The Canadian Journal.

TORONTO, AUGUST, 1855.

On an Earth-Boring Machine.

BY COLIN MATHER.*

The construction of Mr. Mather's new boring-head and shell-pump, and the mode of acquiring the percussive motion, constitute the chief novelties of the system and machine. The couple-cylinder engine, with the reversing or link motion, is used for winding and lowering apparatus; but an ordinary winding engine, similar to those used in collieries, may be applied.

The boring-head consists of a wrought-iron bar, about eight feet long, on the lower part of which is fitted a block of cast-iron, in which the chisels or cutters are firmly secured. Above the chisels an iron casting is fixed to the bar, by which the boring-head is kept steady and perpendicular in the hole. A mechanical arrangement is provided, by which the boring-head is compelled to move round a part of a revolution at each stroke. The loop or link by which the boring apparatus is attached to the rope is secured to a loose casting on the wrought-iron bar, with liberty to move up and down about six inches. A part of this casting is of square section, but twisted about one-fourth of the circumference. This twisted part moves through a socket of corresponding form on the upper part of a box, in which is placed a series of ratchets and catches, by which the rotary motion is produced. Two objects are here accomplished—one the rotary motion given to the boring-head, the other a facility for the rope to descend after the boring-head has struck, and so prevent any slack taking place, which would cause the rope to dangle against the side of the hole, and become seriously injured by chafing.

The shell-pump is a cylinder of cast-iron, to the top of which is attached a wrought-iron guide. The cylinder is fitted with a bucket similar to that of a common lifting-pump, with an India-rubber valve. At the bottom of the cylinder is a clack, which also acts on the same principle as that in a common lifting-pump, but it is slightly modified to suit the particular purpose to which it is here applied. The bottom clack is not fastened to the cylinder, but works in a frame attached to a rod which passes through the bucket, and through a wrought-iron guide at the top of the cylinder, and is kept in its place by a cotter, which passes through a proper slot at the top of the rod. The pump-rod, or that by which the bucket is worked, is made of a forked form, for the two-fold purpose of allowing the rod to which the bottom clack is attached to pass through the bucket, and also to serve as the link or loop by which the whole is suspended.

The wrought-iron guide is secured to the top of the cylinder, and prevents the bucket from being drawn out when the whole is so suspended. The bottom clack also is so arranged that it is at liberty to rise about six inches from its seating, so as to allow large fragments of rock, or other material, to have free access to the interior of the cylinder when a partial vacuum is formed there by the up-stroke of the pump.

The percussive motion is produced by means of a steam-cylinder, which is fitted with a piston of 15 inches diameter, having a rod of cast-iron 7 inches square, branching off to a fork in which is a pulley of about three feet in diameter, of sufficient breadth for the rope to pass over, and with flanges to keep it in its place. As the boring-head and piston will both fall by their own weight when the steam is shut off, and the exhaust-valve opened, the steam is admitted only at the bottom of the cylinder; the exhaust-port is a few inches higher than the steam-port, so that there is always an elastic cushion of steam of that thickness for the piston to fall upon.

The valves are opened and shut by a self-acting motion derived from the action of the piston itself; and as it is of course necessary that motion should be given to it before such a result can ensue, a small jet of steam is allowed to be constantly blowing into the bottom of the cylinder; this causes the piston to move slowly at first, so as to take up the rope, and allow it to receive the weight of the boring-rod by degrees, and without a jerk. An arm which is attached to the piston-rod then comes in contact with a cam, which opens the steam-valve, and the piston moves quickly to the top of the stroke. Another cam, worked by the same arm, then shuts off the steam, and the exhaust-valve is opened by a corresponding arrangement on the other side of the piston rod. By moving the cams, the length of the stroke can be varied at the will of the operator, according to the material to be bored through. The fall of the boring-head and piston can also be regulated by a weighted valve on the exhaust-pipe, so as to descend slowly or quickly, as may be required.

The general arrangement of the new machine may be described as follows:—

The winding drum is 10 feet in diameter, and is capable of holding 3,000 feet of rope, 4½ inches broad and half an inch thick; from the drum the rope passes under a guide-pulley, through a clam and over the pulley which is supported on the fork end of the piston-rod, and so to the end which receives the boring-head, which being hooked on and lowered to the bottom, the rope is gripped by the clam. A small jet of steam is then turned on, causing the piston to rise slowly until the arm moves the cam, and gives the full charge of steam; an accelerated motion is then given to the piston, raising the boring-head the required height, when the steam is shut off, and the exhaust opened in the way described, thus effecting one stroke of the boring-head as regulated by a back-pressure valve in the exhaust-pipe. The exhaust-port is six inches from the bottom of the cylinder; when the piston descends to this point, it rests on a cushion of steam, which prevents any concussion. To increase the lift of the boring-head or compensate for the elasticity of the rope, which is found to be one inch in one hundred feet, it is simply necessary to raise the cams on the cam-shaft whilst the percussive motion is in operation. The clam which grips the rope is fixed to a slide and screw, by which means the rope can be given out as required. When this operation is completed, and the strata cut up by a succession of strokes thus effected, the steam is shut off from the percussive cylinder, the rope unclamped, the winding-engine put in motion, and the boring-head brought up and slung from an overhead suspension bar by a hook fitted with a roller to traverse the bar. The shell-pump is then lowered, the *débris* pumped into it, by lowering and raising the bucket about three times, which the reversing motion of the winding-engine readily admits of; it is then brought to the surface and emptied by the following very simple arrangement. At a point in the suspension-bar a hook is fixed perpendicularly over a small table in the waste-tank, which table is raised and lowered by a screw. The pump being suspended from the hook hangs directly over the table, which is then raised by the screw till

* Journal of the Society of Arts.

it receives the weight of the pump. A cotter, which keeps the clack in its place, is then knocked out, and the table screwed down. The bottom clack and the frame descending with it, the contents of the pump are washed out by the rush of water contained in the pump-cylinder. The table is again raised by the screw, and the clack resumes its proper position; the cotter is then driven into the slot, and the pump is again ready to be lowered into the hole as before. It is generally necessary for the pump to descend three times in order to remove all the *débris* broken up by the boring-head at one operation.

The following facts obtained from the use of the machine in boring in the new red sandstone at Manchester will show its actual performance, and enable us to compare it with the other systems mentioned in this paper. The boring-head is lowered at the rate of 500 feet a minute; the percussive motion is performed at the rate of 24 blows a minute, and being continued for 10 minutes, the cutters in that time penetrate from 5 to 6 inches; it is then wound up at 300 feet a minute. The shell-pump is then lowered at the rate of 500 feet a minute, the pumping continued for one minute and a half, and being charged, the pump is wound up at 300 feet a minute. It is then emptied, and the operation repeated, which can be accomplished three times in 10 minutes, at a depth of 200 feet. The whole of one operation, resulting in the deepening of the hole 5 to 6 inches, and cleaning it of *débris* ready for the cutters or boring-head being again introduced, is seen to occupy an interval of 20 minutes only. The value of these facts will be best shown by comparing them with the results by the old method.

At Highgate the boring has occupied two years in attaining a depth of 680 feet from the bottom of a well 500 feet deep from the surface. Their progress at present is at the rate of 6 inches per week, working night and day. At Warwick, 13 months were occupied in boring 400 feet through red marl; at Saltaire, two years in going 80 yards.

One well-known defect of the old method of boring consists in the "buckling" and dangling of the rods, which has the effect of enlarging the hole in some instance to a diameter of four feet where soft strata intervene. This arises from the buckling and dangling of the rods causing them to strike against the sides of the hole, and breaking off portions of earth which fall to the bottom, thus considerably increasing the quantity of *débris* to be brought up by the shell, and occupying an immense time in getting out the *débris* which has merely fallen from the side, without increasing the depth of the hole. This is a serious defect where geological purposes are to be served by the boring, because the earth from the side falling to the bottom of the hole mixes with that which is cut up by the chisel, and thus prevents an accurate knowledge being obtained of the strata which the boring has penetrated. It must be remarked also that the defect of buckling is to crystallise the iron, deteriorating its quality, and thereby causing those frequent breakages which retard progress, and add so materially to the expense of this system of boring. The process of crystallisation being beyond the observation of the workmen, the result is scarcely, if ever, known till the breaking of the rods reveals it. To remedy this difficulty, and obviate the effects of buckling, it has been found necessary to put down iron tubes into the bore-hole. As the first length of these tubes can scarcely be got to a depth of more than 200 feet, on account of the great external friction, it is necessary, when the tube has to be carried to a further depth, to put down a second and a third length of tube; and as each length must come to the surface, the diameter of the bore-hole is very materially diminished. It will easily be seen that when the bore-hole is required to be of considerable depth, this diminution of its diameter will at length so contract the hole as to render the supply of water comparatively limited, and, in fact, to threaten the design with actual failure, after a vast outlay has been incurred. These inconveniences, so serious in character, are all obviated by the new method of boring. No rods are used; and as the rope which is substituted for them seldom comes in contact with the sides of the hole so as to disturb the strata, tubing will rarely be required. Indeed, it will only be necessary when the particular strata through which the hole passes happens to be very fluid; and even then it will not always be wanted. The great power of pumping and the facility of winding possessed by this new machine would enable it to exhaust any ordinary quicksand which might find its way into the hole. The pumping process could be carried on at a depth of 500 feet, at the rate of a cart-load per hour. It is possible with the improved machine to cleanse the hole so effectually that not a loose particle remains at the bottom. This will at once be seen from the fact that the pump has sufficient power to draw in masses of rock or other substances of from three to four pounds weight. This circumstance renders the machine particularly useful in geological researches, inasmuch as the lowest strata are brought up in a state of the greatest possible compactness and purity, notwithstanding any admixture of earth from the sides, or of that which the shell has been unable to bring up in the previous operation.

Notice of the Application of the Thistle to the Manufacture of Paper.

PATENTED BY LORD BERRIEDALE, LONDON, JULY 8, 1854.*

Whilst India and other tropical regions have been traversed in search of a plant to be used in place of rags in the paper manufacture, Lord Berriedale has turned his attention nearer home, and has selected the common thistle as the most suitable plant for his purpose His invention relates to the application and use of the common thistle, or *Carduus*, as it is termed, according to the botanical classification of Linnæus, in the manufacture or production of pulpy material from which paper is to be made, as well as in the manufacture of a fibrous material for textile purposes. All the varieties of the thistle plant are applicable for the purposes of this invention, but more particularly the large Scottish thistle, which grows luxuriantly in many parts of the British Islands, attaining a great height and thickness of stem. Such thistles furnish, in each plant, a large amount of long fibre of great tenacity, and which, when duly prepared, is most excellently suited for the preparation of a powerfully cohering paper pulp, as well as for use in textile manufactures.

In adapting the thistle to the manufacture of paper pulp, the plant is used either in a green or dried state. If employed in its natural green condition, it is cut or gathered, and at once beaten or broken up by any suitable mechanism, such as is used in the primary treatment of the flax plant, so as to disintegrate the fibrous or ligneous matter. During this breaking treatment, the mucilaginous and aqueous matter present is washed clear away, either by pure water, or by an acidulous solution, or by any other economical and effective cleansing agent. When the thistle stems are thus fully reduced or distintegrated,

* From the Lond. Pract. Mechanics' Journ., March, 1855.

the resultant fibrous mass is worked up or macerated in the usual manner, for the production of a pulp suitable for the use of the paper-maker. This pulp may be used in the manufacture of paper, either unmixed, or commingled with other materials already in use for making paper. The routine of manufacture into paper of the pulp, is similar to that pursued with the ordinary rag pulp, or it may be varied, as the properties of the thistle may suggest. The thistle fibre being strong, the paper made from it is of great tenacity, the fibres cohering well together in the paper machine, and being worked up with very little loss from washing away. The fibres are also of good colour; hence paper of a fair colour may be made from them without bleaching, and if bleaching is resorted to, a very good white colour is obtained at a slight expense. The mucilaginous or gummy matter dislodged from the fibres may be collected and applied in the manufacture of gum or glutinous matter, or it may be otherwise rendered commercially valuable, so as still further to economize the thistle manufacture. In applying the thistle plant to the manufacture of textile materials, the fibres are primarily prepared in the manner already described, and then subsequently treated according to the existing textile processes—such, for instance, as are adopted in the flax manufacture, the thistle fibre being closely allied to the fibre from the flax plant, as regards its general characteristics. Being strong and of good staple, the thistle fibre is particularly well suited for the spinning and weaving processes.

Further Observations on associated cases, in Electric Induction, of Current and Static Effects.

BY PROF. FARADAY, D.C.L., F.R.S., &c.*

Melloni, whose loss science must deeply feel, was engaged in the latter part of his life in investigations relating to static electricity, especially concerning induction, conduction, &c. He desired, in reference to these and the results I had published respecting the charge of, and conduction by, subterraneous and subaqueous insulated wires, to know whether there was any difference in the *time* of transmission through such wires, of currents having greater or less intensity, *i. e.* of currents from batteries of different numbers of plates. I applied to Mr. Latimer Clark on the subject; and he with the same earnestness as on the former occasion, sought and seized the opportunity of making experiments of the like kind, and gave me the results, which I sent to Melloni. The latter published them with some observations in an Italian Journal (whose title is not on the paper which he sent to me), and soon after he was suddenly removed from us by death. As Mr. Clark's results are not yet known in this country, I have thought that a brief account of them would be valuable. His process records, by the printing telegraph of Bain, the results obtained with 768 miles of copper wire covered with gutta percha, and laid in the ground in four lines between London and Manchester, so connected that the beginning and the end of the whole length was in London. The following are his words, dated May 31, 1854:—

"I have tried a few experiments on the relative velocities of currents of different intensities, and I enclose you some strips of paper showing the results. I was unable to equalize the deflexions of a galvanometer by currents of intensity with small plates as compared with currents from a few large plates, for no size of plate would make up for the deficiency in intensity. I allude to the form of experiment suggested by Melloni; —but I believe they will be of interest to him.

"The experiments were made through 768 miles of gutta percha wire, viz.: from London to Manchester and back again twice, with our ordinary sulphate of copper batteries, plates 3 inches square, and with intensities varying from 31 cells to sixteen times 31 cells, or 500 cells.

"In the accompanying strips the upper line indicates the time during which the current was sent, being made by a local arrangement.

"The second line (of dots) indicates *time by seconds*, being made by a pendulum vibrating seconds, and striking a light spring at the centre of its arc of vibration.

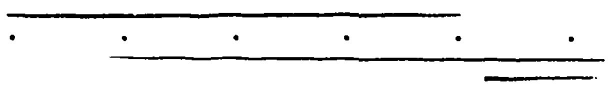
"The third line indicates the time at which the current appeared at (what we call) the distant end of the line, 768 miles off.

"The fourth line merely shows the residual discharge from the near end of the wire, which was allowed to communicate with the earth as soon as the batteries were disconnected; this has no reference to the subject of our enquiries.

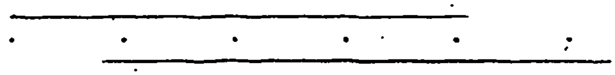
"It will be seen by the *third line*, that about two-thirds of a second elapsed in every case before the current became apparent at the distance of 768 miles, indicating a velocity of about 1000 miles a second; but the most interesting part appears to be, that this velocity is *sensibly uniform for all intensities* from 31 cells to 500."

Melloni has then given a copy of the records made when 31 pair and 500 pair of plates were employed; unfortunately the copy is inaccurate, since it makes the fourth line commence as to time at the termination of the third, whereas it ought to correspond with the termination of the first; also the third line on each does not thin off as those upon the record do. The following is a copy from other slips obtained at the same time from the Bain's printing apparatus. Experiments with 62, 125, and 250 cells, gave like results with those of 31 and 500 cells.

31 cells.



500 cells.



After certain observations, which are mainly upon the manner of the experiments, and the way in which practical difficulties were avoided, Melloni says, "it appears, then, that when the electric current possesses sufficient force to overcome the sum of the resistance offered by a given conductor, whatever its length may be, an augmentation of its intensity ten or twenty fold does not alter the velocity of its propagation. This fact is in open contradiction with the general meaning attributed to the denominations of *quantity* and *intensity*; since the first compares the mass of electricity to that of a fluid, and the second represents its elasticity or tendency to motion. The equal velocity of currents of various tension offers, on the contrary, a fine argument in favour of the opinion of those who suppose the electric current to be analogous to the vibrations of air under the action of sonorous bodies. As sounds, higher or lower in pitch, traverse in air the same space in the same time, whatever be the length or the intensity of

* From the Lond., Edin. and Dub. Philos. Mag. March, 1855.

the aërial wave formed by the vibration of the sonorous body; so the vibrations, more or less rapid or more or less vigorous, of the electric fluid excited by the action of batteries of a greater or smaller number of plates, are propagated in conductors with the same velocity. Every one will see how the hypothesis imagined by us to give a reason for natural phenomena, will serve to suggest certain experimental investigations, the results of which will test their validity or insufficiency."

Melloni then says, that he shall shortly have occasion to publish facts which clearly demonstrate the errors of certain conclusions admitted up to the present time respecting electrostatic induction; and I am aware, from written communications with him, that he considered the results arrived at by Coulomb, Poisson, and others since their time, as not accordant with the truth of nature.* In the meantime he died, and whether his researches are sufficiently perfected for publication or not, I do not know.

The uniformity in the time and appearance of currents of different intensities at the further end of the same wire in the same inductive state, is a very beautiful result. It might at first be supposed to be in opposition to the views I set forth some years ago on induction and conduction, and the statements more recently made with regard to *time*. That, however, does not appear to me to be the case, as a few further observations on Mr. Clark's recent experiments will perhaps show. When the smaller battery is used, much less electricity passes into the wire in a given time, than when the larger one is employed. Suppose that the batteries are so different that the quantities are as 1 to 10; then, though a pulse from each would take the same time for transmission through the wire, still it is evident that the wire would be a tenfold better conductor for the weak current than for the strong one; or in other words, that a wire having only one-tenth of the mass of that used for the greater current should be employed for the smaller one, if the resistance for *equal quantities* of electricity having different intensities is to be rendered equal.

My views connect the retardation of the transmitted current with the momentary induction set up laterally by the insulated and externally coated wire. The induction will be proportionate to the intensity, and therefore its especial effect on the time of retardation proportionately diminished with the less intense current,—a result of action which will aid in rendering the time of retardation of the two currents equal.

