gravel, with rounded stones or "boulders," partly of limestone, but chiefly of the more northern gneissoid rocks, is spread over the surface of the greater part of the County. The same deposit extends indeed over the larger portion of the Province itself, and reaches far into the United States. Geologically, it is known as the Drift, or Drift and Boulder formation. Its age is much more recent than that of the under-

lying rocks. Between the deposition of the two, an enormous interval of time must have occurred—many intervening formations being absent. It is now universally conceded, that, after the deposition of our Palaeozoic rocks, this part of Canada was elevated above the sea in which these rocks were deposited, and that it remained dry land for many ages, whilst the succeeding members of the Palaeozoic series, with the Secondary and Tertiary rocks (properly so called) were under process of deposition in the seas, lakes and estuaries, of other localities. Then, a movement of depression ensued, and our Province was again covered or partly covered by the waters of the ocean. It is also inferred from perfectly trustworthy data, that this period was one of comparative cold. Vast glaciers were formed in northern regions, from whence numerous icebergs, laden with earth and stones, drifted southwords; and gradually melting, or becoming stranded on shoals and islands, deposited their rocky freights over the sea bottom. By the agency of these floating icebergs also, the limestone ridges were broken down, and the calcareous sediments, thus formed, were mixed with the more northern deposits. Proofs of this are seen in the polished and striated surfaces of our limestone strata in many localities; in almost all places, indeed, in which a recent removal of the Drift has been effected. The polished rock, when first exposed, is sometimes as smooth as a mirror; and the fine lines which cross it, and which are supposed to have been produced by stones and gravel frozen into the under side of the icebergs, have almost always a general north and south direction. The same effects of ice-action are seen also on most of the exposed gneissoid rocks in the northern part of the county. Finally, the ground must have been again slowly elevated above the sea; and many of our valleys and other surface inequalities were then produced, by the action of waves and currents on the yielding materials of the Drift and underlying strata. These latter, however, in various localities, had been extensively denuded prior to the deposition of the Drift.

4. *Recent Deposits*:—These are of very slight extent, and of local occurrence, only. They are due to causes which are now in action, or which have prevailed during comparatively recent periods. So far as regards the County of Hastings, they comprise a few beds of "shell marl," arising from deposits in swamps and partially dried up ponds and lakes. These consist of white and more or less earthy calcareous matter, filled with minute shells of *cyclas*, *planorbis*, and other fresh-water genera of molluscs. A deposit of this kind occurs on the high ground above the west bank of the Moira at Belleville; also in the vicinity of Trenton; and at other places. Another recent formation consists of "calcareous tufa" deposited on twigs, moss, stones, etc., in many streams and springs; but frequently both shell marl and calcareous tufa, (properly so called) occur intermixed, and form but one deposit.

MEGALOMUS CANADENSIS.

Major Greet of Guelph, C. W., has recently shewn us some comparatively large specimens of *Megalomus Canadensis* obtained in the immediate vicinity of that town, a locality, we believe, in which this fossil has not hitherto been announced. The rock in which it occurs, is a somewhat porous and sub-crystalline limestone, an extension, of course, of the Galt beds.

IDOCRASE.

Crystals of Idocrase commonly exhibit a well-developed basal plane. In Heuland's celebrated "Catalogue" twenty-four distinct combinations are described, and for the greater part figured, by M. Lévy, in all of which the basal plane is present. The only crystals known to us in which this plane is absent, are the somewhat complex forms from the Ural, figured by Col. Von Kokscharoff. It may not be therefore without interest, to state, that a crystal over half-an-inch in length and of the ordinary simple form, *but without the basal plane,* has lately come into our possession. It exhibits simply the two vertical prisms and the fundamental octahedron, the latter measuring (by common goniometer, the faces being dull) 129°30′ over the polar edges. The colour of this crystal is olive or brownish-green. It was brought from Europe, but we do not know its exact locality. Persons interested in these matters, may see the specimen at the University, Toronto.

NEW BLOWPIPE-SUPPORT.

In the examination of substances by the blowpipe, it is frequently necessary to subject the assay-matter to the process technically termed "roasting," in order to free it from sulphur, arsenic, or other volatile ingredients. In this operation, charcoal is usually employed as a support; but, as, in travelling especially, it is often desirable to economise the stock of charcoal in the blowpipe case, pipe-clay supports, strips of mica, and other substances are sometimes used as a substitute. We have employed for some time, and with great success, for this purpose, small fragments of Meissen porcelain, broken from damaged crucibles, capsules, &c., such as can readily be procured from all importers of chemical apparatus. In roasting the assay we rarely require more than a low red heat, but these supports may be rendered white hot, if necessary, without flying; and the same fragment may often be used, moreover, more than once. The assay is crushed to powder, slightly moistened, and spread upon the surface of the porcelain; and afterwards removed by a small steel or other spatula. These supports are conveniently held by the spring forceps figured and described in Vol. III. of the *Canadian Journal*, page 213.

PUBLICATIONS RECEIVED.

On the Alloys of Copper and Zinc. By Frank H. Storer. *On the Impurities of Commercial Zinc.* By C. W. Eliot, and F. H. Storer.—These are reprints of papers communicated to the American Academy of Arts and Sciences. They give much valuable information, and contain numerous analyses of various compounds of zinc and copper, and of Silesian, Belgian, English, American and other spelters. Mr. Storer has obtained many distinctly crystallized samples of brass, containing variable proportions of the two metals; and as these specimens present the same form (monometric octahedrons,) he looks upon zinc as belonging to the Regular System. The same view, based however on the examination of merely a single specimen, has been adopted by Prof. Gustav Rose.

E. J. C.

CANADIAN INSTITUTE.

The following is the Address presented to the Prince of Wales, by the Canadian Institute, on the occasion of the recent visit of His Royal Highness to Toronto.

To His Royal Highness, Albert Edward, Prince of Wales, K.G., &c. &c. &c.

May it please your Royal Highness,—The President, Council, and Members of the Canadian Institute, incorporated by Royal Charter for the promotion of Science and Literature in this province, humbly approach your Royal Highness with loyal and affectionate greetings; and tender to you, with unfeigned respect, their welcome on this auspicious occasion.

While the energies of this province are chiefly directed to the development of its vast agricultural capabilities, and to the fostering of trade and commerce, as the essential sources of its material prosperity, the Canadian Institute specially devotes itself to investigations and researches such as lead to the discovery of abstract truths in Science, but which ultimately tend to the intellectual and social progress of man. While, therefore, uniting with their fellow subjects in this province of the Empire, in welcoming your Royal Highness with grateful and hearty loyalty, as the representative of their beloved Queen, and the heir apparent to the British Throne, they beg leave respectfully to tender their loyal congratulations unitedly as an Institute devoted to objects and pursuits specially fostered by Her Majesty's countenance, and to the furtherance of which the illustrious Prince Consort has extended his highest favour and influence.