The difference of *time* in the former experiments with air wires, and earth or water wires, very clearly depends upon the difference of lateral induction; the air wire presented a retardation scarcely sensible, the earth wire one amounting to nearly two seconds. If the insulating layer of gutta percha could be reduced from 0·1 to 0·01 of an inch in thickness, and mercury could be placed on the outside of that instead of water or earth, I do not doubt that the time would be still more increased. Yet there is every probability that in any one of these varying cases, electric currents of high and of low intensity would appear at the end of the same long wire after equal intervals of time.

Mr Clark's results may be stated thus:—A given quantity of electricity at a high intensity, or a smaller quantity at a proportionally lower intensity, will appear at the further end of the same wire after the lapse of the same period of time. My statement assumed the discharge of the *same* quantity at *different* intensities through the *same wire*, and the quantities in the illustrative experiments were measured by a Leyden jar. In the consideration and further development of these results, it must be remembered that it is not the difference either in time, velocity, or transmission of a *continuous* current which constitutes the object in view; for that is the same both for an air wire and a subterraneous wire, but it is the difference in the *first appearance* only of the same current when wires under these different conditions are employed. After the first appearance both wires are alike in power unto the end of the current, and then a difference again appears which is complementary to the first.

There are many variations of these experiments which one would wish to make, if possible, and perhaps by degrees the possibility, or else equivalent experiments in other forms, may occur. If the wire employed were changed from a cylinder to a flat ribbon of equal weight, or to several small wires, all being equally coated with gutta percha and submerged, differences would probably arise in the time of delay with the same current; and I think that the ribbon, presenting more induction surface than the cylinder, would cause more delay; but probably any of these, or of like varieties, would cause the *same* delay for currents of different intensities. Again, one can scarcely doubt that with different conducting substances, as iron and copper, the delay would vary, as is the case in the transmission of sound and light. That the delay for currents of high and low intensity should be the same for the same wire in any one of such cases may still be expected, but it would be very interesting to *know* what would be the fact.

The prosecution of these results and the principles concerned in them, through the various forms they may assume by such like variations of the conductors and also of the currents, offers, as Melloni has observed, most extensive and interesting inquiries; even the power of a current to induce a current in neighboring wires and conductors is involved in the inquiry, and also the phenomena and principles of magneto-electric induction.

* He says, "I deceive myself much, or else the fundamental theorem of electrical induction, as we find it ordinarily announced, ought to be modified so as not to confound two effects completely distinct—the electric state during induction, and after the contact and separation of the inducing body. We know perfectly what occurs in the latter case, but not in the former," &c. Again, "In my last letter I raised doubts with regard to the consequences which have up to the present been deduced from the experiments serving as a base for the fundamental theorem of electro-static induction. These doubts have passed to a state of certitude in my mind, ... and behold me at this time thoroughly convinced that the enunciation of that theorem ought to be essentially modified." (July, 1854.)

On taking Daguerreotypes without a Camera.

BY J. F. MASCHER.*

The accompanying stereoscopic pictures were taken by me, by means of a box (to be described hereafter) that contained neither lenses, reflectors, or in short any refracting or reflecting medium of any kind. I accidentally made the discovery that photographic pictures could be taken in this manner while prosecuting some experiments relative to stereoscopic angles.

It is well known that two pictures taken with two ordinary cameras placed only 2½ inches apart horizontally, will not when placed in the stereoscope show proper or sufficient stereoscopic relief, yet it is well known that the human eyes are only placed 2½ inches apart, yet are enabled to see solid objects in their proper solidity and relief; and to explain the why and wherefore of these facts has challenged the attention of Professor Wheat-

* Journal of the Franklin Institute.

stone, Sir David Brewster;* and a host of others. Under these circumstances we may be permitted to ask, why is it that two pictures, taken by two cameras placed 2½ inches apart, do *not* show sufficient stereoscopic relief? Why is it that we must place the cameras about eight times farther apart than the human eyes are in order to produce the proper relief? When these questions first suggested themselves to me, the following answer occurred to me without at that time being able to prove it to be the correct one; namely, because the lenses in the cameras (¼ size) are twelve times larger than the human lenses (eyes).

In order to ascertain whether this is the correct answer or not, it was only necessary to take two pictures with two cameras having a diaphragm in each, the openings in which are ⅛ of an inch in diameter, that being the diameter of the diaphragm in the human eye. In executing this experiment, I was very much surprised to find that the focal range of the camera was increased to an extraordinary extent. The cameras had been focussed for a house on the opposite side of the street, but the moment the diaphragm was introduced, the sash in the window, which before was invisible, suddenly became as sharp and distinct as the house on which the focus had been previously drawn. Subsequently, on removing the camera to an upper story of my house, it was found that this increase in focal range extended not only from the house towards the camera, but to an equal extent beyond the house. After ascertaining these facts, it became desirable to find out the cause of them. With this end in view, the lenses were removed from the tube, and only the diaphragm remained in the same. You may well imagine my astonishment at finding the pictures of houses and other objects in the street faithfully depicted upon the ground glass! the letters of signs, &c., reversed, precisely as if the lenses had been used. The next step was to ascertain whether these pictures possessed photogenic properties, which was soon done by substituting a metal diaphragm with an aperture of 1-50 of an inch in diameter for the paper one of ⅛ inch in diameter, putting in a coated plate, leaving it remain fifteen minutes, coating it in the usual manner, and a beautiful picture, similar to the one herewith sent, was the result.

It was self-evident now, that we had the means to do that with one camera, for which two were before deemed indispensable, namely, taking two stereoscopic pictures through two apertures situated only 2½ inches apart. But as a quarter size plate is only 4¼ inches long, and as it was desirable to take the two pictures on one plate, two apertures 1-66 of an inch in diameter were made in the metal plate above alluded to, only 2¼ inches apart, and after twenty minutes exposure, the sun shining on the house all the time, the accompanying pictures were the result, thus demonstrating conclusively that two stereoscopic pictures can be taken on one plate with one camera (or dark chamber without lenses) and simultaneously, without either reflectors or refractors of any kind whatsoever! It may here be remarked, however, that the pictures thus taken on one plate are stereoscopic reverse, that is to say, the right picture is on the side where the left one ought to be, and *vice versa*, which can, however, be very readily remedied by cutting the plate in two and pasting them together again properly. This stereoscopic reverse was next attempted to be remedied by placing a reflector before the apparatus, but the only effect produced by this device, was the same as the same reflector produces upon pictures taken by an ordinary camera, namely, making the pictures appear in their natural position, so that letters on signs, &c., could be read correctly.

There is another advantage resulting from this camera; it is this. You may make two, four, six, or more sets of holes in the same camera, either all of the same diameter, by which means you will obtain an equal number of stereoscopic pictures with the number of sets of holes, or you may make one set with apertures of 1-200 of an inch, another 1-100 of an inch, one set 1-70 of an inch, and still another set with 1-25 of an inch in diameter, where you will be certain to obtain at least one set of pictures properly "timed," especially as the other pictures which are not properly timed can be rubbed out before gilding, thus saving the plates.

* Mr. Mascher disclaims, in the July number of the Journal of the Franklin Institute, the merit of having first originated the explanations relating to the distortions of pictures. He refers to an article by Sir David Brewster on that subject, published in vol. xv. *Silliman's Journal*, p. 291.

On the Composition of Eggs in the Animal Series.

The conclusions to which M. M. Valenciennes and Frèmy have arrived with respect to the composition of Eggs in the Animal Series are as follow:—

Conclusions.—We have shown, in three successive communications composing our memoir, the facts established by our researches on the eggs of different animals, belonging to all the great classes of Ovipara. Let us by way of recapitulation, endeavour to state in some general propositions, the most important consequences which seem to be the results of this first work. We have shown:—

1st. That there exist fundamental differences between the composition of the eggs of animals, and that under this collective name of *egg*, designating the product of the ovarian apparatus intended to contribute to the perpetuity of the species, very diverse bodies are comprised, different as possible from one another.

2nd. That among the vertebrated animals, the eggs of birds, of reptiles, and of fish, present in their composition, differences which the simplest analysis cannot mistake, and besides that the eggs of Sauria and Ophidia bear great analogy to those of birds, while the eggs of Batrachia resemble those of the cartilaginous fishes.

3rd. That the eggs of Arachnidæ and insects differ altogether, as to their composition, from the eggs of other animals.

4th. That those of Crustacea, organized for living in water, do not at all resemble those of fish or of other amphibious vertebrata.

5th. That this extends to the eggs of Mollusks.

6th. That these differences correspond not only to classes or orders; that they extend to natural families even, without stopping there, since we have proved that an egg of a cartilaginous fish has not the same composition with that of an osseous fish; but further, that a Carp's egg is very different from a Salmon's egg; that the egg of an Ophidian such as an adder's, does not contain the same principles as those of the Chelonia.

7th. That if the composition of different proximate principles is the same in very nearly allied species, the form and the size of vitellin granules vary in a manner sufficiently appreciable to be able to be recognised and assigned to each species.

8th. That the albuminous substances furnished by eggs of birds, reptiles, fish, crustaceans, present in their chemical properties and in their point of coagulation, differences which permit us to suppose that these bodies are made up of different proximate principles.

9th. That an egg changes its nature,—that its liquids alter considerably at different epochs of its formation, when detaching themselves from the ovary, and resting in the oviduct before being hatched.

10th. After having established in the eggs of different animals, the presence of several new proximate principles, icthin, ichthulin, icthidin, emydin, and comparing these results with those which MM. Dumas and Cahours obtained in the analysis of hens' eggs, we do not hesitate to propose to science to admit the existence in eggs of a new class of organic bodies, comprising some proximate principles which we will hereafter designate under the name of Vitelline substances or Vitelline bodies.

On the Formation of Brass by Galvanic Agency.*

Copper is more electro-negative than zinc, and separates more easily from its solutions than a metal less negative. If, then, in order to obtain a deposit of brass by galvanic means, we employ a solution containing the two component metals, copper and zinc, in the proportions in which they would form brass, there will only be produced by the action of the battery a deposit of real copper: the zinc, more difficult of reduction, remains in solution. What must be done, then, to obtain a simultaneous precipitate of the two metals in the proportions required, is either to retard the precipitation of the copper, or to accelerate that of the zinc. This may be effected by forming the bath with a great excess of zinc and very little copper.

Dr. Heeren gives the following proportions as having perfectly succeeded:—

There are to be taken of	Sulphate of copper.........	1 part.
	Warm water...................	4 parts.
And then	Sulphate of zinc............	8 "
	Warm water...................	16 "
	Cyanide of potassium......	18 "
	Warm water...................	36 "

Each salt is dissolved in its prescribed quantity of water, and the solutions are then mixed; thereupon a precipitate is thrown down, which is either dissolved by agitation alone, or by the addition of a little cyanide of potassium: indeed, it does not much matter if the solution be a little troubled. After the addition of 250 parts of distilled water, it is subjected to the action of two Bunsen elements charged with concentrated nitric acid mixed with one-tenth of oil of vitrol The bath is to be heated to ebullition, and is introduced into a glass with a foot, in which the two electrodes are plunged. The object to be covered is suspended from the positive pole, whilst a plate of brass is attached to the negative pole. The two metallic pieces may be placed very near.

The deposit is rapidly formed if the bath be very hot: after a few minutes there is produced a layer of brass, the thickness of which augments rapidly.

Deposits of brass have been obtained in this way on copper, zinc, brass, and Britannia metal: these metals were previously well pickled. Iron may, probably, also be coated in this way; but cast iron is but ill adapted for this operation.—*Mittheilungen des Hannov. Gewerbevereins*, through *Bulletin de la Societe d'Encouragement, No. 16, August*, 1854.

The Unity of the Human Race.

Attention having been directed to this question, by some incidental observations in the May number of the *Canadian Journal*, they have been followed up by further remarks contributed to a succeeding one, designed to convey the impression of the total fallacy of arguments which have appeared to some impartial scientific inquirers, as favouring the idea of the genus MAN being divisible into several species. The writer of the present brief comment—(satisfied of the extreme difficulty of the question, touching, as it necessarily does, on the most momentous relations of man to the principles of moral government, responsibility, and divine atonement, as set forth in the sacred Scriptures)—is simply desirous of freeing the inquiry from any cumbering errors, which in the end can only work evil, whatever conclusion be established.

Premising, therefore, that nothing which is said here is intended to advocate the Non-unity of the Human Race, it is to be regretted that the author of the remarks, signed T.H.M.B., in the last number of the *Journal*, should have rested the defence of the Unity of the Race, or, in other words, the descent of all mankind from the one pair of progenitors, Adam and Eve, on arguments which will not stand the test of investigation as undisputed postulates.

1. "That the offspring of a male and female of diverse kind is barren," is *not* an established fact. Hunter and Owen, the two most distinguished of British comparative anatomists, concur in the opinion that "two species nearly allied to each other will produce a hybrid offspring, and that the hybrid is again productive with the pure breed." Mr. Bell, in his "British Quadrupeds," says—"It is well known that there are many instances of animals, undoubtedly distinct, producing young, which become fertile in conjunction with one or other of the parent kinds;" and Mr. Yarell, in his "History of British Birds," mentions various cases of fertile hybridity among birds. All these are instances produced by writers simply stating facts in Natural History, without reference to the supposed bearing of such an argument on the question of the unity or variety of human species, and it would be easy to quote additional impartial authorities. The argument is directly employed by Dr. Nott, in the "Types of Mankind," in an elaborate paper, entitled "Hybridity of Animals viewed in connection with the Natural History of Mankind," and there many additional examples are noted, and authorities cited.

2. "Experience," says the writer in the July number of the *Journal*, "teaches us that we have to fear, not the mixture of any foreign stock, but rather the continuance of intermarriages among tribes too nearly connected—*the breeding in and in.*" But here, also, he overlooks, or is unaware of the very opposite use made of this very argument as bearing on the question of original descent from one pair. The learned and pious Dr. Pye Smith refers to the idea of men being descended from more than one primary pair as "Taking away some difficulties, such as the sons of Adam obtaining wives *not their own sisters*;" and the distinguished author of the "Crania Americana," remarks in language which, though somewhat irreverent in its tone, forcibly expresses feelings in some respects akin to those of Dr. Pye Smith: "If I could believe that the human race had its origin in *incest*, I should think that I had at once got the clue to all ungodliness. Two lines of catechism would explain more than all the theological discussions since the Christian era:

> Q. Whence came that curse we call primeval sin?
> A. From Adam's children *breeding in and in.*"

These words of the learned ethnologist, Dr. Morton, are quoted, not as approving of them, but simply as showing that the writer of the remarks in the last number of the *Journal* uses, without being aware of it, and specially distinguishes by italics, the

* A delicate galvanometer showed no indication of the passage of an electrical current.

very words employed by the earliest and ablest of all the American writers on the opposite side.

3. "Our species of the Equine Genus which we call, *par excellence*, the horse," is next advanced as exhibiting very great differences of size and shape. But to quote only a single authority, Col. Hamilton Smith, in his "Natural History of the Equidæ," arrives at this conclusion as the result of very extensive inquiries into the natural history of the horse, that horses may be separated into five primitive stocks, constituting "distinct though oscillating species, or at least races separated at so remote a period, that they claim to have been divided from the earliest times of our present zoology."

4. "The dog furnishes us," the writer in the *Journal* next remarks, "with examples even more remarkable of deviations from *his own common type*." But here, again, the common descent of all dogs from one pair is taken for granted as an undisputed truism. Yet on what grounds? If our eye is to guide us, on what principle shall we separate the horse and the ass, not only into different *species*, but, as Gray and other distinguished naturalists do, into distinct *genera*, and yet hold as one the bull-dog, greyhound, setter, terrier, and spaniel? In truth, there is not a shadow of ground for this gratuitous assumption of the one common dog type and species. It is opposed by the ablest living Naturalists, such as Mr. James Wilson for example, without any reference to its applicability to the argument of Human Unity. It is opposed, in like manner, by all monumental and historical evidence; the paintings and sculptures of Egypt and Babylon showing the mastiff, the greyhound, the bloodhound, &c., as distinctly defined by their modern characteristics in the dawn of history as now. The wolf, the fox, and others of the *Canidæ*, are not themselves single species. Yet the wolf, fox, and jackall have been found to breed without difficulty with domestic dogs; insomuch so, indeed, that Mr. Bell, directing his attention too exclusively to one of these, inclines to the opinion that the wolf is the original source from whence all our domestic dogs have sprung.

5. "The union of the various races of human beings has always been productive of a progeny perfect in every physical function, fully capable of continuing the race." Even this is by no means the undisputed dogma here assumed. Dr. Knox, for example, in his "Races of Men," says: "No mixed race can stand their ground for any long period of years. A mixed race may be produced, but it cannot be supported by its own resources, but by continual draughts from the two pure races which originally gave origin to it," and the question, as broadly exhibited on this continent, is one of the most difficult of all the unsettled questions in physiology. It is affirmed that, alike in the half-breed Negro and Indian, a speedy degeneracy becomes apparent, along with an aptitude to diseases of a peculiar type, from which the pure races are altogether or nearly free. Certainly, it is impossible to say at present, if the coloured population of this continent keeps up its numbers, much less increases. No census discriminates between the additions it receives annually by means of a white paternity, and those directly proceeding from the mixed race. In truth, every step we take in this inquiry is on uncertain and debateable ground. Meanwhile, what is affirmed of the mixed races of men is almost precisely what does result from fertile hybridity among the lower animals.

6. Finally, the argument of the philologist is referred to, "drawn from his perception of *a single source and root of all existing languages*." But who is the multi-lingual philologer possessed of such comprehensive perception? A vast step has been achieved in establishing the affinities of the great Indo-European group of tongues, and in tracing remoter relations connecting these with the semitic languages. But who has proved the relation between these and the Hottentot, the Australian, or the Chinook languages, or even acquired the means of testing them? Certainly no one, as yet, pretends to have done so; and, in discussing so grave and momentous a question of modern science we must build on a firmer foundation than vague generalisations, *petitio principii*, and sacred texts construed according to the preconceived ideas of the writer, with perchance as little real grounds as those formerly employed to upset the science of Geology, which now finds its foremost advocates among the Sedgwichs, Hitchcocks, Millers, and others most distinguished among the Divines and Christian layman of the age. In all honest scientific controversy the truths of sacred scripture have nothing to fear. All other truths will ultimately be found reconcileable with these. But meanwhile this new question of "The Unity of the Human Race" is not ripe for controversy. It is open only, as yet, to earnest inquiry; and it will be well for the cause of religion if our divines and theologians seek to master it in all its bearings, in the simple teachable spirit in which scientific, as well as sacred truth, can alone be mastered, before it do ripen into a controversy which will only be characterised by danger in so far as it is stamped with the intolerant spirit of ignorant assumption. The writer whose remarks have suggested the above observations, justly says:—"experience has taught us not too hastily to charge any scientific theory with being contradictory to scripture. Freedom of speculation is rightly privileged. Revealed truth is not endangered by discussion and investigation;" and it is a gratifying confirmation of this, to learn from a recent notice in this Journal that the speculations and inquiries of Agassiz on the profoundly difficult question here referred to, have in no degree diminished his reverential belief in the revelation of God through His Word. D. W.