Enjoying as they do all the priceless blessings derived from institutions by right of which Her Gracious Majesty rules over a free and united people; and sharing in the glories, and sympathising in all the interests of the empire,—of which this province forms no unimportant member,—they hail with loyal satisfaction the presence of your Royal Highness, on whom rest the future hopes of this Great Empire. Their earnest prayer is, that, endowed with all noblest graces and divine blessings, trained in sound learning, and gifted with a liberal love of Science and the Arts, you may be eminently fitted for the high trust of which you are the heir. May he who is the King of Kings, long spare to you, as to them, her who, while commanding honour from your filial heart, lives not less fondly in the affections of a willing people. On her sceptre, the virtues of their loved and gracious Queen have conferred a might more potent than ever ruler achieved by conquest. Under its genial sway, science and letters have accomplished triumphs which will render the Victorian era illustrious in all future ages; and while other nations are struggling to attain such privileges as her subjects freely enjoy, the British Empire—the sceptre of which they trust will hereafter be no less illustrious in your hands than in those of their beloved Queen—has girdled the world with a glorious confederacy of provinces, alike united in freedom, in intellectual progress, and loyal devotion to their Sovereign head.

In their united capacity, as an Institution incorporated by Royal Charter, and specially recognised by Provincial Parliament, as representatives of the interests of Science and Letters, the President, Council, and Members of the Canadian Institute renew their assurances of devoted loyalty to Her Gracious Majesty, and of cordial welcome to your Royal Highness.

D. WILSON, LL.D., *President.*

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—JUNE, 1860.

Latitude—43 deg. 39.4 min. North: Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	ME'N	Excess of mean above Average	Tens. of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't. Direction.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Result'.	ME'N	Rain in inches.	Snow in inches.
					°	°	°	°	°												°							
1	29.487	29.513	29.596	29.5415	54.7	68.8	58.7	60.83	+ 3.88	.325	.309	.273	.314	.76	.44	.55	.60	N W b N	N W b W	N N W	N 36 W	12.0	17.0	12.0	12.95	12.98	...	...
2	.642	.587	.538	.5885	59.4	73.1	56.0	63.02	+ 6.65	.242	.322	.271	.294	.47	.40	.58	.50	N W b N	S S W	N W b W	W	10.6	11.0	4.4	3.40	5.82	...	...
3	.503	.305	—	—	54.7	69.5	—	—	—	.358	.464	—	—	.84	.61	—	—	W S W	S	S W	S 30 W	1.2	8.6	5.0	5.37	5.66	...	...
4	.143	28.981	28.933	.0017	56.7	57.2	57.2	57.03	+ 0.08	.432	.415	.451	.439	.87	.88	.96	.91	S	N E b N	N E b E	N 58 E	2.6	6.4	2.8	3.77	4.83	0.375	...
5	28.981	29.089	29.233	.1142	62.7	64.5	56.9	60.98	+ 2.83	.481	.443	.384	.423	.84	.73	.83	.78	N N W	N W b N	N W b N	N 36 W	8.8	22.0	7.8	12.06	12.13	Inp.	...
6	29.268	.204	.138	.1052	55.1	62.7	54.4	57.85	— 0.60	.353	.390	.320	.358	.82	.68	.75	.74	N W b N	E b S	E N E	N 86 E	6.4	10.0	10.6	4.81	7.13	0.033	...
7	.109	.097	.210	.1378	53.6	69.5	54.4	58.08	— 0.67	.305	.403	.310	.365	.96	.55	.75	.76	N E b E	W b S	W	S 72 W	0.5	10.4	4.5	5.40	6.65	0.045	...
8	.104	.164	.252	.1068	55.1	60.5	52.6	56.18	— 2.88	.353	.351	.311	.344	.82	.65	.78	.76	W	W	W N W	N 74 W	8.5	20.5	20.8	15.95	16.84	0.015	...
9	.322	.408	.474	.4110	52.9	60.9	56.2	57.32	— 2.17	.307	.272	.284	.277	.76	.50	.58	.59	N W	N W	N W	N 41 W	19.5	27.5	13.5	20.44	20.61	...	...
10	.568	.530	—	—	50.0	63.0	—	—	—	.156	.142	—	—	.42	.25	—	—	N b W	N W b N	N W	N 39 W	14.0	23.5	7.5	14.56	14.71	...	...
11	.571	.508	.524	.5377	60.5	69.5	66.6	67.15	+ 7.17	.408	.480	.382	.393	.77	.66	.55	.60	N N W	S	N b W	N 40 W	6.5	7.5	12.4	4.83	8.27	...	...
12	.588	.680	.576	.5807	59.4	67.4	58.3	62.62	+ 2.35	.336	.303	.333	.371	.66	.58	.68	.65	N b W	E S E	N N E	N 74 E	0.8	6.5	3.0	2.66	4.10	...	...
13	.618	.613	.596	.6067	58.3	71.3	56.5	63.85	+ 3.27	.279	.277	.334	.299	.57	.36	.73	.53	N b E	E b S	E	N 59 E	5.0	7.6	2.0	4.33	5.54	...	...
14	.614	.563	.546	.5693	58.7	76.9	63.0	65.63	+ 4.80	.339	.335	.476	.395	.68	.36	.82	.64	N b W	S S E	N E b E	N 88 W	1.5	11.4	4.0	2.49	5.00	0.040	...
15	.558	.573	.620	.5887	64.1	65.6	64.1	64.95	+ 3.82	.447	.518	.450	.481	.75	.82	.76	.78	N N W	S S W	N b W	N 37 W	3.0	2.8	11.6	5.68	7.58	0.295	...
16	.679	.691	.727	.7032	58.0	63.7	59.4	60.70	— 0.65	.370	.410	.410	.400	.77	.74	.81	.75	N	N N W	N N W	N 19 W	8.4	8.8	8.0	7.79	7.85	...	...
17	.707	.713	—	—	61.2	73.8	—	—	—	.386	.502	—	—	.71	.60	—	—	N b W	S b W	S b W	S 36 W	8.0	6.5	2.0	2.53	3.44	...	...
18	.633	.509	.493	.5045	59.8	69.3	62.3	64.58	+ 2.63	.441	.476	.453	.463	.86	.66	.81	.76	W b S	E b S	E b N	S 79 E	2.5	6.5	2.8	3.91	4.35	Inp.	...
19	.328	.301	.335	.3195	62.3	66.3	59.4	63.62	+ 1.48	.497	.562	.399	.482	.88	.87	.78	.81	E b N	S W b W	W b N	N 75 W	2.8	4.0	1.2	5.23	6.32	0.475	...
20	.316	.361	.488	.4030	56.2	74.6	63.4	66.03	+ 3.58	.371	.467	.494	.461	.82	.55	.84	.73	W N W	N N W	E N E	N 25 W	9.5	9.8	1.2	5.01	6.59	Inp.	...
21	.564	.636	.721	.6540	59.8	59.0	57.2	58.55	— 4.12	.492	.410	.415	.434	.96	.82	.88	.88	N E	E b N	N E b N	N 50 E	6.0	9.5	6.5	7.72	7.98	0.005	...
22	.704	.843	.829	.8265	58.3	65.5	56.2	60.38	— 2.57	.401	.336	.270	.333	.83	.53	.62	.64	N E b N	E b N	E S E	N 79 E	8.8	9.2	1.0	4.35	5.24	...	...
23	.837	.813	.798	.8143	54.4	72.0	59.8	63.75	+ 0.60	.362	.472	.417	432	.86	.60	.81	.73	N b W	S b W	S	S 13 W	2.6	9.5	1.8	1.90	4.23	...	...
24	.854	.859	—	—	59.5	77.8	—	—	—	.447	.477	—	—	.88	.49	—	—	N N W	S b E	E N E	S 87 E	1.2	4.2	2.8	3.56	4·40	...	...
25	.831	.773	.733	.7745	59.4	76.4	68.4	68.48	+ 4.93	.434	.567	.548	.512	.86	.62	.79	.74	E b N	S b W	S W	S 14 W	1.7	9.5	5.5	3.98	4.86	...	...
26	.727	.709	.750	.7305	65.4	75.3	66.6	68.80	+ 4.92	.539	.553	.479	.547	.86	.63	.73	.78	W	N W	N N W	N 24 W	0.4	8.5	6.5	3.76	4.70	0.063	...
27	.825	.787	.709	.7665	64.5	68.1	58.7	63.68	— 0.38	.454	.330	.339	.381	.76	.48	.68	.65	N b W	E	E	N 84 E	6.0	11.4	1.0	5.29	5.58	...	...
28	.653	.521	.409	.5172	58.7	81.1	70.4	71.23	+ 6.95	.373	.646	.592	.557	.75	.60	.80	.73	E	S	S W b S	S 16 W	3.5	10.4	7.2	7.02	7.96	0.040	...
29	.269	.281	.355	.3065	68.4	71.5	63.1	69.40	+ 4.95	.662	.694	.552	.624	.95	.90	.80	.86	S W b S	W b S	W	S 81 W	5.5	8.5	6.8	7.70	8.48	0.750	...
30	.495	.545	.610	.5543	60.0	74.2	60.9	65.70	+ 1.12	.279	.410	.379	.371	.53	.49	.70	.68	W b N	S	N W	N 72 W	9.5	8.2	4.8	6.63	8.56	...	...
M	29.5018	29.4865	29.5053	29.4978	59.17	68.65	60.25	63.16	+ 2.13	.399	.433	.397	.414	.78	.62	.75	.71	....	....	....	....	5.89	10.57	6.03	......	7.61	2.136	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JUNE, 1860.