On the formation of a Canal between Lakes St. Clair and Erie

And the foundation of a Town and Harbour at the mouth of the Two Creeks, in the Township of Romney, in connection with the establishment of an extensive system of Drainage, by which near a Million of Fertile Acres would be redeemed in one District. With an illucidatory Map.

BY MAJOR R. LACHLAN, MONTREAL.*

(*Read before the Canadian Institute, March 10th, 1855.*)

No object being more worthy of the attention of a *patriotic* Philosophical Association than the investigation of the physical character of a country, with the view to an improved application of its natural resources and capabilities, it was with much satisfaction that I had from time to time hailed various laudable movements of the Canadian Institute, having that tendency, and especially its late exertions in conjunction with the City Corporation, for the improvement of the important harbour of Toronto. It is true that this praise-worthy course was naturally to be expected from such a Society on the very spot; but it was still not the less commendable as an influential move in the right direction, which, it was hoped would in time be creditably followed by Members of the Association residing in, or connected with, other parts of the extensive region within

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* A large map of the Western District accompanied Major Lachlan's paper, exhibiting the general physical features of the country and showing in the Township of Colchester the extent and distribution of the Inland Marshes adverted to in the text. The map of the Western District, published by Maclear & Co., Toronto, may be referred to with advantage in the perusal of Major Lachlan's paper.

its range, and would ultimately lead to much good, and, in the mean time, though I could not help lamenting that our Rulers should have allowed the credit of the construction of the Sault-Ste. Marie Canal to pass into the hands of our American neighbours, I also felt justly proud of the many signal improvements either already accomplished or now in progress in the navigation of our magnificent inland waters.

While thus reflecting, I had more than once struck a chord in unison with my own feelings, and called up, with mingled sensations of pride and mortification, the recollections of long by-gone times when I had,—in vain,—been the zealous though humble advocate of various local improvements connected with the remote quarter of the Province in which I had for 10 years been a resident, and of which many disjointed memoranda have ever since remained idle in my possession.

Having ventured on so querulous a prefatory remark, it may be as well to state at once, even at the risk of being deemed egotistic, as the most natural though rather narrative introduction to the subject of this paper, that having about 19 years ago been led to emigrate with my family to Canada, and to settle in the Western District, as best suited to a constitution long accustomed to the warm climate of India, it so happened that I was in a short time placed in prominent positions that afforded me favourable opportunities for acquiring information and judging of the capabilities of the surrounding country,* which soon enabled me to perceive that the remote quarter of the Province which I had selected as my home, was "a land of great promise," both in a commercial and agricultural point of view, but more especially the latter, as being from soil and climate pre-eminently entitled to rank as the garden and granary of Canada, though, in its then neglected and mismanaged state, not soon likely to assume that prominent distinction.

I may further add that in the course of a hasty tour of observation through the Province during the previous year, I had visited Chatham by land from the London District, and and from thence travelled along the alternate marshy and sandy border of Lake St. Clair to Sandwich; from whence I made a detour by water up the river St. Clair to Port Sarnia, and back to Sandwich and Amherstburgh; and from thence by land, through the Lake-shore townships, as far as St. Thomas, by which I had good opportunities of noticing both the physical structure and actual state of that line of country.

Thus prepared—and feeling, as every true patriot possessing any local influence ought to do, under similar circumstances—it was not long before I resolved to endeavour to throw into the scale whatever weight might be in my power; and I accordingly ventured to take rather a leading part in various local good works, such as founding an Agricultural, an Emigration, and even a Literary Society, as well as advocating the advancement of popular education. In the course of these sometimes expensive "labours of love," I very soon saw the necessity of some extra stimulus being given to mercantile enterprise,—with so inviting a highway as our magnificent inland waters at our command; at the same time that I felt persuaded that without some direct encouragement from Government in the establishing of a few village harbours—were it only of *refuge*,—along the coast of Lake Erie, little could be accomplished by individuals; and I was therefore induced to make a commencing effort in *both* directions by prevailing on my fellow townsmen of Colchester to petition Government for the establishment of, at least, *one* village and small harbour, on a "Reserve," within a mile of my own property;—a project in which I at last succeeded, after several years of *official* delay. The objects aimed at will be best understood from the following extract from the Memorial alluded to. "Your Memorialists would respectfully draw the attention of Your Excellency to the remarkable fact, that while numerous ports and harbours have been long established along the opposite American Coast, the (more exposed) *Canadian* shore is still without a single port for Refuge of any kind from Amherstburgh to Port Stanley—a distance not less than 130 miles,—and that it has been justly remarked that until there shall be harbours of some kind at which Vessels can touch, neither sailing craft nor steamers can be expected to frequent our coast, far less be *built*, for the purpose of carrying on any thing like *coasting trade*, on the Canadian side of the Lake."

The bearing of the foregoing quotation may not at first be apparent, but will be readily understood when it is added that by having in the first instance devoted my attention to the outline of the Coast, along Colchester, in connection with the prevailing winds and frequent storms on Lake Erie, on the bank of which my own property lay; coupled with a rather laborious examination of a marshy tract lying beyond a gravelly ridge a short distance inland, I was thereby insensibly led to extend my thoughts to devising some inexpensive mode of *general* drainage. My first efforts however were directed to the more limited scheme, above alluded to, for reclaiming about 6,000 acres of valuable marsh land in my own Township, in connection with the Village since established in it; and I then extended my inquires as to the feasibility of introducing the same system into other Lake-shore Townships, and thereby effecting the redemption of perhaps a million of fertile acres, besides favouring the establishment of several much wanted harbours of refuge, and more especially of a very desirable one at the mouth of "Two Creeks," in the Township of Romney which I had long had at heart, and the merits of which are now to form the chief burthen of this Paper.*

But though I had thus acquired much useful and even valuable information, my disjointed memoranda on the subject would perhaps have remained unacted upon, but for my having in 1845 been agreeably roused by learning that the Municipal Council of the District had petitioned Government for a preliminary survey, in behalf of one of the very objects which I had so long in view,—namely, the establishment of a harbour at the mouth of Two Creeks, but unfortunately, it appeared, without furnishing any documents or arguments demonstrative of its feasibility. Finding such to be the case, I lost no time in addressing a long official letter to Mr. Secretary Higginson in support of the Council's Petition, in which I endeavoured to supply such information as I deemed desirable.†

The nature of the reply vouchsafed by the Government to the very reasonable appeal of the Municipal Council I know not. With regard to my own efforts it will for the present be sufficient to premise that though my letter was very flatteringly acknowledged by the Governor-General, on its being referred to the Commissioner of public works for his opinion, and "weighed in the balances" opposed to the great "*Rondeau*" BUBBLE, "was found wanting" and, as such doomed to

* First as Sheriff, and afterwards as Magistrate and Chairman of the Quarter Sessions.

* See the prefixed map, or any good map of the Western District.

† Though savouring somewhat of egotism, it is but justice to note, that having been personally known to the Governor-General in India, I had been condescendingly honoured with an invitation to submit to him at any time whatever suggestions I might think would be beneficial to my adopted Country.

oblivion in that "Tomb of all the Capulets" the shelves of a Secretary's Office,—though not without a last effort to shield it from premature condemnation, from either any *blunders* on my part, or any misapprehension or misapplication of my meaning, as will be found noticed in its proper place.

Such however would doubtless have continued to be the fate of my long cherished disinterested exertions, but for the onward march of mind having at length given birth to a more satisfactory, because independent public arbiter, through whom the merits of all scientific and useful projects can now be investigated and duly appreciated,—though it may not have the power of carrying them into effect.—Need I add that I allude to the auspicious institution of the Canadian Institute of Toronto.—At all events, I can sincerely state that feeling persuaded that such would be the guiding motive of that association, and seeing it exemplified in more than one instance, besides its laudable movement in behalf of the Harbour of Toronto, all my old feelings on the subject of my long dormant patriotic project revived, and led to an endeavour to recover a copy of my letter to Mr. Higgenson; and having succeeded, I was at one time inclined to place that document at the disposal of the Institute, "without note or comment," but on second thoughts I deemed it more advisable to alter the form of my statements so far as, by a few modifications and additions, to make them assume something of the shape of a regular paper, though still partaking more of the character of a simple narrative of facts than an elaborate Essay:—and accordingly in that desultory form are the following particulars respectfully submitted. Feeling however that something more was wanting, I have taken the trouble of preparing and prefixing thereto a large scaled sketch map of the Southern portion of the Western District, as likely to prove of assistance in correctly comprehending the different bearings of the subject, but more especially, as regards the drainage of the Township of Colchester. And I am also willing to confess that in taking that step at this particular time, I was not without hope of thereby drawing the attention of "*The General Drainage Society of Upper Canada*," about to be incorporated, towards a part of the Province furnishing so attractive and profitable a field for their patriotic operations.

Trusting that these introductory remarks will not be deemed altogether misapplied, I now proceed to state,—as observed in the letter above alluded to, and from which I am about to quote almost verbatim, that my attention having (in 1845) been unexpectedly drawn to a petition from the Municipal Council of the Western District to the Governor General, praying for *a Survey*, to ascertain the practicability of forming a harbour at the mouth of "Two Creeks," in the Township of Romney, and at the same time opening a communication from thence either by *Canal* or *Road*, to some point on the River Thames, but without furnishing any specific data from which Government might be encouraged to give a favourable answer to their prayer, and having observed the same project strongly advocated by a well-informed though rather over-sanguine correspondent of "*the Patriot*," from Chatham, I was induced to throw whatever might be the weight of my humble advocacy of so patriotic a proposal into the scale, in the hope that the additional information which I happened to be able to furnish would ensure the matter being not only brought pointedly before the Governor General, but patronised to an extent beyond the hopes of either the Municipal Petitioners or the writer alluded to.

Impressed with these feelings I took the liberty of stating that it so happened that the undertaking in question had been regarded by me as a great *desideratum*, ever since my arrival in the Country, and that my progressive enquiries on the subject, in connection with a plan for the general drainage of a large and valuable portion of the Lake-shore Townships, (which I proposed to form the basis of another communication)* rendered me not altogether unqualified for giving a well-grounded opinion as to the feasibility of the project, as well as to the prospective public benefits derivable therefrom. In stating thus much, however, I did not wish it to be inferred that I laid any claim to being the originator of the idea, the truth being that I had noticed it broached some 8 or 9 years before in some publication on Canada, in a letter written by Mr. William Elliott of Sandwich, (then I believe member for the County of Essex), when I was so struck with it, that I was, from time to time, induced to make memoranda on the subject, for future reference,—of one of which the following is the substance.

"Mr. Elliott of Sandwich observes that much advantage to the Western District would be derived, could a Canal be made *from the first fork of the Thames to Lake Erie*, near the Romney Township line; and is of opinion, from information obtained from others, and his own observation, that this would be practicable at an expense truly trifling, compared with its advantages, and the quantity of fine land that would be thereby reclaimed, amounting to at least a million of acres! Were the waters once made to take this course, it would of itself soon wear it to a level with Lake Erie, and thereby lower the waters of Lake St. Clair, if not reduce it to a river.† Were this effected, much of the Government and Canada Company's lands in Harwich, Raleigh, Tilbury, Rochester, and Maidston, would be drained by it, besides much other land, which, without something of the kind being done, must remain a Marsh, particularly the fine plains at the mouths of the rivers St. Clair and Thames."

My attention having been thus attracted towards a project pregnant with such great public benefits, it had ever since been more or less kept in view during my visits to the various localities alluded to; and, though unable to keep pace with Mr. Elliott's sweeping conclusions and sanguine expectations, I had thereby become so satisfied of, not only it feasibility, but its certain utility and value as a public work, that I made up my mind to publish a few desultory observations in its favor, but was long deterred from attempting it by the unsettled state of the political horizon. The matter having however been at length unexpectedly mooted by the Municipal Council of the District, I determined not to run the risk of its merits not being properly appreciated, for want of either sufficient preliminary data (such as I happened to possess) or my own humble testimony in its behalf.

Having thus introduced the subject, I next proceeded to refer to the letter‡ alluded to, (a copy of which is here annexed),

* It may be necessary to note that the reception which my letter met with completely extinguished any desire to fulfil the intention mentioned.

† The level of Lake St. Clair is a little more than 5 feet above that of Lake Erie.

‡ The excellent letter above alluded to, was as follows: "Sir, Through the medium of your Journal, I beg leave to call the attention of Merchants and Traders to a subject of the greatest importance to their interests,—a subject which was mooted at the last Session of the Municipal Council of the Western District, and which has for its object the uniting of the waters of Lakes Erie and St. Clair, by means of a Canal between the mouth of the River Thames and what is called "Two Creeks," in the Township of Romney, on Lake Erie. The whole distance across in this direction is 15 miles, and 23 chains and 45

as having appeared in the Toronto *Patriot;* and added that I heartily concurred in many of the writer's remarks, though in some instances a little too sanguine, and in others he overlooked arguments in favour of the project which I might perhaps take the liberty of supplying; but that in the mean time I might remark that the writer was evidently neither a military nor naval man, otherwise he would not have altogether overlooked the great advantage that would result, *in the event of War with the States*, from our thereby possessing so much additional *internal* navigation, and having the control of the waters of Lake St. Clair, in case of any hostile movement from Detroit.

I then proceeded to state that in addition to less *direct* information, picked up at intervals, relative to the suggested line of canal, and the great natural capabilities of the mouth of "Two creeks" for being converted into a superior harbour, I had then lying before me a minute profile of the levels of the very tract of country through which the former was proposed to pass, which had been in my keeping several years, and to which I had, after a careful examination of the details, attached the following memorandum:—

"Memorandum regarding the levels of the country between the mouth of the Thames and Lake St. Clair on the north, and Lake Erie on the south; as applicable to the feasibility of cutting a canal between the two Lakes in that direction.

"From the data furnished by an elaborate *Profile* (from actual survey) of the proposed line of canal from a creek and marsh on the north shore of Lake Erie, (inferred to be *Two Creeks*, but not expressly so stated) to Jennett's Creek, at the mouth of the River Thames, on Lake St. Clair, by A. E. Hathon, Esq., Engineer, (executed about eight or nine years ago), it would appear that the surface of Lake St. Clair is 5¼ feet higher than that of Lake Erie, and that the direct horizontal distance between the two Lakes is 1,140 chains, or about 14¼ miles.* and that from Lake Erie the land has a gradual ascent for between four and five miles, until it has attained its greatest elevation or summit level of 38¾ feet above the lakes, when it descends gently for more than four miles to a black-ash swamp and creek (not named) about sixteen and a half feet above the lake; after which there is a slight sudden rise of about three feet, after which it resumes a continued gradual slope during the remaining third of the distance until it meets Jennett's Creek (at a point not definitely explained) on the same level with Lake St. Clair. The nature of the surface *soil* is nowhere particularly noted; but it would appear to be free from rocky impediments; and its general superior character, as regards agriculture, may be inferred from the forest with which it is described to be clothed, consisting of varieties of hardwood, indicative of fertility, such as black-ash, elm, red and white oak, maple, hickory, and beech."

Having thus furnished the data from which I had been led to assume that the opening of a canal or cut between Lakes Erie and St. Clair, at a moderate expense, was quite practicable, I next referred to the following memorandum respecting the equally easy conversion of the mouth of Two Creeks into a "first-rate" harbour for any reasonable number of vessels, as gathered from two highly intelligent friends residing in the neighbouring Township of Gosfield, who were familiarly acquainted with its locality; adding that there were not a few other well informed persons in that quarter who regarded Two Creeks as not only superior to the Rondeau as a safe and sufficiently commodious harbour, but a far more eligible site for a village, the latter sheet of water being so very extensive as to partake more of the character of an open road-stead than a shelter harbour, and at times agitated by waves of such magnitude as to place small craft in no little jeopardy; and the neighbouring land being in general low and marshy; whereas the proposed harbour at the mouth of Two Creeks is described as well sheltered on all sides, and the village site on the point of land at the junction of the two branches high and dry, and otherwise of a very agreeable aspect, as demonstrated in the following "Descriptive Sketch:—"†

"The name of Two Creeks is derived from two branches

links, and the difference of level in the waters about 8 feet (taken from a Survey made some years ago.(*a*) By throwing the eye over a Map of the district, the immense advantages which such a channel of communication would produce are immediately seen. Vessels navigating the upper lakes would save a distance of from 125 to 150 miles, and that of the most dangerous part of the voyage. Three-fourths of the vessels which go up the Detroit River, passing by that City, and even those intended for that Port, would gain by the proposed improvement, in as much as Vessels are often wind bound for days together at the mouth of that River, to the great detriment of trade and loss to the owners.(*b*) To Propellors, which will no doubt very soon supersede the sail craft on our Lakes, it will make a material difference in the article of fuel. Those boats are particularly adapted to our narrow and deep streams and when used by us will have the effect of adding to our inland navigation some 300 miles through a country abounding with the choicest woods, with a soil unsurpassed in richness and fertility,—the destined granary of the Province. The contemplated project would facilitate trade and navigation, by affording a cheaper, safer and speedier route,—objects of no small importance to those whose means are limited. It would be a link in the chain of improvements now going on in the Province; and, instead of detracting from, would add to their general utility and profit, by increasing the means of transit, and thereby bringing the productions of the "Far West" nearer to market; a desideratum most essential to the settlement and growth of the country, as well as to the development of its resources. One of the difficulties which its present inhabitants have to contend with would be removed, encouragement would be held out to the industrious, and new energy imparted to every part of the province. Capital would be safely invested in a thousand ways, with the certainty of an ample and sure return; and the Farmer would not only obtain a better equivalent for his labours, but the necessaries of life, being cheaper would be more available, and the luxuries of life would sweeten its cares.—The Municipal Council have addressed His Excellency on the subject, requesting that a Survey may take place, and a report be made thereon, under the control of the Board of Works. A question of such moment, it is to be hoped will not be lost sight of by the Merchants of Toronto, and Kingston; but that on the contrary they will canvass its merits and demerits. Several eminent Engineers have pronounced the work practicable; and that it would be profitable there is no doubt. Trade is every year increasing. The project is not visionary, but real; and all that is wanted is a united effort to consumate it. (Signed.) Y. Z.