Highest Barometer . . . . . . 29.859 at 2 p. m. on 24th. } Monthly range=
Lowest Barometer . . . . 28.909 at 7.30 p. m. on 4th, } 0.950 inches.

Self-registering Ther.:
Maximum temperature . . . . 81°6 on p.m. of 28th } Monthly range=
Minimum temperature . . . . 49°2 on a.m. of 10th } 32°4
Mean maximum temperature . . 72°58 } Mean daily range = 17°24.
Mean minimum temperature . . 55°33 }
Greatest daily range . . . . . . 28°9 from a. m. to p.m. of 11th.
Least daily range . . . . =2.0 from a. m. to p. m. of 21st.

Warmest day . . 28th ... Mean Temperature . . . 71°23 } Difference=15°05.
Coldest day . . . 8th ... Mean Temperature . . . 56°18 }

Maximum Radiation { Solar . . . . 98°4 on p. m. of 14th } Monthly range=
{ Terrestrial . . . . . . 36.0 on a. m. of 8th } 62°4.

Aurora observed on 2 nights, viz.: on 9th and 10th; possible to see Aurora on 17 nights; impossible on 13 nights.

Raining on 14 days; depth, 2·136 inches; duration of fall, 34.8 hours.

Mean of cloudiness=0.58; most cloudy hour observed, 2 p. m., mean=0.66: least cloudy hour observed, midnight; mean=0.44.

Sums of the components of the Atmospheric Current, expressed in Miles.

North.	South.	East.	West.
2543.62	934.88	1003.41	2579.10

Resultant direction, N 44° W; Resultant Velocity, 3.13 miles per hour.
Mean velocity 7.61 miles per hour.
Maximum velocity . . . 30.8 miles per hour, from 2 to 3 p.m. on the 9th.
Most windy day . . 9th—Mean velocity, 20.61 miles per hour. } Difference 17.17
Least windy day . . 17th—Mean velocity, 3.44 do } miles.
Most windy hour, 2 to 3 p. m.—Mean velocity, 10.61 miles per hour. } Difference
Least windy hour, 3 to 4 a. m.—Mean velocity, 5.20 do. } 5.41 miles.

1st. Corona round the Moon 10 p. m.
4th. Fog from 7 to 10.30 p. m.
5th. Fire Flies first observed this season 9 p. m.
7th. Foggy 8 a. m. Thunderstorm from 4 to 5 p. m.
13th. Solar Halo at noon (very distinct.)
14th. Thunderstorm 2.30 to 5.50 p. m.
15th. Thunderstorm 7 to 8 a. m., and again from 11 a. m. to 2.30 p. m.
18th. Thunderstorm 10 to 11.10 p. m.
19th. Thunderstorm 11.20 a. m. to 10.40 p. m.
20th. Foggy 8 a. m. Thunderstorm 8 a. m. to 3 p. m.

Heavy dew recorded on 3 mornings during this month.
Pollen of plants fell with the rain on the 14th, 15th and 19th.

The Resultant Direction and Velocity of the Wind for the month of June, from 1848 to 1860 inclusive, were respectively N. 76° W., and 0.72 miles.

The month of June, 1860, was warm, dry and windy—the mean temperature was 1°8 above the average of 21 years. The depth of Rain recorded was 1.012 inches less than the mean of the same number of years, and the mean velocity of the wind 2.40 miles per hour above the average of 13 years, was absolutely the most windy June during that period.