(*a*) There is probably some mistake here: the distance according to my memorandum being 14¼ miles, and the difference of level between the two lakes only 5¼ feet. See Note R. L., as below.

(*b*) This, owing to the great prevalance of N.W. and N.E. winds is often exemplified in from 20 to 30 vessels being at times seen at anchor for days together, waiting for a fair wind, both at the mouth of the Detroit and in Lake St. Clair.—presenting to the idle spectator a very interesting view of these "Musquito Fleets" taking a bustling advantage of the first puff of a favourable breeze.—It may also be here added that so rapid is the deposition of sediment in Lake St. Clair, from there being no perceptable current, that it is inferred by many that it will ere long assume the form of a regular River, bordered by broad marshes. How far this will tend to fill up, or to deepen the few narrow navigable channels now available may be a question.—But it is a fact that at the mouths of the Rivers that fall into it, it is difficult to discern whether the water flows out or in, and that there is generally a greater depth within their mouths than outside. R. L.

* This is about two miles less than from Chatham to Shrewsbury, on the Rondeau, which by the plank-road is about sixteen miles.

† It may be proper to add, with regard to the Rondeau, that the large natural basin, so called from its being of a round form, is situated on the western side of a long projecting point of low land, named Point aux Pins, and consists of about 6,000 acres, with a depth of from ten to eleven feet, but so unsheltered--the surrounding marshy tract being

happening to unite within 100 yards or so, of the beach of Lake Erie. The western one is small, shallow, and marshy towards its mouth; but the eastern or main one, which is peculiarly calculated to form a commodious harbour, capable of containing 100 vessels, consists of a fine clear channel, from twelve to sixteen feet deep, and about twenty rods wide, extending full half a mile inland, besides being skirted to the eastward by a marshy bay of less depth, about 100 yards wide, the mass of vegetation on the surface of which being known to rise and fall with the level of the water in the creek, might easily be broken up, and floated down into the lake, and thereby add much to the capacity of the harbour. The land on the east side of this bay is low; but that on the west side of the east creek forming the point between the two branches, and also the right bank of the west branch is high and commanding, and well suited for a village site, being from twelve to sixteen feet above the water level, with steep banks on both sides, and covered with stately hard-wood forest. The soil also is good, being a light colored sandy loam, resting upon yellow clay; and there is no indication of rocks or stones in the neighbourhood. The Talbot road crosses both creeks about one mile and a half inland, where the banks of the east branch are about thirty yards apart, and ten feet deep, with a stream in the middle about thirty feet wide, and two deep. As already observed, from the point of land at the confluence of the two creeks to the beach of the lake is about 100 yards, and the mouth is sometimes obstructed by a dry sand-bank or bar, formed by the wash of the surf; as was the case when visited by my informants in the month of May, at which time it was about three feet above the level of the lake, and about thirty yards across. The lake off the creek deepens rapidly, there being sixteen feet about fifty yards from the shore; but there is a small shoal about 100 yards further out. Beyond that, however, there is uninterrupted deep water, from three fathoms upwards."

As a striking instance of the facility with which a channel may be cut through the sand bank at the mouth of the creek, it may be mentioned that on the occasion alluded to my two friends happening to stop there in the evening with a loaded boat, they amused themselves with scooping out with their hands a very small channel, so as to allow the water to flow off towards the lake; and that in the morning they were not a little astonished to find an opening through which they were not only able to take their boat, but of such breadth and depth as to have admitted a schooner of considerable burthen.

To be continued.

very little above the level of the lake—that vessels, after effecting an entrance are, in a gale, liable to drag their anchors and run aground on the mud. It will, therefore, perhaps, not be wondered, that after an expenditure of from £25,000 to £30,000 of the public money in the attempt to convert the Rondeau into a safe harbour, and laying out the town of Shrewsbury on its north side as a port of entry, it was judged expedient to abandon the undertaking, and transfer the unfinished works to a private Company, by whom they have been allowed to go to decay, while so unproductive have the harbour dues and customs proved that they have seldom defrayed the expense of collection. Add to which, by late accounts, (1853), the location of the town has proved nearly a failure; as the light-house at the point not having then been lighted for a year, several vessels had been stranded outside the harbour. Should, however, the plank-road between Chatham and Shrewsbury be completed, and a line of steamers be established between the Rondeau and Cleveland, there may yet be great changes, as though the neighbouring marshes are very extensive, their immediate connection with the lake produces a constant flux and reflux in their waters, which in a great degree counteracts any miasmatic influence.

Remarks on the Flavouring of Confectionary.

In the last number of the *Journal*, in a paper on Food and its Adulterations, abridged from the *London Quarterly*, reference was made to the use of certain substances now extensively employed in giving peculiar flavours to various kinds of confectionery, and thus successfully imitating those of different fruits. The author, in endeavouring to excite a prejudice against their use, says:—"All these delicate essences are made from a preparation of æther and rancid cheese and butter."

The fact is certainly true, but it may be doubted whether it is a fair line of argument to attempt to create disgust against any particular substance by referring to the sources from which it is obtained. The various chemical processes and operations to which the original matters are subjected, should be described at the same time, and it would then appear that the result is of a perfectly pure character, and bears not the faintest resemblance to the sources from which it has been obtained.

No one objects to eat vegetables, or fine hot-house grapes, although common manure is not an enticing article, and grape growers much delight in dead horses for their vine borders.

But a much more forcible argument against the validity of this objection is to be found in the fact, that one of the most curious discoveries of modern chemistry is the existence in plants, flowers and fruits, of certain flavouring principles which on examination are found to be of precisely the same nature as the substances artificially prepared for the above mentioned purpose. Several cases of this kind have been discovered, of which we need only mention a few:—the sweet scent of the Winter Green is owing to the presence of Salicylate of Methyle, a compound possessing all the characters of an *æther*. The flavour of the Quince is owing to Pelargonate of Æthyle, another perfect æther, which, like the former, can be readily prepared in the laboratory. I am not aware that the essence of the pine-apple has been separated in a pure state, but there can be but little doubt that it is Butyric Æther, or at any rate an æther of one of the analogous volatile fatty acids. Butyric acid itself (derived from "rancid butter") is found in the "St. John's bread," (the fruit of *Ceratonia Siliqua*,) so that Dame Nature seems as liable to the same objection as the confectioners.

Several other instances might be adduced, but the above will suffice to show the probability of our artificial flavourings being in many cases absolutely the same as those existing in the natural products. This certainly does not hold good with all, the artificial essence of Ratafia (Nitrobenzide) is purely a product of manufacture and only resembles the oil of bitter almonds in its smell, it remains to be proved, however, that it is injurious in its effects, a priori one would judge it to be less hurtful than the crude oil or its preparations.

H. C.

New Expedition into Central Africa.*

The limits of the great unexplored region of Africa may be roughly indicated by the parallels of 10° north and south from the equator, and extending from Adamaus in the west to the Somanli country in the east. This extensive region is just touched by the routes of South-African explorers, Livingston and Lacerda,—and by the Abyssinian travellers, by Barth, Overweg, Vogel, and the Chadda Expedition in the north. The greatest inroad into this unknown region has been made by travelling up the Bahr el Abaid, or White River, on which and along which there has been a continuous tide of explorers since 1835, when the Egyptian Government despatched an Expedition up

* Athenæum.

this river,—which was followed by several others of the same kind, as well as by Austrian Catholic missionaries, by many traders and adventurers. The extreme points reached on this river by any of the travellers lay between 4° and 5° north latitude.

At the westernmost bend of the Bahr el Abiad, in about 9° 10′ north lat. and 29° 15′ east long, this river opens out into a rather ill-defined lake or marsh, by some called No, or Nu,—by others, Birket el Ghazel, —by others still, Lake Kura. Its circumference seems to vary at different times; and M. Brun Rollet in 1851 found it of very small dimensions. Into it, from the west, according to a variety of sources, is said to run an immense river, formed by two large branches, of which the one has a westerly or W. N. W. direction; the other one from the south-west. The name of the latter is mostly given as Bahr el Ghazal, Bahr Kulla, or Misselad,—the latter names being also applied to the united main stream. The head waters of these rivers are supposed to extend to the borders of Waday, Bagirmi, and even Adamaua. But so little is known of the region thus described as the basin of the river received by Lake No, that nothing can be stated with any degree of certainty, except that certain rivers exist there, and that these rivers belong to the basin of the Nile. Thus, Dr. Barth, from information he received while in Bagirmi, from persons on whom he had reasons to place reliance, lays down a river called Bahr il Ada in about 7° north lat. and 22° east long. Greenwich, running eastward. In a report from Cairo, dated the 22nd of October, 1843 (see *Augsburgh Zeitung*, Nov. 18, 1843), it was stated that a German traveller had been in Darfur, thence travelled for seven days due south, and came upon a river, on which he embarked, and on it ultimately reached the White River. This may or may not be true:—our present information relating to that region is altogether vague and uncertain. The extreme point reached by Europeans on the north side is Kobeth, the capital of Darfur, in 14° 11′ north lat. and 26° 55′ east long. Greenwich,—first visited by Browne in 1793. The furthest point reached by Barth (or any other European) from the west is Masena, the capital of Bagirmi, the position of which may be taken at 11° 40′ north lat. and about 16° east long. Greenwich. When in Bagirmi, Dr. Barth collected an immense amount of information respecting the countries between it and the Nile, which information he connected and laid down on the map. It relates, however, more particularly to the region east and north-east from Masena, in the direction of Khartum, along the various caravan and pilgrim roads, which, unfortunately, do not extend in the direction of Lake No or south of it. The distance between Masena and Lake No nearly amounts to 800 geographical miles, being equal to that between Kuka and Timbuktu.

The feeders of Lake Tsad Dr. Barth traced to about 18° east long.; there a broad mountainous region extends from north to south, which, it is little doubtful forms the line of waterparting between the basin Lake Tsad and that of the Nile, and gives birth to the rivers running into the Bahr el Abiad at Lake No.

It is from Lake No that the New Expedition is going to penetrate to the westward, up the Bahr el Ghazel. This Expedition is fitted out by, and under the direction of, M. Brun Rollet, a Sardinian, who for the last twenty-three years has been residing in Khartúm, chiefly engaged in mercantile pursuits. This gentleman has already ascended the Bahr el Abiad several times from Khartúm as far as 5° north lat.,—of which explorations a full account will shortly be published. As may be supposed, Mr. Brun Rollet is intimately acquainted with the countries of the White River, its inhabitants and natural resources. He has been very successful in his mercantile transactions, particularly in ivory and gum, so abundant in those countries,—the yearly export of the former amounting at present to about 800 cwt. But he has reasons to know that the country he now proposes to explore is much richer in that and other articles of commerce. This Expedition will consist of six boats, manned by about sixty men, all well armed. M. Brun Rollet is strongly built and inured to the climate, of scientific attainments, and has been aided in his scientific outfit and preparations by the *savans* of Paris and Turin. The Expedition is entirely a private one, and undertaken by his own means, the French and Sardinian Governments having given him special letters of recommendation to the Pasha of Egypt.

M. Brun Rollet is at present in Cairo, and will shortly start for Khartúm, where his final preparations will be made for the ascent of the Bahr el Abiad and Bahr el Ghazel, in the direction of Waday. It may be noticed that the latter river has mostly been called Kellak in late years; but I am informed by M. Brun Rollet that the Arabs and the black natives of those countries do not know it under that name, but principally by that of Bahr el Ghazel, sometimes Misselad.

AUGUSTUS PETERMANN.

Royal Geographical Society.

At the last Anniversary Meeting of the Royal Geographical Society (May, 1855,) the report stated that the Patron's gold medal has been awarded to Dr. Livingston for his recent explorations in Africa, between Lake Ngami and the Portuguese settlements on the west coast; and a testimonial of the value of 25 guineas in surveying instruments, bearing a suitable inscription, to Mr. Charles John Anderson, for his travels in south western Africa, as laid down in his route-map communicated to the society. The Bishop of Oxford, in moving the adoption of the report, said, the award of the gold medal to Dr. Livingston, a friend of his own gave him indeed great pleasure, for he had been the means of introducing commerce and civilization to the uncivilized parts of the earth. As a minister of religion he had been the pioneer of art, commerce, and civilization. In geographical discoveries in many parts of the world they had followed the same tract as here, leading to the highest purposes of humanity and civilization. One of the most remarkable instruments used by Dr. Livingston was contained in his reducing to writing the language of the barbarous and uncivilized nations of the earth, and by their written language conveying the truths of Christianity to the uncivilized people. As Dr Livingston was the first man of their blood who had crossed the great continent of South Africa, most heartily did he congratulate the members of the Royal Geographical Society that their gold medal had gone into such hands.

The Earl of Ellesmere in his annual address, commenced by adverting to the members of the society who had been removed by death during the past year. First in importance was their friend and associate, Sir John Franklin, the hero and victim of the Arctic regions, for which service he had been trained almost from his youth. He suffered shipwreck in 1807, and honourably served under Nelson at Copenhagen and Trafalgar, and was one of six out of 60 who, standing on the poop of the Bellerophon, escaped unhurt. He served under Cornwallis and St. Vincent, and, although wounded, after his gallant services in war the harvest of his fame was still to be won. He was employed in America from 1809 to 1820, and by his services 1,200 miles of coast were added to the map of the British possessions. The sad details that had reached them left no room for hope, preceded as that intelligence was by the sacrifice of the gallant Bellot, which melancholy event inaugurated the alliance now happily existing between his own and this country. As long as the name of Franklin should be known, it would be venerated and admired After passing some warm eulogiums on the excellence of the late General Sir Andrew Barnard (Governor of Chelsea Hospital), Mr. Joseph Hume, Rear-Admiral Price, Colonel Lloyd, Sir Henry de la Beche, Mr. G. B. Greenough, Lord Dudley Stuart, and Lord de Mauley, he proceeded to comment on the advances that has been made in the acquirement of geographical knowledge during the past year. Since their last annual meeting Captain Collinson had returned in the Enterprise, having left his country in 1849, but had not added much to their geographical knowledge of the Polar Seas. By Dr. Rae's intelligent discoveries of the relics of Franklin's expedition there could be no doubt as to his melancholy fate, but still he hoped that further light would be thrown upon the subject by means of the Hudson Bay expedition. In allusion to the Arctic question he might observe that plans for the monument to Lieutenant Bellot had been submitted by the council, and it would shortly be erected near Greenwich Hospital. He also alluded to the opening of the trade between the United States and Japan, after all intercourse with the latter country had been closed for nearly two centuries. Having adverted to some other topics, in conclusion, he thanked the members for the indulgence they had shown him while he occupied the presidential chair, and announced, as his successor, Admiral Beechy, who would amply supply any deficiency they might have sustained.

Wheat from Ægilops*

The announcement by Prof. Dunal, of Montpellier, two or three years ago, that M Fabre, of that vicinity, had converted *Ægilops triticoides* into wheat, by cultivation for several generations, excited a lively sensation, which has not yet subsided. Prof. Dunal appears to have satisfied himself that *Ægilops triticoides*, or rather its ancestor, *Æ. ovata*,—a common grass on the southern coast of France,—is the original of wheat, and Prof. Lindley has adopted this opinion. This, if true, would be the only instance in which any one of the staple cereal grains has been identified with a wild original. Dunal's published account has called forth many detailed discussions, in which vari-

* American Journal of Science and Art.

ous views have been maintained; but at length a few simple experiments of M. Godron of Besançon appear to have disposed of the question. M. Godron's paper is published in the *Annales des Sciences Naturelles*, vol, ii. for 1854, No. 4. He remarks, in the first place, that the so-called species, *Ægilops triticoides*, is only of sparse and occasional occurrence; that it is seldom if ever found except in the vicinity of wheat fields, and in the districts where *Æ. ovata* abounds as a wild plant; that intermediate states between *Æ. ovata* and *Æ. triticoides* do not occur, as they are apt to do between races or varieties of any species; but that *Æ. triticoides* itself varies in certain respects and according to the kind of wheat which is cultivated in the neighborhood; and finally, that the wild *Æ. triticoides* usually produces very little seed. From these considerations he was naturally led to suspect *Æ. triticoides* to be a hybrid, resulting from the accidental fecundation of *Æ. ovata* by the pollen of wheat. And this conclusion he has verified by direct experiment; that is, he has raised *Æ. triticoides* from seeds produced by impregnating the ovaries of *Æ. ovata* by wheat pollen. At the same time, and in the same manner, M Godron produced a new and analogous hybrid by impregnating *Ægilops triaristata* with the pollen of common wheat; as well as another by impregnating *Æ. ovata* with the pollen of *Bearded Spelt* (*Triticum Spelta, barbatum*). It seems, therefore, most probable that M. Fabre's Ægilops-wheat owed its origin to the accidental fertilization of the *Æ. triticoides* experimented with—itself a hybrid between wheat and *Æ. ovata*—by the pollen of its male parent, wafted from adjacent wheat-fields; the cross-breed returning to the male type in the usual manner under such circumstances.

This evidence, however, does not convince Dr. Lindley; who objects that M. Godron and others have not explained what the origin of wheat has been, if it is not a domesticated condition of *Ægilops*;—an undertaken which we must say is by no means incumbent upon M. Godron, who had accomplished his object when he has shown, as he has clearly done, that M. Fabre's famous experiments do not prove Ægilops to be the original of wheat; although in his opinion the two should be ranked in the same genus. Can Dr. Lindley indicate the wild original of Maize, Rye, Barley, or Rice? And does the fact that the originals (if they indeed exist) are unknown, render it any more likely that these cereal grains are the progeny, in altered guise, of some other known Gramineæ?

The late Assyrian Expedition.