COMPARATIVE TABLE FOR JUNE.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Difference from Average.	Maximum observed.	Minimum observed.	Range.	No. of days.	Inches.	No. of days.	Inches.	Resultant Direction.	Resultant Velocity.	Mean Velocity
	°	°	°	°	°					°		
1840	59.8	— 1.6	78.5	37.1	41.4	11	4.860	...	...	...	...	...
1841	65.6	+ 4.2	92.8	45.7	47.1	9	1.560	...	...	...	...	0.36 lbs
1842	55.6	— 5.8	73.9	28.0	45.9	15	5.755	...	...	...	...	0.31 "
1843	58.4	— 3.0	81.3	28.5	52.8	12	4.595	...	...	...	...	0.27 "
1844	59.8	— 1.5	82.8	33.1	49.7	9	3.535	...	...	...	...	0.19 "
1845	61.0	— 0.4	83.6	40.9	42.7	11	3.715	...	...	...	...	0.27 "
1846	63.3	+ 1.9	83.3	41.5	41.8	10	1.920	..	...	...	...	0.32 "
1847	58.4	— 3.0	78.3	36.7	41.6	14	2.625	...	...	...	...	0.30 "
1848	62.9	+ 1.5	92.5	38.3	54.2	8	1.810	...	...	N 61 W	1.90	4.51ms.
1849	63.2	+ 1.8	84.9	45.2	39.7	7	2.020	...	...	S 71 E	0.49	3.32 "
1850	64.3	+ 2.9	83.2	49.0	34.2	10	3.345	...	...	S 60 W	0.38	4.54 "
1851	59.2	— 2.2	79.2	41.2	38.0	11	2.695	...	...	S 2 W	1.26	4.42 "
1852	60.8	— 0.6	86.1	43.6	42.5	10	3.160	...	...	S 76 W	1.49	4.09 "
1853	65.5	+ 4.1	86.3	43.3	43.0	9	1.550	...	...	N 1 W	0.10	3.73 "
1854	64.1	+ 2.7	88.7	47.4	41.3	9	1.460	...	...	N 24 E	0.71	4.15 "
1855	59.9	— 1.5	90.7	40.6	50.1	17	4.070	...	...	N 69 W	1.33	5.70 "
1856	62.1	+ 0.7	82.6	48.3	34.3	13	3.200	...	...	S 21 W	0.90	5.30 "
1857	56.9	— 4.5	75.1	40.9	34.2	21	5.060	...	...	N 49 W	1.15	7.60 "
1858	66.2	+ 4.8	86.3	48.7	37.6	12	2 943	...	...	S 20 E	0.25	5.53 "
1859	58.3	— 3.1	85.2	33.9	51.3	16	4.085	2	Inp.	N 77 W	1.95	7.19 "
1860	63.2	+ 1.8	81.1	50.0	31.1	14	2.136	...	...	N 44 W	3.13	7.61 "
Mean	61.36	...	83.64	41.04	42.60	11.8	3.148	...	...	...	...	5.21

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—JULY, 1860.

Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.

Days.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of mean above Average	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction.	Velocity of Wind.					Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10PM	ME'N		6 A.M	2 P.M	10 P.M.	M'N	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	10PM	Re-sul't.	ME'N		
					°	°	°	°	°												°							
1	29.663	29.698	—	—	60.9	66.6	—	—	—	.402	.410	—	—	.74	.67	—	—	N N E	S E b S	W	N 57 E	7.0	7.5	6.0	2.63	6.60	...	...
2	.677	.644	.628	29.6317	59.8	71.3	61.9	65.27	+ 0.27	.392	.510	.451	.456	.76	.66	.82	.73	N	S	S b W	S 9 E	0.5	7.5	3.0	2.63	3.84	...	...
3	.572	.473	.453	.4985	61.9	64.8	61.9	63.67	— 1.48	.461	.515	.503	.498	.84	.83	.90	.84	S b W	N E b N	N E b E	N 56 E	2.8	6.2	5.5	4.01	5.40	0.115	...
4	.410	.397	.218	.3467	60.5	65.0	60.0	61.98	— 3.32	.496	.513	.503	.499	.94	.82	.94	.90	N E b N	E b N	E b N	N 53 E	4.4	9.2	13.5	7.53	9.28	0.870	...
5	.298	.304	.488	.4052	54.7	70.6	60.5	61.57	— 3.82	.380	.412	.410	.416	.89	.55	.86	.77	N b W	N	E S E	N 6 E	11.5	8.5	3.2	5.03	7.52	0.005	...
6	.582	.645	.683	.6105	56.5	66.6	59.8	61.52	— 4.08	.378	.376	.302	.348	.83	.57	.58	.64	N b E	E S E	N N E	N 66 E	4.8	9.4	6.6	5.39	6.53	...	...
7	.697	.676	.516	.6110	60.1	72.4	62.7	65.78	+ 0.08	.343	.413	.441	.408	.65	.52	.77	.65	N b E	S E	E N E	S 71 E	2.8	7.5	6.8	4.03	5.50	...	...
8	.308	.221	—	—	62.3	63.7	—	—	—	.446	.556	—	—	.79	.94	—	—	S S E	E N E	S W b S	S 30 E	9.0	2.8	4.5	4.03	6.65	0.480	...
9	.157	.357	.521	.3645	68.1	69.5	59.6	65.33	— 0.65	.666	.494	.403	.499	.97	.68	.80	.79	S W	W	W N W	S 88 W	7.3	16.8	5.5	12.19	12.43	...	...
10	.502	.566	.697	.6168	55.8	68.1	55.8	59.67	— 6.42	.400	.485	.333	.408	.90	.70	.74	.79	W b N	S b W	N W b N	N 52 W	1.2	5.0	9.4	3.67	5.15	...	...
11	.770	.781	.810	.7918	53.6	65.6	54.7	58.88	— 7.30	.308	.415	.272	.314	.74	.65	.64	.63	N N W	S b W	N W b N	N 40 W	8.0	6.0	8.5	4.75	8.07	...	...
12	.831	.821	.803	.8177	55.8	68.1	61.2	62.42	— 3.88	.280	.293	.416	.348	.62	.42	.83	.63	N W b N	N W	N W	N 27 W	7.6	12.5	5.8	8.52	8.72	...	...
13	.810	.742	.701	.7479	55.8	70.6	61 6	63.95	— 2.63	.365	.516	.405	.441	.82	.73	.74	.75	N N W	S b W	S b W	S 36 W	2.0	7.8	3.5	1.76	3.93	...	...
14	.722	.675	.626	.6730	56.5	75 3	60.1	64.70	— 1.72	.378	.497	.425	.446	.83	.57	.81	.74	N N W	S b W	S W b S	S 17 W	3.8	12.6	0.5	5.41	6.52	...	...
15	.636	.600	—	—	59 4	71.3	—	—	—	.434	.636	—	—	.86	.83	—	—	W S W	S S W	S W	S 42 W	0.8	6.0	4.5	3.46	4.81	0.075	...
16	.515	.394	.561	.4925	63.2	81.8	62.3	68.38	+ 1.80	536	.484	.434	.482	.92	.44	.77	.72	S W b W	W b N	N W b N	N 65 W	2.1	29.4	3.4	8.75	11.49	0.013	...
17	.658	.667	.630	.6538	56.9	69.9	58.3	62.85	— 3.83	.408	.480	.390	.417	.88	.65	.80	.74	N W	S S E	S	S 7 W	4.0	9.2	0.5	3.46	4.45	...	...
18	.630	.567	.398	.5252	57.1	64.5	63.7	63.18	— 3.50	.382	.532	.670	.521	.82	.88	.96	.89	S	E S E	E N E	S 45 E	3.2	3.0	2.5	2.57	4.35	0.510	...
19	.391	.455	.575	.4860	68.8	85.8	68.8	75.00	+ 8.22	.656	.508	.501	.585	.93	.46	.72	.70	S W b S	W b N	N W	N 80 W	3.5	11.2	5.5	7.89	8.93	...	...
20	.020	.552	.303	4992	61.9	76.5	65.9	69.53	+ 2.82	.401	.440	.554	.470	.73	.48	.87	.66	N W b N	S b W	S W b W	S 44 W	1.5	9.8	1.8	4.35	4.97	...	...
21	.215	.252	.473	.3237	68.1	71.0	58.7	66.93	+ 0.12	.679	.528	.252	.442	.85	.69	.51	.64	S W b W	N W	N W	N 58 W	4.0	24.6	12.5	14.70	15.47	0.475	...
22	.581	.510	—	—	57.2	66.6	—	—	—	.404	.315	—	—	.86	.48	—	—	N N W	S S E	S S E	S 73 E	5.0	7.0	1.5	3.59	5.12	Inp.	...
23	.198	.370	.556	.3842	58.0	63.4	48.2	57.68	— 9.20	.441	.278	.245	.323	.92	.47	.72	.66	S W	N W	N W b W	N 60 W	2.4	27.5	3.0	12.52	13 23	...	...
24	.546	.456	.584	.5322	53.5	73.1	60.9	63.25	— 3.62	.278	.276	.414	.323	.68	.33	.78	.57	N W b W	W S W	W b N	S 75 W	3.5	22.2	4.0	8.66	9.53	...	...
25	.671	.653	.594	.6435	57.2	68.1	61.9	63.20	— 3.77	.282	.433	.489	.417	.60	.62	.88	.71	W b N	E S E	E b S	S 11 E	0.8	4.6	2.0	2.39	4.06	...	...
26	.530	.500	.560	.5380	62.7	74.6	64.5	67.37	+ 0.40	.478	.608	.519	.535	.84	.70	.85	.80	S W b S	W	N W b N	N 62 W	5.2	11.5	8.0	5.58	7.87	0.160	...
27	.709	.731	753	.7355	59.0	64.8	57.2	60.00	— 6.98	.369	.326	.325	.330	.74	.53	.69	.64	N b W	S	N W	S 45 E	7.2	8.6	5.0	1.23	6.35	...	...
28	.764	.697	.598	.6785	55.1	65.9	63.0	62.43	— 4.53	.331	.209	.475	.343	.76	.33	.82	.62	N N W	E N E	N E b N	N 61 E	2.0	9.6	7.4	6.73	7.28	0.655	...
29	.383	.321	—	—	61.2	70.6	—	—	—	.524	.706	—	—	.97	.94	—	—	E N E	W S W	N W b N	N 39 W	6.0	5.0	6.0	4.07	7.27	0.935	...
30	.458	.472	.458	.4600	60.5	72.0	64.1	66.38	— 0.57	.442	.528	.512	.500	.84	.67	.85	.77	N W b N	S b W	Calm.	S 57 W	1.8	6.6	0.0	1.99	2.93	0.043	...
31	.417	.512	.660	.5418	61.6	68.4	53.6	61 27	— 5.68	.481	.327	.287	.346	.87	.47	.69	.64	W b S	N N W	N W b N	N 36 W	3.8	19.8	7.6	11.44	11.68	...	...
M	29.5568	29.5562	29.5745	29.5610	59.33	70.30	60.45	63.92	— 2 33	.420	.442	.419	427	.81	.59	.78	.72	....	....	....	....	4.18	10.80	5.26	......	7.29	4.336	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JULY, 1860.

Highest Barometer .... 29.839 at 8 a. m., on 12th } Monthly range=
Lowest Barometer .... 29.174 at 8 a. m. on 21st } 0.665 inches

Self-registing Thermom.
- Maximum Temperature .... 88°0 on p. m. of 19th } Monthly range=
- Minimum Temperature .... 43°8 on a. m. of 24th } 44°2
- Mean maximum Temperature .... 72°09 } Mean daily range=
- Mean minimum Temperature .... 55°85 } 17°15
- Greatest daily range .... 30°7 from a. m. to p. m. of 24th.
- Least daily range.................. 8°2 from a. m. to p. m. of 3rd.

Warmest day......... 19th ... Mean temperature......... 75.00 } Difference = 17°32.
Coldest day........... 23rd... Mean temperature......... 57°68 }

Maximum { Solar.................................. 104°4 on p. m. of 10th } Monthly range=
Radiation. { Terrestrial.......................... 33°2 on a. m. of 24th } 71°2.

Aurora observed on 6 nights, viz., on 11th, 12th, 17th, 19th, 21st and 27th.
Possible to see Aurora on 10 nights; impossible on 12 nights.
Raining on 13 days,—depth 4.336 inches; duration of fall 48.4 hours.
Mean of cloudiness = 0.43.
Most cloudy hour observed, 2 p. m., mean = 0.50; least cloudy hour observed, 6 a. m., mean, = 0.35.

Sums of the components of the Atmospheric Current, expressed in miles.

North.	South.	East.	West.
2043.62	1245.07	1111.50	2500.42

Resultant direction N. 60° W.; Resultant Velocity 2.15 miles per hour.
Mean velocity............................ 7.29 miles per hour.
Maximum velocity .... 31.4 miles, from 3 to 4 p. m. on 16th.
Most windy day .... 21st......Mean velocity 15.47 miles per hour. } Difference=
Least windy day .... 30th......Mean velocity 2.93 ditto. } 12.54 miles.
Most windy hour... 4 to 5 p. m..................Mean velocity 11.57 ditto. } Difference
Least windy hour... 2 to 3 a. m. ....Mean velocity 3.72 ditto. } 7.85 miles.

4th.—Severe thunderstorm from 4 to 6 p. m.
10th.—Distant thunder and sheet lightning 5 to 8 p. m.
15th.—Sheet lightning from 8.30 p. m.
16th.—Thunderstorm from 7 to 8.30 a. m.
18th.—Thunderstorm from 10.40 to 11.40 p. m.
20th.—Very brilliant meteor passed from W. N. W. towards S. E. at 9.30 p. m.
21st.—Heavy thunderstorm from 9 to 10 a. m.
29th.—Dense fog from 8 a. m. to 1 p. m.
30th.—Solar Halo at 4 p. m. Lunar Halo 8.20 to 9.30 p. m.
31st.—Lunar Corona from 9 p. m.

Heavy Dew recorded on 11 mornings during this month.

The Resultant Direction and Velocity of the Wind for the month of July, from 1848 to 1860 inclusive, were respectively N 62° W, and 0.42 miles.

The month of July, 1860, was extremely cold, wet and windy.

The Mean Temperature was 2°99 lower than the average of 21 years; it was absolutely the coldest July during that period. The depth of rain recorded was in excess of the mean by 0.806 inches, and the mean velocity of the wind was 2.36 miles per hour above the average, which is considerably greater than we have recorded here during any previous July for the last 13 years.

COMPARATIVE TABLE FOR JULY.