Col. Rawlinson has arrived in London from Bagdad, having brought to a close the excavations in Assyria and Babylonia which he has been superintending for the last three years on behalf of the Trustees of the British Museum. The results of these excavations have already in part reached the Museum, but the most valuable portions of them are still in transit. One hundred and fifty cases containing sculptures, inscribed tablets, terra-cotta cylinders, and a very large collection of small objects of Assyrian Art, were recently unpacked at the Museum. One perfect obelisk, and the fragment of a second, are the only objects of this collection which have been yet exhibited to the public in the Assyrian Gallery; but the inscribed tablets, which amount in number, we believe, to at least 10,000, the two fine cylinders from Kitch Shergat, and all the smaller relics—which, for better security, are deposited in closed cases—can be examined by the curious. A collection of almost equal extent and of greater value—inasmuch as the sculptures belong to the culminating period of Assyrian Art, and are infinitely superior to those which form the present Nineveh Gallery at the Museum—was shipped last month at Bussorah, and may be expected to reach the Thames in August or September; while a third or supplementary collection, composed of select specimens, the master-pieces of Assyrian Art which were disinterred from the new Palace at Nineveh during the past autumn and winter, is about to be brought to Europe, in virtue of an arrangement concluded between Col. Rawlinson and M. Place on board the Manuel, a vessel which was sent out by the French Government for the purpose of bringing home the collections of M. M. Place and Fresnel. Col. Rawlinson has further brought with him over-land a single small case, containing, among other relics of especial interest, the Nebuchadnezzar cylinders which he obtained from Birs Nimrud in the autumn of last year, and those still more valuable cylinders of Nabonidus, the last king of Babylon, which record the name of that monarch's eldest son Belshar-ezer, the Belshazzar of Daniel. It is sincerely to be hoped that means will be found for exhibiting these slabs to the public, as soon as the whole of the three collections shall have arrived, either by a new arrangement of the present Assyrian Gallery, or by the allotment of fresh space to the Antiquity Department of the Museum. Unless, indeed, some measures of this nature are taken, the fruits of the late Assyrian Expedition, of which the labours are now brought to a close, will be lost to the great majority of the nation,—the number of those who can appreciate the historical and scientific results, obtained from so vast an accumulation of cuneiform materials, being, of course, comparatively few.—*Athenæum.*

The Sault St. Marie Canal.

The leading demensions of this important link of communication between the Ocean and the Lake Superior regions are as follows:—

Its length is one mile and an eighth, its width 70 feet at bottom, and 100 at water line, depth 12 feet, and of sufficient capacity to admit steamboats of 2,000 tons burden, and larger than can pass up the St. Mary's River. This is sufficiently large for all the trade that will be carried on through it for years. If there were a ship canal round the Falls of Niagara of equal capacity, and a few thousand dollars expended in improving the navigation of St. Clair Flats and St. Mary's River, a steamer of 2,000 tons might make an uninterrupted passage from Liverpool to Fond du Lac, at the head of Lake Superior.

The Locks are deservedly admired on account of their beauty, durability and perfect manner in which the stone and workmanship had stood the test of a rigorous winter. The gates are of massive construction, but work with great ease, and being of vast strength, and securely fixed in their places, and stayed by numerous iron braces, four inches square, running down into, and anchored below the stone work, they can hardly be supposed to give way. They are easily handled by two men.

It is anticipated that the slope of the walls, (45 deg.) will interfere with the passage of side-wheel steamers, especially when the wind is blowing fresh, to obviate which difficulty, snubbing posts have been set a distance of four hundred feet apart on the tow-path side, and two hundred feet distant on the river or heel-path side, and the State Engineer is of opinion that a large scow will be required to keep the side-wheel crafts off the banks.

The present State tariff of tolls, is fixed at a minimum of four cents per ton, measurement, which would give on an ordinary schooner, from $10 to $15; on a brig, from $17.50 to $20; on a large propeller $30, and on side-wheel steamboats, from $40 to $50.

The means of getting boats and propellers through the Canal, is of course by the use of their wheels, but sail vessels will require to be towed, and for that purpose horses will be required, the expense of towage falling, of course upon the vessels. A wide and handsome tow-path has been made upon the right bank of the work, and a corresponding heel-path upon the left bank.

On the twenty-first May 1855, the day on which the State authorities were upon the work, there was 12 feet 8 inches of water at the head of the upper pier, and 12 feet 5 inches in depth in the lower lock, consequently any vessel, no matter how heavily laden, which has ever navigated the western waters, could pass up and down with ease, as the locks are seventy feet in width, and three hundred and fifty feet in length, in the clear. The average class of steamers do not draw over nine feet, loaded.

The artificial walls, or banks of the canal are from seventy to one hundred feet in thickness at the bottom, and thirty-five feet at the high water line, standing on both slopes at an angle of forty-five degrees, lined with dry stone work on the sides inward.

The aggregate lift of the locks, is seventeen feet six inches.

Use of Lime-Water in the Formation of Bread.

To neutralise the deterioration which the gluten of flour undergoes by keeping, bakers add sulphate of copper or alum with the damaged flour. Professor Liebig, however, has conceived the idea of employing lime, in the state of solution, saturated without heat. After having kneaded the flour with water, and lime, he adds the yeast, and leaves the dough to itself; the fermentation commences, and is developed as usual; and if we add the remainder of the flour to the fermented dough at the proper time, we obtain, after baking, an excellent, elastic, spongy bread, free from acid, of an agreeable taste, and which is preferred to all other bread after it has been eaten for some time. The proportions of flour and lime-water to be employed are in the ratio of 19 to 5. As the quantity of liquid is not sufficient for converting the flour into dough, it is completed with ordinary water. The quantity of lime contained in the bread is small—160 ounces of lime require more than 300 quarts of water for solution; the lime contained in the bread is scarcely as much as that contained in the seeds of leguminous plants. Professor Liebig remarks that "it may be regarded as a physiological truth, established by experiment, that corn flour is not a perfectly alimentary substance; administered alone, in the state of bread, it does not suffice for sustaining life. From all that we know, this insufficiency is owing to the want of lime, so necessary for the formation of the osseous system. The phosphoric acid likewise required is sufficiently represented in the corn, but lime is less abundant in it than in leguminous plants. This circumstance gives, perhaps, the key to many of the diseases which are observed among prisoners, as well as among children whose diet consists essentially of bread. * * The yield of bread from flour kneaded with lime-water is more considerable. In my household, 19 pounds of flour, treated with ut lime-water, rarely give more than 24½ pounds of bread; kneaded with 5 quarts of lime-water, the same quantity of flour produces from 26 pounds 6 ounces to 26 pounds 10 ounces of well baked bread. Now as, according to Heeren, 19 pounds of flour furnish only 24 pounds 1½ ounces of bread, it may be admitted that the lime-water bread has undergone a real augmentation."—*Annalen der Chemie und Pharmacie*, and *Chemist*, March, 1855.

Photography.—Employment of the Cyanid of Iodine.*

M. Stephane Geoffray, Advocate at Roanne, and a great amateur in the art of photography, has employed with success the cyanid of iodine as the sensitive agent in direct positives. This compound he obtains by the action of iodine upon cyanid of mercury. It is very soluble in a solution prepared with wax and benzine, and gives to this coating a rapidity of action nearly equal to that obtained by the use of ceroleine. Applied to collodion in the proportion of other iodids, the cyanid uniformly affords direct positive proofs of great beauty and which do not subsequently change. After fixation in the old bath of hyposulphite, the lights become very beautiful and are not inferior to those given by the use of the sesquichlorid of mercury.

M. Geoffray also employs the sesquichlorid of iron for all the purposes for which the sesquichlorid of mercury has been hitherto used, to bring out negative proofs on collodion and upon albumen in the manner employed for direct positives. He also employs this agent in place of the iodid to prepare sensitive papers for making positives in the shade and in a few seconds; according to the process of M. Blanquart-Evrard. With this chlorid he also prepares a dry collodion of excellent quality, as follows:

To 100 grammes of ordinary non-sensitive collodion he adds 50 centigrammes of dry and finely pulverized perchlorid of iron, having no acid reaction; he boils it for a quarter of an hour, and adds four drops of tincture of iodine and filters the mixture. The glass being perfectly cleaned, he pours on the collodion, waits a moment to allow the coating to acquire a certain solidity—then plunges it in a bath of nitrate of silver, again in distilled water, and finally is dried, protected from the dust. The image is revealed as usual by pyrogallic acid.

This collodion is more sensitive than that prepared by using the protochlorids, but is much less so than the moist collodions.

Artificial Alcohol.*

In my last communication I neglected to speak of the production of alcohol by means of water and illuminating gas. M. Berthelot has reached this important result through a species of contact between C_4H_4 dissolved in fuming sulphuric acid and water contained in the acid. This important discovery has been the subject of a Report to the Academy of Sciences by M. Thènard. In this Report (a very flattering one to the young chemist) the venerable Dean of French chemists points out several other attempts of M. Berthelot and among them that of converting grape sugar into cane sugar. In spite of certain difficulties, we may still believe this a possible result. Nevertheless M. Biot doubts the possibility of this change, because it requires that the intimate molecular structure of the substance should be changed, a change to which we have no analogy in the transformations hitherto made known. This difficulty however does not appear to MM. Thénard and Dumas as insurmountable; since in treating cane sugar, with an acid, its molecular constitution is changed so that its rotatory power over the polarized ray is reversed from right to left, why then should it be impossible to convert left-handed rotation to right-handed?

*American Journal of Science.

Micro-chemical Researches on the Digestion of Starch and Amylaceous Foods.*

BY PHILIP BURNARD AYRES, M.D. LONDON.*

After some general historical remarks on the methods hitherto employed in the investigation of the complicated phænomena of the process of digestion, the comparatively small results obtained by chemical analysis of the contents of the stomach, intestinal canal, and of the evacuations, by Tiedemann and Gmelin, Berzelius, and others, the author proceeded to demonstrate the necessity of a minute examination of the contents of the alimentary canal by the microscope, and such chemical tests as we possess for the determination of the changes of such articles of food as exhibit definite structure.

In order that we may ultimately arrive at a complete exposition of the phænomena of digestion, he is of opinion that it will be necessary to examine,—first, the structure of particular kinds of food, then the changes produced in them by cooking, and lastly to trace the changes they undergo at short intervals, through the alimentary canal from the stomach to the rectum. The results of a series of researches of this character on the changes in starch, and starch-containing foods, are presented in this memoir.

The method adopted for the examination of the changes in starch and starch-foods was as follows.—An animal was kept fasting twenty-four hours, and afterwards confined to a diet consisting of the starch or amylaceous food, with water, for five or six days, until the debris of all other kinds of food previously taken were cleared from the alimentary canal. At a determinate time, after a meal, the animal was killed, the abdomen laid open as quickly as possible, and ligatures placed at short intervals on the intestinal canal, from the pylorus to the rectum. The contents of the stomach and each portion of the intestinal canal included between the ligatures were then carefully examined. This mode of examination sufficed to determine the changes which occur in the food during normal digestion, but other questions as to the particular secretion or secretions by which the changes observed were effected.

The fluids poured into the alimentary canal are five in number,—the saliva, gastric juice, bile, pancreatic juice, and finally, the intestinal mucus.

The influence of the saliva is easily determined, by chewing the particular food subjected to experiment, and keeping the mixture at about 98° Fahr. The combined action of the saliva and gastric juice is seen in the contents of the stomach. To determine the action of the bile, the common bile-duct was tied, and to ascertain the action of the intestinal mucus, it was necessary to ligature the bile and pancreatic ducts. If the digestion of the substance is not effected in the stomach, it is evident that it cannot be attributed to the saliva or gastric juice; if the digestion is still effected in the intestinal canal after ligature of the bile-duct, it cannot be attributed to the action of the saliva, gastric juice or bile, if it still go on after ligature of the bile and pancreatic ducts, the digestive power must of necessity be referred to the action of the intestinal mucus, provided no change has previously taken place in the stomach; but if the food passes unchanged after cutting off the supply of bile and pancreatic juice, but proceeds after ligature of the bile-duct alone, the act of digestion must be referred to the pancreatic juice.

The author first briefly describes the structure of the starches and starch-containing vegetables employed in his experiments; then the changes produced by cooking, and finally enters on a minute description of the changes observed in the experiments he performed on normal digestion, and after cutting off the supply of bile and pancreatic juice.

The correct appreciation of the structure of the starch-granule is of considerable importance in relation to these investigations, and the author believes that he has been able to afford a satisfactory solution of these vexed questions. The changes observed during the digestion of starch favour the original opinion of Leuwenhoeck, that the starch-granule consists essentially of an investing membrane or cell-wall, enclosing an amorphous matter, the true starch, which strikes an intense blue colour with iodine; and these changes also support the opinion of Professor Quekett, that the concentric circles seen on the starch-granules of many plants are simple foldings of the investing membrane, leaving it still doubtful, however, whether these concentric circles are not in the starches of some plants composed of linear series of dotted elevations or depressions of the investing membrane.

* The London, Edin. and Dub. Phil. Mag.

By these experiments it was determined that the concentric circles remain after the whole of the starch matter, colourable by iodine, was removed, and that even then the characteristic cross and colours were still seen when the granules were viewed by polarized light, although more feebly than before, this result being probably due to the lessened power of refracting light, after the removal of the starch matter.

After describing the structure of the wheat-grain and flour, the changes occurring in the wheat-starch during the manufacture of bread are given in detail, but the most interesting of the changes produced by cooking are those seen in the boiled or roasted potato and in the boiled pea.

In each of these the act of cooking effects two purposes:—it causes great enlargement and physical change of the starch-granules, and dissolves the intimate adhesion of the starch-cells, which afterwards appear as ovoid or globular, slightly adherent bodies distended by the swollen starch-granules, the out-lines of which are indicated by more or less irregular gyrate lines, produced by the mutual compression of the starch-granules within an inelastic cell-membrane.

The starch-granules of the pea possess a much thicker investing membrane than those of the potato, which causes their outlines to remain much more distinct after the removal of the true starch substance during the process of digestion. The other structures seen in the pea are carefully described, the most curious among them being the cells composing the external layer of the testa, which bear so strong a resemblance to columnar epithelium of the intestine, that they might be mistaken for the latter by an inattentive observer.

The substances submitted to experiment were,—1, boiled wheat-starch; 2, wheaten bread, 3, uncooked tous les mois, 4, boiled tous les mois, 5, boiled potato; 6, uncooked peas; 7, boiled peas, 8, boiled peas after ligature of the bile-duct; 9, boiled potatoes after ligature of the bile and pancreatic ducts. Several subsidiary experiments were made to determine the action of the intestinal mucus, the saliva, and the substance of the pancreas, on starch.

The conclusions at which the author arrives from the experiments are,—

1. That the starch-granule is composed of two parts, chemically and histologically distinct,—a cell-membrane and homogeneous contents. The markings seen on many varieties of starch are referred to folds or markings of the investing membrane.

2. No perceptible change occurs in the starch, whether raw or cooked, during its sojourn in the stomach of quadrupeds or the ventriculus succenturiatus and gizzard of birds, all the granules preserve their perfect reaction with iodine and their pristine appearance.

3. The conversion of boiled starch into dextrine and glucose is chiefly effected in the first few inches of the small intestine, but it continues to take place in a less degree throughout the entire intestinal canal.

4. In the digestion of boiled wheat or other starch, or of wheaten bread, the bulk of the mass rapidly diminishes in its passage through the small and large intestines, so that it ultimately yields only a small quantity of fæcal matter. After being deprived of their contents, the membranes of the granules shrink and shrivel up into a minute granular matter, which constitutes the chief bulk of the fæcal evacuations after an exclusive diet of starch food.

5. The digestion of raw starch food (peas) in the pigeon or other granivorous birds goes on much more slowly, and progresses pretty equally throughout the entire intestinal canal. The starch-granules, whether free or included in cells, become intersected by radiating or irregular lines or fissures, more or less opaque or granular; they also gradually lose their characteristic reaction with iodine; and this important change, commencing at the surface, progresses towards the centre, until the whole of the starch matter is removed, leaving the starch membranes often apparently whole, retaining their characteristic markings. The fissured and granular condition of the starch-granules is not due to their trituration in the gizzard, but to the action of the intestinal fluids, since it was often seen in granules enclosed in and protected by perfect starch-cells. In the digestion of raw starch food, a considerable quantity always escapes change, for many starch-cells and granules in the fæces perfectly retain the characteristic reaction with iodine.

6. As the starch remains unchanged in the stomach, its conversion into glucose cannot be attributed to the saliva or gastric juice, unless we suppose these fluids to remain inactive in the stomach, and suddenly to regain their activity in the first part of the small intestine. The author found that the saliva was capable of effecting the conversion of starch into glucose, but that the mixture of saliva and gastric juice in the stomach did not possess that property even after being rendered alkaline by carbonate of soda. It is probable that the converting power of the saliva, as it flows from the mouth, depends not on the true saliva, but on the buccal mucus; for Magendie found that saliva taken from the parotid duct was wholly inactive, while the mixed saliva from the mouth effected the conversion with great facility. Unless, then, the sublingual and submaxillary glands secrete a different fluid from the parotids, it is evident that the activity of the saliva must be attributed to the buccal mucus.

7. The difference between the digestion of boiled and raw starch in dogs is seen in the experiments on the digestion of boiled wheat-starch, boiled tous les mois, and bread. In all these, some starch-granules escape the action of heat and water, and remain in nearly their pristine condition. These uncooked starch-granules undergo slow and imperfect changes, being fissured, broken, and more or less altered, but in general retaining their characteristic reaction with iodine.

8. The conversion of starch into glucose is not effected by the bile, since after ligature of the common bile-duct, the changes occur to as great an extent as when the bile passes freely into the intestinal canal.

9. It is not due to the pancreatic juice, inasmuch as after ligature of the bile and pancreatic ducts in the same animal, the digestion of starch is still effected.

10. The only remaining secretion is the intestinal mucus, which is especially abundant at the upper part of the intestinal canal: and a further proof is afforded of the activity of the intestinal mucus taken from the upper part of the duodenum above the entrance of the pancreatic duct after ligature of this duct and the common bile-duct, by its capability of converting a large quantity of fresh boiled starch into glucose out of the body.

11. In the cooking of starch-containing vegetables, such as potatoes and peas, the adhesion of the starch-cells is dissolved or weakened, so as to render them easily separable and amenable to the action of the intestinal fluids. At the same time the starch-granules undergo a large increase in bulk, distend the cells, and by their mutual compression, their outlines present the appearance of gyrate lines beneath the cell-wall. The cells seldom burst so as to emit their contents, or present any appreciable opening through which the intestinal fluids can directly penetrate. The author cannot positively affirm so much of the starch-membranes, because these are so extremely delicate that fissures might be invisible, but he believes that in a great number the membranes remain entire.

12. If this be the case, the conversion of starch matter into glucose must be effected by the permeation or endosmose of the intestinal fluids through the invisible pores of two membranes, in the digestion of the pea, the potato, and other similar foods, and the glucose must escape through the same membranes by exosmose.

13. Before the conversion of starch into glucose, the amylaceous matter contained in the starch is more dense than the intestinal mucus in immediate contact with the cells, and an inward current or endosmose is established, but after that conversion, the syrupy fluid is less dense than the mucus, and then an outward current or exosmose occurs, by which the glucose escapes from the cells into the intestine and is absorbed. If this be the case, as the details of the experiments tend strongly to prove, a new and important function is assigned to the intestinal mucus.