Year.	Temperature.					Rain.		Snow.		Wind.		
	M'n.	Diff. from Aver.	Max ob'd.	Min. ob'd.	Range.	No. of days.	Inch's.	No. of days.	Inch's.	Resultant Direction.	Resultant V'y.	Mean Force or Velocity.
	°	°	°	°	°							
1840	65.8	—1.1	79.4	48.2	31.2	6	5.270	...	...	...	...	....
1841	65.0	—1.9	86.3	43.2	43.1	10	8.150	...	...	...	...	0.27 lbs.
1842	64.7	—2.2	90.5	42.0	48.5	4	3.050	...	...	...	...	0.33
1843	64.5	—2.4	86.1	40.2	45.9	8	4.605	...	...	...	...	0.44
1844	66.0	—0.9	86.1	40.5	45.6	12	2.815	...	...	...	...	0.19
1845	66.2	—0.7	94.6	45.6	49.0	7	2.195	...	...	...	...	0.30
1846	68.0	+1.1	94.0	44.9	49.1	9	2.895	...	...	...	...	0.29
1847	68.0	+1.1	87.5	43.8	43.7	8	3.355	...	...	...	...	0.19
1848	65.5	—1.4	82.7	46.7	36 0	10	1.890	...	...	N 14° W	0.18	4.94 mls.
1849	68.4	+1.5	89.1	51.0	38.1	4	3.415	...	...	S 5° W	0.75	3.52
1850	68.9	+2.0	84.9	52.8	32.1	12	5.270	...	...	N 81° E	0.59	4.56
1851	65.0	—1.9	82.7	52.1	30.6	12	3.625	...	...	N 60° W	0.88	4.13
1852	66.8	—0.1	90.1	49.5	40.6	8	4.025	...	...	N 43° W	0.93	3.33
1853	65.6	—1.3	85.4	49.4	36.0	10	0.915	...	...	S 58° E	0.24	3.69
1854	72.5	+5.6	93.6	53.0	40.6	9	4.805	...	...	S 49° W	0.37	4.03
1855	67.9	+1.0	88.4	53.1	35.3	13	3.245	...	...	S 19° W	0.73	6.47
1856	69.9	+3.0	92.0	51.4	40.6	8	1.120	...	...	N 79° W	1.57	5.84
1857	67 8	+0.9	85.4	52.4	33.0	15	3.475	...	...	S 68° E	0.81	4.74
1858	67.9	+1.0	83.4	55.9	27.5	13	3.072	...	...	N 15° E	1.13	5.76
1859	66.9	...	87.7	50.5	37.2	12	2.611	...	...	N 56° W	1.48	5.81
1860	63.9	—3.0	85.8	47.5	38.3	13	4.336	...	...	N 60° W	2.15	7.29
M	66.91	...	87.41	48.27	39.14	9.7	3.530	...	...	....	...	4.93 Ml.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JUNE, 1860.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M.D., LL.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°			Temp. of the Air.—F.			Tension of Vapour.			Humidity of Air.			Direction of Wind.			Horizontal Movement in Miles in 24 hours.	Mean of Ozone. t'nths	Rain in inches.	Snow in inches.	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.
1	29.571	29.603	29.722	58.5	67.1	86.1	.423	.378	.279	.88	.54	.84	N	N E b N	E b N	153.50	2.0	...	...	Cu. Str. 8.	Cu. Str. 4.	C. C. St. 8.
2	758	580	609	44.9	76.7	58.9	211	470	358	72	52	73	S E	S S W	E b N	10.88	2.0	...	...	Fog.	Cum. 2.	Clear.
3	679	523	528	54.6	79.6	69.4	328	501	430	77	51	61	E S E	S b E	S b E	82.80	1.0	...	...	Heavy Dew, C	Clear.	Do.
4	420	301	281	64.1	84.7	69.4	373	476	430	62	42	61	S b E	S S E	S S E	114.10	1.0	...	...	Do.	Hazy.	Do.
5	242	271	406	66.4	69.2	63.2	451	402	478	78	66	83	S E b E	S S E	S b E	191.50	2.0	...	...	C. C. Str. 9.	C. C. Str. 10.	Cu. Str. 10.
6	468	396	438	60.0	79.2	67.0	456	405	403	88	47	71	N E b E	N E b E	N E b E	62.80	2.5	...	...	Clear.	Clear.	Clear.
7	399	304	312	62.9	78.9	63.0	379	507	478	66	52	83	N E b E	N E b E	W b S	126.60	2.0	...	...	Do.	Do.	Nim. 10.
8	322	314	384	59.0	68.6	89.1	410	457	410	82	69	82	S S W	S b W	S	215.70	2.0	0.562	...	Cu. Str. 10.	St. 2.	Clear.
9	419	417	471	55.0	69.9	57.0	370	456	359	84	63	73	S b W	W b N	N W	119.90	1.5	...	...	Do. 10.	Cu. Str. 4.	Cu. Str. 9.
10	499	537	624	53.1	89.5	56.6	321	433	357	80	85	79	N W	N W	N b W	124.60	4.0	Inap.	...	Do. 4.	Nimb. 10.	Do. 8.
11	641	628	724	54.1	73.5	62.4	335	338	453	80	41	80	N b W	N b E	N	134.10	1.0	...	...	Clear.	Clear.	Clear.
12	752	854	783	50.4	80.1	65.4	265	567	509	75	57	81	E b S	S	E S E	15.10	1.5	...	...	Do.	Do.	Do.
13	870	748	800	62.0	90.9	71.0	489	744	442	75	52	59	E b S	S E b E	S E	122.20	2.5	...	...	Do.	Do.	Do.
14	801	763	770	69.0	91.0	71.0	498	536	503	70	37	66	S W b S	S W	S W b W	37.00	1.0	...	...	Do.	Do. Sol. Halo.	C. Str. 2.
15	730	700	707	65.4	85.0	84.2	483	577	897	78	49	53	S S W	S W	W S W	10.50	1.5	...	...	Do.	Cir. 4 do.	C. C. Str. 4.
16	814	824	906	63.0	82.1	65.6	422	610	542	75	56	87	S E	N E b E	N E b E	84.90	2.5	Inap.	...	Cu. Str. 4.	Cu. Str. 4.	Do.
17	884	914	986	64.0	89.4	61.2	483	894	464	73	61	77	N E b E	S E b S	S E b E	105.10	2.5	...	...	Clear.	C. C. Str. 2.	Cu. St. 2.
18	886	738	728	70.0	84.5	71.0	586	584	572	80	50	66	S E	S E	S E b E	28.70	2.0	...	...	Do.	Cu. Str. 4.	Do. 8.
19	604	601	614	66.0	78.4	59.1	542	664	439	87	69	88	S E b E	S S E	N E	0.50	2.0	0.403	...	Do.	C. Str. 2. d. th	Do. 10.
20	804	614	717	58.2	52.1	54.2	446	460	390	90	85	93	N N E	N E b E	N E b E	249.90	3.0	0.272	...	Cu. Str. 10.	Do. 10.	Rain.
21	914	924	941	52.7	72.9	60.1	328	390	367	83	50	71	N E b E	N N E	S E b E	157.10	3.5	0.600	...	Do. 8.	Clear.	Clear.
22	974	957	914	62.0	82.6	65.0	406	604	490	74	54	81	S S E	N N E	N W b W	33.10	2.0	...	...	Clear.	C. C. Str. 4.	Do.
23	904	900	30.000	61.5	77.2	63.0	449	587	517	85	63	91	W S W	E S E	S W b W	28.60	1.5	Inap.	...	C. C. Str. 10.	C. Str. 10. d. lt.	Cu. Str. 2.