14. In normal digestion, chyme escapes very slowly from the stomach into the duodenum, in small quantities, as it is detached from the alimentary mass by the muscular movements of the stomach, and this gradual propulsion often occupies several hours after a meal. This slow propulsion is evidently intended to expose the comminuted food fully to the action of the intestinal juices, and produce an intimate mixture with them. The comparatively empty condition of the upper part of the small intestine, even during active digestion, is thus fully explained.

15. If the food be too finely divided or incapable of a second solidification in the stomach, it passes too rapidly into the first part of the small intestine, is insufficiently mixed with the intestinal fluids, and a considerable part escapes digestion. On the other hand, if it enters the small intestine in masses incapable of reduction by the muscular action of the parts or solution in the fluid, it traverses the intestinal canal unchanged, except at the surface, which is then alone exposed to the action of the intestinal fluids.

16. It is not necessary for the conversion of starch into glucose that the fluids in the duodenum or other parts of the intestinal canal should be alkaline, or even neutral, for in several of the experiments the contents of every part of the alimentary canal had an acid reaction.

17. The greater part of the intestinal mucus is not excrementitious, for little, if any, mucus is perceptible in the fæces in normal digestion, except at their surface, whereas the greater proportion of the contents

of the small intestine consists of mucus. A considerable quantity of mucus is seen in the cæcum, but it rapidly diminishes in the colon, and is scarcely detectible in the fæces, except that on the surface, which is *probably derived from the mucous membrane of the rectum.* The author raises the question, whether one of the chief functions of the cæcum is not to effect the conversion of the intestinal mucous into some other substance capable of re-entering the blood, and performing some ulterior purpose in the animal economy.

18. In normal digestion, the separation of the epithelium of the mucous membrane of the intestine is the exception instead of the rule, as stated by some physiologists. The author questions the theory of the detachment of the epithelium of the villi in each act of absorption, on the grounds that the presence of detached epithelium was unfrequent in the whole course of his experiments; that epithelium is readily detached by manipulation; that the continual reproduction of such a vast amount of cell-tissue must necessarily be accompanied by a vast expenditure of vital force; and finally, that it is not necessary, because fluids readily penetrate epithelial membranes.

19. The passage of a given food through the whole length of the intestinal canal may occupy a comparatively short time, especially when the animal is fasting. In one experiment, where a pigeon refused food until the fæces contained no visible debris of previous food, starch-granules were detected in the fæces within two hours after a meal, and this although the intestine of this animal is extremely narrow and about a yard in length.

20. A remarkable circumstance in the digestion of starch or starch foods is the constant presence of myriads of Vibriones in the lower part of the intestinal canal. They are generally first observed in the lower part of the small intestine, as minute brilliant points, just visible with a power of 600 diameters, in active movement. They increase in numbers towards the cæcum, in which a large number of fully-developed vibriones are constantly seen. These minute organisms increase in size and length in the colon and rectum, and their fissiparous mode of propagation, first described by the author in the 'Quarterly Journal of Microscopical Science,' may be distinctly traced by examining the contents of these portions of the intestine.

The Tempering of Steel.

In the discussion on Mr. Sanderson's paper, "On the Manufacture of Steel," an inquiry was made as to the kind of Steel suitable for particular articles, and how its quality might be tested. This gave rise to the remark that the tempering of steel depended on the skill and experience of the workman. Mr. Harry Scrivenor, of Liverpool, has, however, obtained from a clever workman the following memoranda on the subject:—

"I received your letter inquiring what steel was best for different kinds of manufactures. I should say cast-steel, if it can be applied; double shear for hatchets, or any kind of edge tool that cannot be well made of cast-steel. The temper to be as follows:—

"1st. For boring cylinders, turning rolls, or any large cast iron, let it be as hard as water will make it, minding not to heat it more than a cherry red.

	Degrees. Fahr.
2nd. Tools for turning wrought iron, pale straw colour	430
3rd. Small tools for ditto, shade of darker yellow	450
4th. Tools for wood, a shade darker	470
5th. Tools for screw taps, &c, still darker straw colour	490
6th. For hatchets, chipping chisels, brown yellow	500
7th. For small rimers, &c., yellow, slightly tinged with purple	520
8th. For shears, light purple	530
9th. For springs, swords, &c., dark purple	550
10th. For fine saws, daggers, &c., dark blue	570
11th. For hand and pit saws &c., pale blue	590

"The temper greatly depends on the quantity of carbon that is in the steel—this the practical man soon finds out, and he tempers or draws down his t[illegible] accordingly."—*Jour. Soc. Arts.*

Oxygen in the Nascent state—Ozone.

For some time past, observations have been made in Europe on atmospheric ozone. Owing to the persevering efforts of MM. Wolf of Berne, D. Bœckel of Strasburg, and Dr. Simonin of Nancy, some general facts of the highest interest have been reached by the use of Schönbein's test (*i. e.* paper made sensitive by starch and iodid of potassium). According to those observations there exists an intimate *relation between the quantity of ozone in the air and certain epidemic* diseases such as cholera, grippe, intermittent fever, &c. They think they have established that the appearance of the grippe coincides with the presence in the air, of an excess of ozone; that on the contrary the invasion of cholera is accompanied by almost complete absence of ozone in the air; this is at least true for the places above named.

It is well known that ozone is regarded as an isomeric or allotropic condition of oxygen. MM. Becquerel and Fremy have called it electrized oxygen and have prepared it, by submitting pure oxygen to the electrical current.

The following is a new mode of preparing it in abundance (or at least a *similar* body) capable of oxydizing silver, of decomposing iodid of potassium, of burning ammonia, of disengaging chlorine from hydrochloric acid, and of forming water with hydrogen. This simple process consists in treating peroxyd of barium ($Ba\,O_2$) with monohydrated sulphuric acid at a temperature below 70° C. The oxygen disengaged in this process possesses the properties named above, and it has the characteristic odor which is known as the Lobster odor. M. Houzeau assistant to M. Boussingault, is the author of this process which he discovered during a series of researches on the preparation of oxygen from the peroxyd of barium by heat.—*Cor. of M. Nicklès.* —*Sill. Journal.*

Chinese Method of Scenting Tea.

A few weeks ago I sent you an account of the Chinese method of dyeing teas with Prussian blue and gypsum, to suit our depraved tastes in England and America. I shall now endeavour to describe a much more agreeable and rational manufacture—namely, that of scenting teas. That it is so in the eyes of the Chinese, may be gathered from the fact, that while they *dye* their teas not to drink, but only to sell, they consume and appreciate highly these scented teas. The following account of this interesting process is copied from my journal:—

"I have been making inquiries for some time past about the curious process of scenting teas for the foreign markets; but the answers I received to my questions were so unsatisfactory that I gave up all hopes of understanding the business until I had an opportunity of seeing and judging for myself. During a late visit to Canton I was informed the process might be seen in full operation in a tea factory on the Island of Honan. Messrs. Wilkinshaw and Thorburn, two gentlemen well acquainted with the various kinds of teas sent annually to Europe and America, consented to accompany me to this factory, and we took with us the Chinese merchant to whom the place belonged. I was thus placed in a most favourable position for obtaining a correct knowledge of this curious subject. When we entered the tea factory a strange scene was presented to our view. The place was crowded with women and children, all busily engaged in picking the stalks and yellow or brown leaves out of the black tea. For this labour each was paid at the rate of six cash a catty, and earned on an average sixty cash a day,—a sum equal to about threepence of our money. The scene altogether was not unlike that in the great Government Cigar Manufactory at Manilla. Men were employed giving out the tea in its rough state, and in receiving it again when picked. With each portion of tea a wooden ticket was also given, which ticket had to be returned along with the tea. In the northern tea countries the leaves are carefully weighed when they are given out and when they are brought back, in order to check peculation, which is not unfrequent. I did not observe this precaution taken at Canton. Besides the men who were thus employed, there were many others busily at work, passing the tea through various sized sieves, in order to get out the caper, and to separate the various kinds. This was also partly done by a winnowing machine, similar in construction to that used by our farmers in England. Having taken a passing glance at all these objects on entering the building I next directed my attention to the scenting process, which had been the main object of my visit,—and which I shall now endeavour to describe.

"In a corner of the building there lay a large heap of orange flowers, which filled the air with the most delicious perfume. A man was engaged in sifting them, to get out the stamens and other smaller portions of the flower. This process was necessary, in order that the flowers might be readily sifted out of the tea after the scenting had been accomplished. The orange flowers being fully expanded, the large petals were easily separated from the stamens and smaller ones. In 100 parts 70 per cent. were used and 30 thrown away. When the orange is used, its flowers must be fully expanded, in order to bring out the scent; but flowers of jasmine may be used in the bud, as they will expand and emit their fragrance during the time they are mixed with the tea. When the flowers had been sifted over in the manner described they were ready for use. In the meantime the tea to be scented had been carefully manipulated, and appeared perfectly dried and finished. At this stage of the process it is worthy of observing, that while the tea was perfectly *dry* the orange flowers were *just as they had been gathered from the trees.* Large quantities of the tea were now mixed up with the flowers, in the proportion of 40lb. of flowers to 100lb. of tea. This *dry* tea and the *undried* flowers were allowed to lie mixed together for the space of twenty-four hours. At the end of this time the flowers were sifted out of the tea, and by the repeated sifting and winnowing processes which the tea had afterwards to undergo they were nearly all got rid of. Sometimes a few stray ones are left in the tea, and may be detected even after it arrives in England. A small portion of tea adheres to the moist flowers when they are sifted out, and this is generally given away to the poor, who pick it out with the hand.

"The flowers, at this part of the process, had impregnated the tea leaves with a large portion of their peculiar odours, but they had also left behind them a certain portion of moisture which it was necessary to expel. This was done by placing the tea once more over slow charcoal fires in baskets and sieves prepared for the purpose of drying. The scent communicated by the flowers is very slight for some time, but like the fragrance peculiar to the tea leaf itself, comes out after being packed for a week or two. Sometimes this scenting process is repeated when the odour is not considered sufficiently strong; and the head man in the factory informed me he sometimes scented twice with orange flowers, and once with the "Mo-le" (*Jasminum Sambac*).

"The flowers of various plants are used in scenting by the Chinese, some of which are considered better than others, and some can be had at seasons when others are not procurable. I considered it of some importance to the elucidation of this subject to find out not only the Chinese names of these various plants, but also by examining the plants themselves, to be able to give each the name by which it is known to scientific men in all parts of the world. The following list was prepared with great care, and may be fully relied upon. The numbers prefixed express the relative value of each kind in the eyes of the Chinese, and the asterisks point out those which are mostly used for scenting teas for the foreign markets:—

1. Rose, scented (Tsing moi-qui hwa).
1 or 2. Plum, double (Moi hwa).
2*. Jasminum Sambac (Mo-le-hwa).
2 or 3*. Jasminum paniculatum (Sieu-hing-hwa).
4*. Aglaia odorata (Lan-hwa, or Yu-chu-lan),
5. Olea fragrans (Kwei hwa).
6*. Orange (Chang hwa).
7*, Gardenia florida (Pak-sema hwa).

It has been frequently stated that the Chloranthus is largely used. This appears to be a mistake, originating, no doubt, in the similarity of its Chinese name to that of *Aglaia odorata*. The Chloranthus is called 'Chu-lan;' the Aglaia 'Lan' or 'Yu-chu-lan.'

"The different flowers which I have just named are not all used in the same proportions. Thus, of Orange flowers there are 40 lb. to 100 lb. of tea; of Aglaia there are 100 lb. to 100 lb.; and of *Jasminum Sambac* there are 50 lb. to 100 lb. The flowers of the Sieu-hing (*Jasminum paniculatum*) are generally mixed with those of the Mo-le (*Jasminum Sambac*) in the proportion of 10 lb. of the former to 30 lb. of the latter, and the 40 lb. thus produced are sufficient for 100 lb. of tea. The 'Qui-hwa' (*Olea fragrans*) is used chiefly in the northern districts as a scent for a rare and expensive kind of Hyson Pekoe,—a tea which forms a most delicious and refreshing beverage when taken *a la Chinoise*, without sugar and milk. The quantity of flowers used seemed to me to be very large; and I made particular inquiries as to whether the teas that are scented were mixed up with large quantities of unscented kinds. The Chinese unhesitatingly affirmed that such was not the case, but notwithstanding their assertions, I confess I have some doubt on this point.

"The length of time which teas thus scented retain the scent is remarkable. It varies, however, with the different sorts. Thus the *Olea fragrance* tea will only keep well for one year; at the end of two years it has either become scentless, or has a peculiar oily odour which is disagreeable. Teas scented with Orange blossoms and with those of

the Mo-le will keep well for two or three years, and the Sieu-hing kinds for three or four years. The Aglaia retains the scent longer than any, and is said to preserve well for five or six years. The tea scented with the Sieu-hing is said to be most esteemed by foreigners, although it is put down as second or third rate by the Chinese.

"Scented teas for the foreign markets are nearly all made in Canton, and are known to merchants by the names of 'Scented Orange Pekoe,' and 'Scented Caper.' They are grown in and near a place called Tai-shan, in the Canton Province Mr. Walkinshaw informs me that other descriptions of tea, both black and green, have been scented for the English market but have been found unsuitable. True 'caper' is to black tea what the kinds called 'imperial' and 'gunpowder' are to green: it assumes a round, shot-looking form, during the process of manipulation, and it is easily separated from the other leaves by sifting or by the winnowing machine. It is a common error to suppose that 'imperial' or 'gunpowder' amongst green teas, or 'caper' amongst black ones, is prepared by rolling each leaf singly by the hand. Such a method of manipulation would make them much more expensive than they are. One gathering of tea is said to yield 70 per cent. of orange pekoe, 25 of souchong, and 5 of caper. The quantity of true caper would therefore appear to be very small; but there are many ways of increasing the quantity by peculiar modes of manipulation.

"In a large factory, such as this at Canton, there is, of course, a considerable quantity of dust and refuse tea remaining after the orange pekoe, caper, and souchong have been sifted out of it. This is sold in the country to the natives at a low price, and no doubt is often made up with paste and other ingredients into those *lie teas* which now-a-days find a market in England. Nothing is lost or thrown away in China. The stalks and yellow leaves which have been picked out by women and children are sold in the country; while the flowers which have done their duty in the scenting process are given to the poor, who pick out the few remaining tea leaves which had been left by the sieve or winnowing machine. Some flowers, such as those of the Aglaia for example, after being sifted out from among the tea are dried and used in the manufacture of the fragrant 'joss stick,' so much used in the religious ceremonies of the country.

"It appears from these investigations that many kinds of fragrant flowers besides those used by the Chinese would answer the purpose equally well, and therefore in places like India, where tea is likely to be produced upon an extensive scale, experiments in scenting might be made with any kinds of Jasmines, Daphnes, Aurantiaceous or other fragrant plants indigenous to the country."—R. F.

Consumption of Smoke.

The following synopsis of conclusions arrived at by the General Board of Health (Eng.), with reference to the operations of inventions for the consumption of smoke, has been submitted to Viscount Palmerston by the Board.

1. That the emission of smoke is the effect and may be taken as the proof of imperfect combustion, and is therefore always attended with waste of fuel.

2. That the fuel wasted is not only the visible smoke, which is unburnt carbon, but generally a far larger portion in the form of gas, both common coal gas and that called carbonic oxide, which is only half-burnt carbon, and which therefore has not produced the heat which it would have generated if it had been perfectly consumed.

3. That the chief impediment to the prevention of smoke in manufactories is the insufficient boiler surface in proportion to the steam required; a deficiency which causes waste in two ways; first because much of the heat produced escapes up the chimney uselessly, and next because this deficiency has to be made up by over-firing, whence imperfect combustion and consequent waste of fuel.

4. The employers of furnaces labour under great difficulty as to the best and most economical use of fuel, because ordinary makers of furnaces seem to be guided in their construction by little better than empirical rules, instead of acting upon well established scientific principles or the results of accurate experiments.

5. That notwithstanding this great difficulty many persons have succeeded in entirely preventing the escape of visible smoke, except while first lighting their furnaces, and many others have reduced the time during which smoke is emitted to a small fraction of its former amount.

6. That experience has fully proved that there is no truth in the common allegation, that if smoke be prevented, there must be increased difficulty in getting up and maintaining steam.

7. That successful modes of preventing smoke, if there be proper boiler surface, may be adopted without the infringement of any patent

right, the methods in question not having been patented or the patents having expired.

8. That notwithstanding the great and obvious advantages of perfecting the combustion of fuel, and the certainty that the cost of doing so will be amply repaid by the saving effected, such is the indisposition of practical men to depart from the beaten track, that nothing but the force of law is likely to ensure the care and attention necessary to protect the public from a grievous nuisance, the manufacturers themselves from heavy unnecessary expense, and the national resources from grievous waste of fuel to the amount of millions a-year.

9. That though the absolute and immediate prohibition of smoke could not be enforced without compelling most of the owners of furnaces to incur very heavy expenses, its reduction to a very small amount may be effected with comparative ease, and with very great benefit both to themselves and others; while it cannot be denied, that any who produce more smoke than others who use fuel for the same purposes, do produce more than is practically necessary.

10. That the enforcement of smoke regulations can be most easily and quickly effected by the appointment of constables to keep a regular and constant watch upon all chimneys liable to emit much smoke; and that the prevention of smoke will be more quickly and certainly effected by constant supervision and immediate information of any breach of the regulations, than by heavy penalties irregularly imposed.

11. That great facility in the prevention of smoke would be afforded by the publication of the specifications and descriptions of patented and other inventions for the prevention of smoke, by which those interested could be informed what they could and could not do in this matter, without infringing upon any patent right.

12. That great facility would also be afforded by the appointment of officers specially qualified, and *not connected with any patentee, or manufacturer of boilers or furnaces*, to superintend the police officers employed to suppress the nuisance of smoke, and to advise owners of furnaces how best to comply with the provisions of the law, and to report upon cases of its infringement.

Pre-historic History of Scotland.*

Geology, properly speaking, is a branch of history which reveals the current of past events, not by the aid of documents, or the interpretation of traditions, but by the observation of skeletons and remains of vegetation. Consequently, the greater, and by far the most striking, part of geological history, relates to what took place before man appeared upon the scene. There is, however, a long interval between the occupation of the world by man and the commencement of history proper. Take, for example, the case in this respect of our own island. From the time when Pharaoh was contemplating the erection of the pyramids, or Cecrops founding Athens, or Joshua besieging Jericho; from the time, in fact, when mankind began to disperse over the world to the landing of Julius Cæsar at Deal, what does history tell us of the habits and customs of the early inhabitants of Britain—of our savage ancestors? Nothing. There may, however, be said to be a geological formation lying over the newest tertiary, deposited ere history began her records, and containing the fossils of men who have dwelt in it, but of men of we know not what tribe or nation, and of whom history has never given, and never can give an account; yet the researches recently made geologically into the anthropological formation, if we may so term it, have at least thrown some light into that which was utter darkness.

Antiquarianism, notwithstanding its having been a very favourite pursuit with many, has never until quite recently attempted to solve this problem. Indeed, to the antiquary, the unknown savage, of whom history told no tale, was an object of contempt. He must have a Danish axe in his coffin, or a Roman toga for a shroud, before antiquarian sympathy can be roused. Antiquarianism was thought a branch, and a subordinate branch of history, and not a science of itself; and still less a geologically connecting link between geology and history, destined in some sort to fill up the blank and dreary space that extended between the two. Of late, however, this has been amended. The Scandinavian antiquaries have geologically deduced some important facts regarding the pre-historic period; and Dr. Wilson has followed up the inquiry, with regard to Scotland, in a manner worthy of all praise. His work upon the pre-historic antiquities of Scotland contains an immense mass of facts, with a due proportion of rational deduction. Taking it for a guide, we may conclude pretty nearly as follows:—

Scotland (and unquestionably England and Ireland also) has, without doubt, been inhabited for a very long time; probably for many centuries before the Roman invasion, and the beginning of historical records. From a diligent examination of ancient tombs and their contents, and of other monuments and remains, it is made clear that three different subformations, if we may so call them, may be traced in Scotland, extending from the colonization of the land to the commencement of history. The first may be called the Stone formation; because the men that lived during it, and whose remains are found in it, were acquainted with no weapons, implements, or utensils, save such as were constructed out of stone. The second may be denominated the Bronze formation; as during its prevalence, we have evidence that the inhabitants were acquainted with tin and copper, and constructed weapons, ornaments, &c., of bronze—a compound of these two metals. The third is the Iron formation; so called, because those who figured in it knew and employed iron—and with the close of this formation begins the dawn of history.

It is curious to think that, during the deposition of these prehistoric formations, Scotland was a forest, and that where now is mile after mile of moss and blackness, there flourished oaks; and that among these lived numerous wolves, wild boars, and savage bulls. To secure himself from these enemies, even if he had none such in his brother man, the aboriginal Caledonian required a dwelling; and even in the stone period, he contrived to have some such protection. The dwellings of the men of this state were like those of the badgers, and indeed like those of certain natives of Siberia at this day—underground. Dr. Wilson has collected curious instances of such. They are, he tells us, most uniformly found in groups—a striking instance of the propensity of mankind to sympathize with each other. The rudest of them are merely excavations in the ground, and do not appear to have been longer than eight feet, and not even stones were employed to make them more substantial.

Stones, however, were often employed in constructing them. "The Aberdeenshire caverns," writes Wilson, "are constructed of huge masses of granite, frequently above six feet in length; and, though by no means uniform either in internal shape or dimensions, a general style of construction prevails throughout the whole. Some of them have been found upwards of thirty feet long, and from eight to nine feet wide. The walls are made to converge towards the top, and the whole is roofed in by means of the primitive substitute for the arch which characterizes the Cyclopean structures of infant Greece, and the vast temples and palaces of Athens and Yucatan. The huge stones overlay each other in succession, until the intervening space is sufficiently reduced to admit of the vault being completed by a single block extending from side to side. They have, not unfrequently, smaller chambers attached to them, generally approached by passages not above three feet in height; and it affords a curious evidence of the want of efficient tools in the builders of those subterranean structures, that when these side apartments are only separated from the main chamber by the thickness of the wall, the stones, though placed flush with the walls of the latter, project irregularly into the small cells, giving them a singularly unshapely and ragged appearance."

These subterranean dwellings are very common in Scotland, and there is scarcely a moor, perhaps, in which, if sought for, they may not be found. The remains of foxes and animal bones are found in them, together with weapons, personal ornaments, and implements, all made of stone. Upon one or two occasions, the weapons, or part of the stone weapon that had inflicted death, has been found in the tomb containing the skeleton of the murdered man. It seems almost strange to find, in so rude and barbarous an age, personal ornaments; but such abound. Among the most remarkable of these, are two stone imitation horse-collars, which were found near Glenroy, and which are elaborately carved. Generally speaking, however, these ornaments are not well finished, and very often are only necklaces made of oyster and cockle shells strung together.

The skeletons found in the sepulchres belonging to the stone period, tell us that the Aborigines were a short and poorly developed race, particularly in their hands and feet. Their crania are very remarkable. The jaws and zygomata and bones of the face are large, while the skull cap is small; in fact, they present just such a conformation as we should expect to find among savage hunters who had no opportunity of intellectual exercise. We infer from the examination of these crania, that their possessors belong to Prichard's division of the human

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* Pre-historic History of Scotland, by Daniel Wilson, L.L.D., University College, Toronto. Abstract of an article in the Westminster Review, July 1855.

race, named by him Allophylians. Dr. Prichard maintains that the religion of these Allophylian tribes was Fetishism, and mainly consisted in the employment of spells and incantations, without any hope or fear of a future state in which there should be retributive justice.

It is a curious fact on a small scale, that the teeth in these Allophylian crania are uniformly found perfect and unchanged. Animals that live nearly entirely upon flesh may to this day generally be observed to preserve their teeth in like manner to old age. But the cause of the exemption of these aboriginals from toothache may have been partly the shortness of their lives, and partly the prevalence of hunger and absence of dyspepsia.

To the stone period succeeded that of the Bronze. This country has from time immemorial been famous for her mines of copper and of tin. There can be no doubt but that the Tin Islands of Herodotus referred to Cornwall and its adjacent islets, and that the Phœnicians visited them for the sake of their important metals. We can even trace indications of these visits in the earliest British coins, which have a Phœnician construction. Implements weapons, and utensils of bronze were probably first obtained from the foreign visitors, but ultimately our forefathers would learn to construct them for themselves; and in the remains of this bronze formation, in which, however, no iron is to be found, we perceive evidences of an extended civilization, a greater amount of comfort, the possession even of luxuries, and of an increased development of intellectual attainments.

Thus the men of these islands no longer dwelt in underground holes, but erected structures from the spoils of the adjacent forest. The cleared spaces would give opportunity for the hunter to practise the art of the husbandman, and his new alloy would afford him the means of tilling the soil. The weapons used in war became, if not more deadly than the old stone ones of sling-balls, more elegant, and we perceive weapons of defence as well as offence. Of this latter kind, the more common remains are those of shields, uniformly round, and with bosses in the centre. The domestic utensils formed of bronze, or rather the remains of them, show considerable art and refinement; and to this class, along with those of bronze, we must now associate some of pottery. Personal ornaments too assume a degree of elegance that strongly contrasts with the oyster necklaces of the rude inhabitants of the stone period, and we learn from such of these as we find lying in the ground of the bronze formation, that those who dwelt here during its deposition were also acquainted with gold and silver. Perhaps the greatest indication of all, of the improved civilization of the men of this formation, is the fact of inscriptions occurring on their sepulchral monuments. The men of the stone time were burned without any indication that their course was not altogether run, but those of the bronze period were even after dead still represented as linked up with human aspirations and futurity. Last of all, we trace in the remains of this period, preponderance of female ornaments, indicative of women having attained a higher social position.

From this we come to a new formation, containing relics of man along with worked iron. We have not space to dwell upon its characteristics;—the many uses to which that metal was put,—the signs of the subjugation of the horse,—the evidence of the existence of strongholds—of the greater cranial development of the skulls, or of the appearance of the true Celtic head. We are able to trace the dying away of this formation, and of its passing into the traditional histories, the times of Macbeth and his wife Gruach; St. Patrick, St. Keernan, and the Northmen. Then we come to the days of history.

Even in these (geologically speaking) recent times, the transition of land to sea, and of sea to land, has in Scotland been considerable. For example, ten yards under the surface of the present canal of Falkirk, and far removed from any navigable stream, a canoe was found. Nay, in the same district, when constructing the Union Canal, the skeleton of an elephant was discovered, pointing perhaps to land communication long since destroyed. At the distance of a mile from the Frith of Forth, the bones of a whale were discovered, with a bone harpoon in them. Still more recently, another whale's skeleton with another harpoon was found seven miles farther inland, on what is now the Blair Drummond estate. Analogous remains have been discovered about the valley of the Clyde, all of which go to prove that it too was once the bed of an extinct estuary. Other relics in other localities tell the same tale for their districts, and show us that the geographical appearances of Scotland have been greatly changed, and that former seas have become dry land, as also former lands have probably become sea-beds.

Permanent Impressions of Flowers on Glass.*

Mr. Robert Smith of Blackford, who has often contributed to our pages, has contrived a very ingenious and effective plan of ornamenting glass, by producing thereon, permanent impressions of flowers, leaves of plants, and other objects. In this process of ornamentation, the operator goes to work by first preparing the objects to be reproduced on the glass surface with a solution of gum. The details of the figure are thus attached to the glass, in the positions required by the device. The entire face of the glass thus treated, is then covered over with a composition of oil, tallow, and wax, in a warm state. When this composition coat becomes solid, the objects are removed from the glass, which is now submitted to the action of fluorine gas; or liquid fluorine may be poured upon the glass; or further, the plate may be treated with fluor spar and sulphuric acid. This is the ordinary treatment involved in glass etching—the peculiarity of Mr. Smith's process being the mode in which the design or the line of action of the acid is produced. The fluorine corrodes the glass only at the parts where the flowers or pattern objects have been placed, and hence the forms of the objects, however elaborate or delicate, are faithfully reproduced from the models supplied by nature herself. The ornamental designs produced in this way are extremely beautiful, contrasting as strongly with the result of ordinary staining, as does a good daguerreotype picture, or nature painting, with a mechanically produced engraving: the figuring accomplished in this way may be coloured as fancy suggests, by the common process of baking or "burning-in" in a furnace. This is another of those processes, by which we are now compelling nature to reproduce for us her choicest devices in a more enduring form.

Steam as an Industrial Agent.*

Mr. William Fairbairn, whose great services in developing mechanical science can never be overlooked or forgotten in any quarter of the world where mechanical talent possesses rank at all, has just given one more proof of his attention to the exigencies of the times, by delivering two elaborate lectures at the Manchester Mechanics' Institution, on "Steam, its Properties and Application to the Useful and Industrial Arts." In that great centre of steam power, such a subject, commented upon by such an authority, and coming, too, in the wake of the movement there making to secure a better system of steam superintendence, was certain of meeting with more than ordinary attention; and we are glad to find that the lecturer's efforts were duly appreciated by the large audiences assembled to meet him. In that portion of his discourse which related to boilers, he stated that the cylindrical or spherical was the most eligible and the strongest form in which iron plates would resist internal pressure. The deduction for loss of strength, on account of riveted joints and the position of the plates, was about 30 per cent. for the double riveted joints, and 44 per cent. for the single ones; the strength (calling the plates 100) being in the ratio of 100, 70 and 56. He found that 34,000 lbs. to the square inch was the ultimate strength of boilers having their joints crossed and soundly riveted. Flat surfaces, frequently essential, were not so objectionable with respect to strength as they appeared to be at first sight, but when properly stayed, were the strongest part of the construction. This was proved by the result of experiments made on the occasion of the bursting of a boiler at Longsight. Two thin boxes 22 inches square and 3 inches deep, were constructed. One corresponded in every respect to the sides of the fire-box of the exploded boiler, the stays being in squares, 5 inches asunder, and the side containing 16 squares of 25 inches area. The other contained 25 squares of 16 inches area, the stays being 4 inches asunder. One side of both boxes was a copper plate ½-inch thick; and the other side of both an iron plate three-eighths inch thick. To these the same valve, lever, and weight were attached, and the pumps of an hydraulic press applied. That divided into squares of 25 inches area, swelled ·03-inch with the eighth experiment, at a pressure of 455 lbs. to the square inch. At the nineteenth experiment, with a pressure of 785 lbs. to the square inch, the sides swelled ·08-inch; and at a pressure of 815 lbs. the box burst by the drawing of the head of one of the stays through the copper, which, from its ductility, offered less resistance to pressure in that part where the stay was inserted. The tenth experiment, with the other box of 16 inch areas, resulted in a swelling of ·04-inch, the pressure being 515 lbs. to the square inch. At 965 lbs. the swelling was ·08-inch, and from that point up to 1265 lbs. the bulging was inappreciable. With the forty-seventh experiment, at a pressure of

* From the London Practical Mech. Journal, April, 1855.

1625 lbs., one of the stays was drawn through the iron plate, after sustaining the pressure upwards of 1½ minutes, the swelling at 1595 lbs. having been ·34-inch. The first series of experiments proved the superior strength of the flat surfaces of a locomotive fire-box, as compared with the top or even the cylindrical part of the boiler. The latter evidenced an enormous resisting power, much greater than could be attained in any other part of the boiler, however good the construction; and they showed that the weakest part of the box was not in the copper but in the iron plates, which gave way by stripping or tearing asunder the threads or screws in part of the iron plate. According to the mathematical theory, the strength of the second plate would have been 1273 lbs.; but it sustained 1625 lbs., showing an excess of one-fourth above that indicated by the law, and that strength decreased in a higher ratio than the increase of space between the stays. The experiments show a close analogy as respects the strengths of the stays when screwed into the plates, whether of copper or iron; and riveting added nearly 14 per cent. to the strength which the simple screw afforded. These experiments were conducted at a temperature not exceeding 50° Fahrenheit. His experiments on the effects of temperature on cast iron, did not indicate much loss of strength up to a temperature of 600°; and he concluded that the resisting stays and plates of locomotive boilers were not seriously affected by the increased temperature to which they were subjected in a regular course of working.

Some Experiments upon Coffee as a Beverage.

BY AUGUSTUS T. DALSON AND CHARLES M. WETHERILL, PH. D., M. D.

There are two great classes of beverages in use among all nations of men, whether the most civilized or the most savage. One of these classes is alcoholic, the other may be called, for brevity, the non-nitrogenized. Physiologists are pretty generally agreed, that the nitrogenized articles of food are especially effective by their union with oxygen in the body in keeping up the supply of animal heat important to life, and that if such food be liquid so as to be more quickly absorbed, it will effect its result more speedily. The South American Indians ferment their maize, reducing it to pulp by mastication; the Pacific Islanders prepare their *arva* from a root in a similar manner; the Tartars, Arabs and Turks ferment and distil the milk of mares and cows, and among the more civilized nations, those of warm climates employ mild wines, while those of cold countries prepare a stronger alcoholic drink by distillation. In general, the colder the climate the stronger is the drink and more deplorable is the consequence of its abuse. Whether this craving for alcohol in some form or other be an instinct implanted in our nature or not, and if so, whether it be not wiser to direct rather than to attempt to eradicate it, are questions which are at present about being investigated experimentally on a large scale in our country, and whatever be the result, are deeply interesting, not only from a moral but from a psychological point of view. The other class of beverages, containing nitrogen, is one, the use of which is as widely spread as the former. Nitrogenized food is supposed effective to replace the substance of the different organs of the body, gradually wasted away by the processes of vitality.

That which is the subject of this article, *coffee*, although in its introduction, violently opposed and subjected to prohibitory laws, is at present regarded as a boon to humanity, and is cultivated to the extent of six hundred millions of pounds weight.

Besides the tannin in the coffee, and which is somewhat altered during the process of roasting, the berry is characterized by two substances; one, nitrogenized, *caffeine*, which is contained in the proportion of about one per cent. (the same exists in nearly a double proportion in tea,) and is not altered by the roasting process, and the other a peculiar volatile oil developed during the roasting, existing in an extremely minute quantity, and to which coffee owes its delicious flavor. Dr. Julius Lehman (*Liebig's Annalen* LXXXVII, 205) has investigated the effects of these two substances upon the system, and has shown that coffee retards the waste of the tissues of the body, and that consequently its use diminishes the amount of food necessary to preserve life. This effect he ascribes to the latter. These two acting to excite to greater activity the nervous and vascular systems, give to the wearied mind a greater elasticity and stimulate it to increased reflection. The increased activity of the heart, (and headache, &c., when taken to excess) are caused by the caffeine, and the increased action of the kidneys, the sudoriferous glands, and the intestines, together with the restlessness and congestion caused by an excess, he ascribes to the volatile oil. These effects were studied by Lehman by analysis of the excretory products of a person in a normal condition, and while under the influence of the above substances, and the conclusion is confirmed by deductions from observations made upon the effect of coffee upon the poorer classes of people whose nourishment is necessarily restricted. Much of the *nutritive* portion of coffee, namely, that contained in the legumine of the berry, is lost by the European method of making coffee, but the caffeine, contains nearly 29 per cent. of nitrogen, and Payen has calculated that a quart of *cafe au lait*, contains six times more nitrogen than an equal measure of flesh broth. Liebig has called attention to the fact that 140 milligrammes of caffeine correspond to 31 of gall in the form of taurine, and that if a decoction of coffee or tea contains only 0·05 centigrammes of caffeine, it must produce an appreciable effect, if this substance conduces to the formation of bile, which seems probable from its beneficial effect in certain diseases and in treatment for poisonings.—*Journal of the Franklin Ins.*

CANADIAN INSTITUTE—ELECTION OF MEMBERS.

Council Meeting, April 25, 1855.

The following gentlemen were provisionally* elected members of the Institute:—

George Morphy .... Toronto.
J. G. Ridout .... "
W. C. Evans .... Montreal.
Rev. J. G. Geddes .... Hamilton.

June 19th, 1855.

Sir George Simpson .... Lachine, C.E.
James Webster .... Guelph.
William Wilson .... Simcoe.
James Crawford .... Brockville.
W. Kingsford, C.E .... Toronto.
W. Hodgins, C.E .... Hamilton.
Colonel Baron de Rottenburg .... Kingston.

June 27th, 1855.

J. Russell, M.D .... Toronto.
A. Jackes, M.D .... St. Catherines.
Charles Jones .... Toronto.
Alexander Murray .... Woodstock.