24	30.114	30.101	104	64.1	85.5	66.1	464	570	502	77	47	78	S S E	S S W	S S W	13.80	1.5	...	...	Clear.	Clear.	Do. 4.
25	059	004	29.960	66.3	83.0	72.1	536	558	631	84	50	81	S S W	W S W	W S W	80.60	1.5	...	...	Do.	Do.	Clear, [Com. v.
26	29.847	29.890	897	60.3	79.7	68.6	635	606	483	80	60	78	W S W	W S W	N b W	76.35	3.0	0.597	...	C. C. St. 4.	C. C. Str. 4.	Cu. Str. 10.
27	30.021	940	501	60.3	79.7	61.6	426	644	390	82	64	74	N E	W	W S W	89.60	1.5	...	...	Clear.	Clear.	Do. 4.
28	29.807	745	543	64.2	72.8	71.1	464	355	572	77	32	76	S W	W S W	S S W	103.10	1.9	Inap.	...	Cu. Str. 4.	Cu. Str. 4.	C. C. Str. 4.
29	470	367	538	76.3	77.0	72.1	652	799	771	73	36	95	S W b S	W b N	S S W	149.90	3.5	0.116	...	Do. 10.	Do. 10.	Do. 4.
30	550	597	754	70.2	78.4	65.0	628	342	307	88	36	51	S W	W b S	W N W	158.30	2.0	...	...	Clear.	Clear.	Cu. St. 8.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JULY, 1860.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., LL.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° 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air.—F. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Horizontal Movement in Miles in 24 hours.	Mean of Ozone. (tenths)	Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29.867	29.817	29.866	61.0	74.1	60.6	.325	.568	.338	.61	.67	65	s w	w b n	w b s	34.64	1.0	...	...	Clear.	Cir. 4.	Clear.
2	899	822	841	52.6	81.6	63.2	354	638	386	90	83	67	w s w	n w b w	s b w	22.20	1.5	...	...	Do.	Do.	Cu. Str. 4.
3	794	693	635	65.0	86.3	71.0	389	418	592	63	36	76	s b w	s w	s b w	252.60	1.0	...	...	Do.	C. C. Str. 8.	Cirr. Str. 8. C.s.
4	697	712	687	61.1	76.1	59.0	413	273	317	77	30	62	E s E	E s E	s s E	83.40	1.0	...	...	Do.	Clear.	C.C. Str. 10. hy.
5	619	675	797	57.2	75.9	58.2	322	477	394	69	51	82	N E b E	s E b s	w s w	20.00	1.0	...	...	Cu. Str. 10.	C. C. Str. 4.	Str. 2.
6	895	814	876	65.1	83.2	62.7	[illegible]	376	416	60	33	72	s E b s	E s E	s E	97.00	1.5	...	...	Clear.	Clear.	Clear.
7	835	849	818	67.0	85.8	66.0	489	487	431	75	40	66	s E	s s w	s s E	45.00	1.5	...	...	Do.	Do. thunder.	Cirr. 4.
8	761	644	521	58.6	81.6	66.9	423	362	496	88	34	77	s s E	s s E	s b E	169.60	2.0	...	...	Do. heavy	Do.	Cu. Str. 6.
9	396	353	581	60.8	77.6	67.7	665	608	556	92	67	84	s s E	s w	w s w	231.20	3.0	0.330	...	Rain. [dew.	Cu. Str. 10.	Do. 8.
10	882	741	742	57.0	64.1	57.0	350	464	429	75	77	91	s w b w	w b n	w b s	224.70	3.0	...	...	Cu. Str. 8.	C. C. Str. 10.	Do. 2.
11	862	830	872	52.1	68.9	57.8	308	313	282	79	45	88	w n w	n w	n n w	233.60	1.5	...	...	Heavy dew,	Cu. Str. 2.	Do. 8.
12	940	917	941	56.0	77.1	63.7	370	422	471	84	46	81	n w b n	s w	w	45.80	1.5	...	...	Clear. [clear.	Clear.	Do. 2.
13	987	870	900	64.1	82.3	69.1	376	425	496	89	39	70	s s w	n b w	w s w	38.04	2.0	...	...	Do.	Str. 4.	Clear.
14	849	838	832	67.5	87.9	70.1	489	543	482	75	42	66	w s w	s w	c s w	96.10	2.0	...	...	Do.	Cirr. St. 4.	Do.
15	816	735	770	66.9	89.0	73.5	438	569	525	68	42	61	s w	s w	s w	65.60	2.0	...	...	C. C. Str. 4.	Clear.	Cu. Str. 9.
16	776	517	604	68.6	84.2	62.0	800	545	536	81	47	92	s w	w s w	w n w	79.50	1.5	1.880	...	Cu Str. 4.	Cu. Str. 6.	Do. 9.
17	832	827	914	60.0	72.9	65.0	338	383	438	65	48	75	w n w	w b n	w b n	125.90	3.5	...	...	Clear.	C. C. Str. 4.	Clear.
18	821	784	690	62.3	84.2	69.2	399	470	503	72	40	66	s s w	s s w	s w	53.20	2.0	...	...	C. C. Str. 6.	Clear.	Do. Au. Bor.
19	688	594	680	70.2	88.4	74.6	621	650	497	85	49	59	s w	w b s	s s w	17.90	2.0	...	...	Cu. Str. 8.	C. C. Str. 8.	Cu. Str. 6
20	826	809	602	64.7	81.0	68.9	458	510	536	75	48	77	s s w	w b s	s w	78.80	2.5	...	...	Clear.	Clear.	Do. 4.
21	410	371	572	63.4	67.9	55.0	536	581	328	92	87	77	s s w	w	w b n	56.30	3.0	0.440	...	Rain.	C. Str. 4.	Do. 8.
22	748	777	676	50.0	71.4	60.3	302	503	315	82	66	68	w n w	w b n	w b n	220.40	1.5	...	...	Clear.	Clear.	Do. 9.
23	421	323	652	61.0	68.6	44.9	413	443	275	77	65	92	s b w	w b n	w	232.20	2.0	1.055	...	C. C. Str. 6.	Cu. Str. 6.	Clear. Au. Bor
24	612	566	739	51.0	64.2	55.8	206	403	365	70	68	76	s w	s w	s w	151.70	3.0	1.250	...	Clear.	Do. 8.	Do.
25	861	824	856	51.3	78.0	62.9	321	514	429	86	51	77	s w	s w	s s w	31.20	2.0	...	...	Fog.	Do. 4.	Do.
26	508	614	703	63.1	71.3	64.0	517	403	536	91	54	92	s s E	s s w	s s w	90.40	2.5	0.706	...	Cu. Str. 4.	Nim. 10.	Cu. Str. 10.
27	878	840	30.007	53.7	68.2	56.6	223	232	336	64	34	73	n b w	n n E	n b w	125.40	1.5	...	...	Clear. [dew.	C. C. Str. 6.	Do. 2.
28	901	967	29.976	47.5	74.2	63.0	201	568	388	89	67	69	w	s w	s w	18.30	1.0	...	...	Do. heavy	Clear.	Clear.
29	779	665	612	65.6	70.0	59.1	483	483	477	78	66	95	s s w	s s E	s s E	99.90	2.0	In'p.	...	Cu. Str. 8.	Cu. Str. 10.	Nim. 10.
30	626	601	608	64.2	80.3	62.4	461	599	399	77	59	72	w s w	s s w	w	78.80	1.0	...	...	Clear.	Do. 4.	Clear.
31	701	608	744	56.6	72.1	58.3	413	524	328	90	66	77	s s w	w s w	w	131.10	3.0	0.071	...	Do.	Do. 10.	Cu. St. 6.

REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JUNE, 1860.

Barometer	Highest, the 24th day	30.114
	Lowest, the 4th day	29.231
	Monthly Mean	29.682
	Monthly Range	0.883
Thermometer...	Highest, the 14th day	91°0
	Lowest, the 12th day	44°8
	Monthly Mean	68°15
	Monthly Range	46°2

Greatest intensity of the Sun's rays .... 101°2
Lowest point of Terrestrial Radiation .... 34°6
Mean of Humidity .... .715
Amount of Evaporation 3.72
Rain fell on 10 days, amounting to 2.819 inches; it was raining 18 hours 15 minutes, and was accompanied by thunder on one day.
Most prevalent wind, the S. E. by E.
Least prevalent wind, the N.
Most windy day, the 20th day; mean miles per hour, 10.41.
Least windy day, the 19th day; mean miles per hour inappreciable.
Aurora Borealis visible on 1 night.
Solar Halo visible on 2 days.
The Electrical state of the Atmosphere indicated moderate and constant tension.
Ozone was present in moderate quantity.

REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JULY, 1860.

Barometer	Highest, the 27th day	30.007
	Lowest, the 23rd day	29.323
	Monthly Mean	29.733
	Monthly Range	0.684
Thermometer...	Highest, the 14th day	89°1
	Lowest, the 22nd day	43°8
	Monthly Mean	66°47
	Monthly Range	45°3

Greatest Intensity of the Sun's Rays .... 100°3
Lowest point of Terrestrial Radiation .... 37°1
Mean of Humidity .... .679
Amount of Evaporation, 3.78 inches.
Rain fell on 8 days, amounting to 5.732 inches; it was raining 25 hours and 15 minutes, and was accompanied by thunder on two days.
Most prevalent wind, the S. S. W.
Least prevalent wind, the N. by W.
Most windy day, the 3rd day; mean miles per hour, 15.52.
Least windy day, the 5th day; mean miles per hour, 0.83.
Aurora Borealis visible on 3 nights.
Meteor in N. W. at 8.30 p. m. 21st day.
The electrical state of the atmosphere has indicated constant and moderate intensity.
Ozone was in moderate quantity.
Eclipse of the Sun visible on the 18th day.

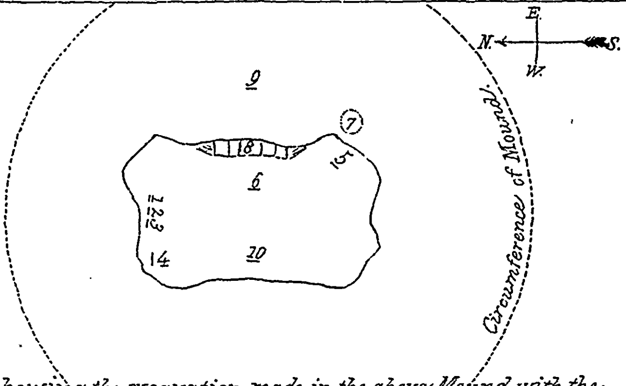
cf. P. 40?

Plate I.

Fig. 1.

Sketch shewing position of skeleton found at root of Oak stump.

Fig. 2.



Plan shewing the excavation made in the above Mound, with the positions of skeletons found therein, and the shape of the rude wall of the sepulchral chamber.

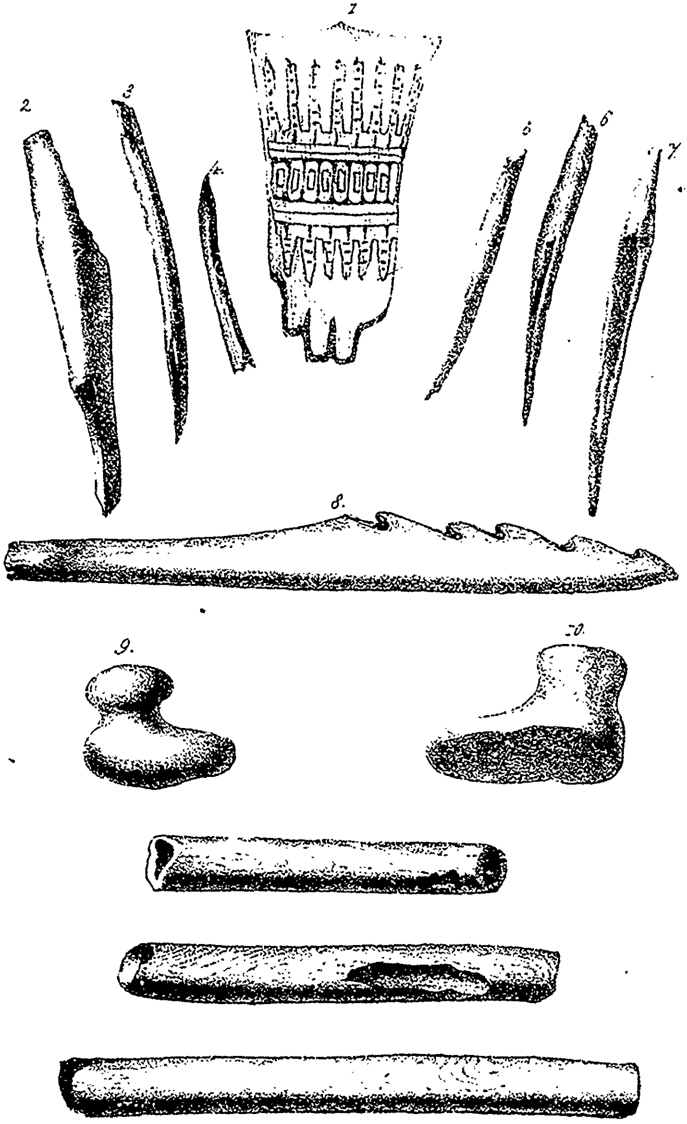
Fig. 3.

Section of Mound shewing its construction.

H. Cawthra, Esqr. del. Fuller & Bencke Lith. Vict: Hall, Toronto.

cf. p. 415

Plate II.



Comb needles &c. (real size) found in a sepulchral Mound on shore of the Bay of Quinte Canada West.

H. Cawthra, Esq. del.

Fuller & Bencke Lith. Vict. Hall. Toronto.

DIAGRAM, showing expansion and contraction of Ice. (100 feet in length.)
Also a Thermometrical Section corresponding to the latter Ice movement

J. H. Dumble C. E.