* During the interval between the Sessions of the Institute, gentlemen desirous of becoming members may be provisionally elected by the Council, when duly proposed, and their election confirmed at the first ordinary meeting of the Institute in the ensuing Session. The formal election of members can only take place at an ordinary or general meeting of the Institute. The first ordinary meeting of the Session of 1855-56 takes place on Saturday, December 1st, 1855.

August 4th, 1855.

Captain Beecher, R.N .... London, England.
Hon. Robert Spence .... Quebec.
Archibald Carlyle .... Orillia.

Donations received since May 1st, 1855.

From the Hon. W. B. Robinson, M.P.P.

Report of the Select Committee on the Geological Survey.

Report on the Dredging of Lake St. Peter, and on the Improvement of the River St. Lawrence, between Montreal and Quebec, with Charts, by Thomas Keefer, Engineer.

Geological Survey of Canada, Report of Progress, years 1852-53.

Preliminary Report of the Secretary to the Executive Committee of Canada, in connection with the World's Exhibition, Paris, 1855.

Second Report of the Standing Committee on Public Accounts.

Statements of Sums expended out of £30,000 for aiding the Settling of vacant Crown Lands in Lower Canada.

Report of the Commissioners of Public Works, 1852 and 1853.

Report on Caughnawaga Canal.

Report on Trade and Navigation, 1854.

Railway Map of Canada, 1853.

The Outlines of Flemish Husbandry.

Miscellaneous Parliamentary Documents.

From the Hon. J. H. Cameron, M.P.P.

Annual Report of the Normal and Model Schools and Common Schools of Upper Canada.

Reports of the Commissioners appointed to inquire into a series of Accidents and Detentions on the Great Western Railway, Nov. 3, 1854.

Report of J. B. Jarvis, Esq., relative to the Survey of the proposed Caughnawaga Canal, and Documents relative to the Survey and Improvement of the Rapids of the River St. Lawrence, by Messrs. Maillefort and Radsloff, Civil Engineers.

From the Societies, through H. Rowsell, Esq.

Quarterly Journal of the Geological Society, May, 1854.
" " " " " August "
" " " " " November "
" " " " " February, 1855.

Journal of the Asiatic Society of Great Britain and Ireland. Vol. XVI., Part I.

Descriptive Catalogue of the Historical Manuscripts in the Arabic and Persian Languages preserved in the Library of the Society.

Essay on the Architecture of the Hindus, by Rám Ráz, Native Judge at Bungalore, Corresponding Secretary of the Society; 48 plates.

Address at the Anniversary Meeting of the Royal Geographical Society, 22d May, 1854, by the Right Hon. the Earl of Ellesmere, K.G., D.C.L.

From the Board *of* Agriculture.

Journal and Transactions of the Board of Agriculture of Upper Canada, No. I, Vol. 1, April, 1855; No. II., Vol. I., July, 1855.

From the Regents *of the* University *of the* State *of* New York.

Documents relating to the Colonial History of New York. Vol. V.

Sixteenth Annual Report of the Regents of the University of the State of New York, 1855.

Annual Report of the Trustees of the State Library of the State of New York.

From the Hon. East India Company.

Bombay Magnetical and Meteorological Observations for year 1851.

From Dr. R. Beck, *through* C. Jones, Esq.

Eighth Annual Report of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History and Historical and Antiquarian Collection annexed thereto.

Report of the Alms' House Committee on the subject of a Re-organization of that Institution.

Public Schools in Albany, 1855.

Sixth Annual Report of the Albany Penitentiary, 1855.

From the Society.

Twenty-seventh Annual Report of the Natural History Society of Montreal, 1855.

Prevention of Smoke in Steam Vessels.—An experiment has been tried at Portsmouth, on board the royal steam-tender Elfin, with Mr. Prideaux's furnace valves for the protection of smoke. Not only was the smoke effectually got rid of, and with West Hartley coals, but the steam was kept up in the boilers at full pressure after one furnace fire out of four was extinguished, showing that the advantages conferred by these valves in preventing smoke and reducing the temperature of the engine-room are obtained without any diminution of the steam-generating power of the furnaces. Upon Mr. Prideaux's valve doors being removed and the ordinary doors substituted, the thermometer, which had previously stood at 66 degrees, rose to 96; exemplifying what must certainly be regarded as one of the features of this invention—viz., that during its use the exterior of the fire furnace door always remains cool no matter to what extent the firing may be pushed.

On the Dicynodon Tigriceps, by Prof. Owen.—In this paper Prof. Owen described a new species of extinct bidental reptile (*Dicynodon tigriceps*), transmitted by A. G. Bain, Esq., from South Africa. The skull surpasses in size that of the largest Walrus, and resembles that of the lion or tiger in the great development of the occipital and parietal ridges, the strength of the zygomatic arches, and the expanse of the temporal fossæ,—all indicating the possession of temporal (biting) muscles as largely developed as in the most powerful and ferocious of the carnivorous mammalia. This unique modification of a sauroid skull is associated with the presence of a pair of long, curved, sharp-pointed, canine tusks, descending as in the machairodas and walrus, outside the lower jaw when the mouth is shut, these tusks being developed to the same degree as in the smaller species of Dicynodon (*D. lacerticeps*, *D. testiduceps*, &c.,) described by the author in a former memoir; and, as in those species, so in the present more gigantic one, no other trace of teeth was discernible, the lower jaw being edentulous, as in the extinct Rhynchosaurus, and the Chelonian reptiles. Most of the extinct reptiles exemplify the law of the prevalence of a more general structure, as compared with the more specialized structures of existing species. The Labyrinthodonts combined sauroid with Batrachian characters; Rhynchosaurus, sauroid with Chelonian characters. The Ichthyosaurus had modifications borrowed from the class of fishes, and the Pterodactyle others borrowed from the type of birds and bats,—in both cases engrafted on an essentially sauroid basis. The Dicynodonts—which were like lizards in their more important cranial character, as, for example, the divided nostrils, the dependent tympanic bone, and the pair of symmetrical suboccipital processes—resembled the crocodiles in the extent of ossification of the occiput, resembles the Tryonyces in the extent of ossification of the palate, and in the form and position of the posterior nostril; and resembled the Chelonia generally in the edentulous, trenchant border of the whole of the alveolar part of the lower jaws and of a great part of that of the upper jaw. But they also superadded to this composite reptilian structure of the skull a pair of long, sharp, descending tusks, and temporal fossæ and ridges, which seem to have been borrowed from the mammalian class.

Citric Acid Contaminated with Copper.—Citric acid being now much used in the preparation of lemonade, its purity becomes a matter of some importance. Incidentally copper has been detected in several samples—an impurity not previously suspected. From a bottle of lemonade 26 centigrammes of metallic copper were extracted, being in the proportion of 9 centigrammes to the kilogramme of acid. Samples of citric acid, before being used in the preparation of any beverage or article of food, should be tested with the yellow prussiate of potash, and rejected if a red tint or precipitate appears.—*Artizan.*

Erratum.—Page 304, line, 47, for "official" read "unofficial."

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West. -June, 1855.

Latitude, 43 deg. 39.4 min. North. Longitude, 79 deg 21. min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direct.	Mean Vel'y	Rain in Inch.
1	29·404	29·216	29·284	29·289	59°·6	62°·9	54°·9	59°·1	+ 2°·2	0·444	0·516	0·401	0·461	·89	·93	·95	·93	S W b S	S E b E	N N W	W 36° N	4·57	0·315
2	·356	·346	·377	·371	50·6	69·1	47·7	54·8	— 2·5	·330	·453	·268	·316	91	65	82	81	NWb N	S S E	N b W	N 27 W	4·39	0·025
3	·418	·448	—	—	54·6	54·6	—	—	—	·374	·283	—	—	90	68	—	—	NWbW	S S W	N W	W 4 N	4·14	...
4	·486	·461	·507	·489	44·7	52·6	47·0	48·9	— 8·9	·257	·254	·232	·252	88	65	78	74	N	W	Calm	W 9 S	4·23	...
5	·490	·451	·522	·490	49·7	63·4	46·3	54·4	— 3·7	·245	·419	·258	·306	70	74	83	73	W b N	W b N	N N W	W 15 N	6·60	...
6	·596	·532	·490	·533	53·5	67·2	49·7	55·7	— 2·7	·286	·450	·272	·314	71	70	77	71	Calm	S b W	Calm	S 14 E	1·87	Inap.
7	·396	·278	·312	·326	48·1	55·5	52·0	52·1	— 6·7	·296	·385	·362	·351	89	89	95	91	Calm	N E bN	W	N 37 W	2·97	0·290
8	·349	·364	·407	·376	49·5	62·2	48·5	54·4	— 4·7	·303	·311	·257	·319	87	56	77	76	N W	W N W	Calm.	...	...	0·010
9	·425	·361	·272	·331	51·7	70·4	60·6	56·8	— 2·7	·307	·442	·262	·332	81	61	72	73	Calm	W b S	Calm.	...	...	0·490
10	28·990	28·996	—	—	50·3	62·5	—	—	—	·360	·506	—	—	100	91	—	—	Calm	W		...	...	0·205
11	29·271	29·868	·473	·384	47·0	54·6	44·2	48·7	—11·3	·267	·228	·230	·245	84	54	81	78	N W	W	W	...	...	...
12	·545	·647	·734	·649	43·5	61·0	44·2	50·3	—10·0	·221	·290	·221	·250	79	55	77	69	S W	W b N	W b N	W 10 N	10·01	...
13	·773	·722	·714	·736	51·0	63·4	48·5	53·4	— 7·2	·248	·266	·277	·259	68	47	83	66	NWbW	S b W	N W	W 41 S	7·22	...
14	·695	·604	·576	·608	57·1	72·5	59·4	64·1	+ 8·3	·283	·438	·318	·345	62	58	64	59	NWbW	S S W	W b N	W 27 N	9·65	...
15	·449	·393	·458	·427	58·0	71·8	58·1	63·6	+ 2·4	·365	·422	·362	·373	77	55	76	67	W	NWbW	SW b S	W 29 N	9·24	0·015
16	·448	·436	·485	·468	56·4	63·4	60·3	61·4	+ 0·1	·394	·408	·371	·393	89	71	73	74	N b W	S W	N	N 8 E	3·95	...
17	·701	·738	—	—	54·6	58·6	—	—	—	·278	·360	—	—	66	75	—	—	NE b N	E b S	N b E	E 28 N	4·49	...
18	·811	·754	·683	·731	58·7	63·9	56·7	60·2	— 1·7	·390	·276	·390	·328	81	47	87	66	NE b N	E	E N E	E 12 N	7·03	0·175
19	·577	·476	·482	·503	54·1	54·1	53·0	53·2	— 8·9	·379	·383	·382	·369	93	94	97	93	N E	N E	Calm.	E 6 N	6·33	0·335
20	·522	·498	·473	·501	53·1	60·7	54·7	55·9	— 6·6	·368	·415	·361	·384	93	80	86	88	Calm	S S W	E	S	2·85	...
21	·486	·452	·393	·442	49·4	63·5	61·2	58·2	— 4·4	·324	·456	·487	·422	93	80	92	88	N E bE	E b S	E N E	E 6 N	5·30	0·580
22	·384	·426	·568	·462	58·9	72·7	64·4	65·5	+ 2·5	·452	·536	·482	·483	93	69	82	80	E b N	N N W	N b W	N 19 W	7·77	...
23	·644	·665	·634	·640	61·8	68·9	62·0	64·0	+ 0·9	·420	·505	·439	·454	78	73	82	78	N b W	S E b S	N E	E 23 N	5·03	0·875
24	·564	·471	—	—	58·9	66·4	—	—	—	·435	·483	—	—	89	76	—	—	N E	N b E	N N W	N 3 E	10·36	0·045
25	·499	·478	·549	·511	60·9	69·1	62·8	64·9	+ 1·4	·430	·506	·419	·457	82	73	75	76	NW bN	S	N W	W 13 S	4·54	0·060
26	·620	·624	·655	·636	59·3	70·7	58·4	62·9	— 1·0	·465	·567	·432	·487	93	78	91	87	S W b S	S	S S W	S 15 W	5·57	0·110
27	·703	·673	·601	·654	61·7	74·7	66·6	67·6	+ 3 6	·490	·584	·594	·561	91	70	93	86	S W b S	E S E	S W b S	S 4 E	3·59	0·495
28	,672	·728	·687	·690	65·6	78·1	70·7	72·2	+ 7·9	·557	·696	·626	·631	92	75	86	83	W b N	S	S WbW	S 39 W	5·11	...
29	·676	·587	·553	·604	71·1	85·3	74·0	78·7	+14·3	·670	·786	·707	·722	90	66	87	78	Calm	S b W	W b S	S 37 W	5·65	...
30	·558	·513	·465	·502	76·1	81·5	71·4	77·3	+12·7	·718	·751	·622	·704	82	72	88	78	W S W	S S W	S W	S 20 W	5·83	0·045
M	29·532	29·502	29·514	29·513	55·8	66·7	56·4	59·9	— 1·1	0·381	0·452	0·386	0·406	·84	·69	·83	·78	3·56	7·88	4·16	W 21 N	5·70	4·070

Highest Barometer...... 29·811, at 6 a.m. on 18th } Monthly range:
Lowest Barometer....... 28·942, at 9 30 a.m. on 10th } 0·869 inches.
Highest registered temperature 91°·5, at p.m., 29th } Monthly range:
Lowest registered temperature 36°·2, at a.m. on 12th } 55°·3.
Mean Maximum Thermometer.............. 68°·89 } Mean daily range:
Mean Minimum Thermometer....... ...... 50°·68 } 18.21
Greatest daily range.........30°·8, from p.m. of 5th to a.m. of 6th.
Least daily range ....5°·2, from p.m. of 19th, to a.m. of 20th.
Warmest day....... 29th. Mean temperature......78°·72 } Difference,
Coldest day......... 11th. Mean temperature......48°·65 } 30°·07.
Greatest intensity of Solar Radiation, 106°·0 on p.m. of 29th } Range,
Lowest point of Terrestrial Radiation, 28°·6 on a. m. of 13th } 77°·4.
Aurora observed on 4 nights: viz. on 8th, 10th, 16th and 22nd.
Possible to see Aurora on 17 nights. Impossible on 13 nights.
Raining on 17 days. Raining 74·1 hours; depth, 4·070 inches.

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

North—1276·82 West—1516·51 South—975·59 East—746·52.
Mean direction of Wind, W 21° N. Mean velocity 5·70 miles per hour.
Maximum velocity, 19·5 miles per hour, *from 11 a.m. to noon on 15th.*
Most windy day, the 24th; mean velocity, 10·36 miles per hour.
Least windy day, the 6th; mean velocity, 1·87 " "
Most windy hour, 1 p.m.; Mean velocity, 8·63 miles per hour.
Least windy hour, midnight; Mean velocity, 3·55 miles per hour.
Mean diurnal variation, 5·08 miles. Mean of Cloudiness, 0·65.
14th. Fire-flies first observed. 15th. Fire-flies numerous this evening.
17th. Halo round the Sun from 11 a.m. to 1 p.m.
18th. Beautiful and very perfect Halo round Sun at noon.
21st. Severe Thunderstorm from 4.30 p.m.
24th. Splendid Rainbow from 7.15 to 7.45 p.m. 25th. Do. at 7.30 p.m.
25th. Pollen fell in small quantities in this day's rain.
26th. Pollen fell in considerable quantity in the rain of this night.
27th. Severe Thunderstorm from 7.30 to 10 p.m.
28th. Sheet Lightning and distant Thunder at midnight.
30th. Incessant Sheet Lightning from 10 p.m.

The *Components* of the Wind, and its *Mean Velocity*, are not perfect for this month, the Anemometer having been dismounted from its old position on the 8th, was repaired and mounted on the New Tower of the Observatory on the 12th, consequently the results do not include those quantities from the 8th to the 12th inclusive. The quantity of Rain which fell during the month has been 1·028 inch above the average, and the number of days on which Rain fell exceeds that recorded for any other June of the series. The Mean Temperature of this month has been 1°.5 below the average of the last 16 years, the first three weeks having been very cold, whilst the last week was excessively warm. The 29th was the warmest day in any June on the records of the Observatory.

Comparative Table for June.

Year.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Wind. M'n Direc.	Mean Velocity in Miles.	
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	Miles.
1842	55·6	—5·8	73·9	28·0	45·9	15	5·755	...	0·31	Miles.
1843	58·4	—3·0	81·3	28·5	52·8	12	4·595	...	0·27	Milesr
1844	59·9	—1·5	82·8	33·1	49·7	9	3·535	...	0·19	Miles.
1845	61·0	—0·4	83·6	40·9	42·7	11	3·715	...	0·27	Miles.
1846	63·3	+1·9	83·3	41·5	41·8	10	1·920	...	0·32	Miles.
1847	58·4	—3·0	78·3	36·7	41·6	14	2·625	...	0·30	Miles.
1848	62·9	+1·5	92·5	38·3	54·2	8	1·810	W 29 N	4·51	Miles.
1849	63·2	+1·8	84·9	45·2	39·7	7	2·020	E 20 S	3·32	Miles.
1850	64·3	+2·9	83·2	49·0	34·2	10	3·345	W 30 S	4·54	Miles.
1851	59·2	—2·2	79·2	41·2	38·0	11	2·695	S 2 W	4·42	Miles.
1852	60·8	—0·6	86·1	43·6	42·5	10	3·160	W 13 S	4·09	Miles.
1853	65·5	+4·1	86·3	43·3	43·0	9	1·550	N 14 W	3·67	Miles.
1854	64·1	+2·7	88·7	47·4	41·3	9	1·460	N 10 E	4·12	Miles.
1855	*59·9*	*—1·5*	*90·7*	*40·6*	*50·1*	*17*	*4·070*	*W 21 N*	*5·70*	*Miles.*
									0·29	lbs.
M'n.	61·37		84·13	40·01	44·12	10·7	3·042		4·30	Miles.

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

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

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

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 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.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain 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	29·770	29·740	29·680	67·5	71·8	65·7	·534	·681	·555	·81	·88	·89	S S W	S W	S b W	6·26	5·00	7·13	...	Cir. Str. 10.	Cum. Str. 10.	Cum. Str. 10.
2	·680	·750	·700	66·4	66·6	63·2	574	576	547	89	90	99	S b W	S	S	13·53	2·24	3·25	0·533	Do. 8.	Rain.	Do. 10.
3	·689	·705	·734	61·0	72·9	60·6	530	578	494	99	74	94	S W	W S W	S b E	7·74	8·78	0·87	0·433	Rain.	Str. 8.	Str. 4.
4	·610	·687	·735	53·6	57·4	51·0	386	462	351	96	94	90	W	W b S	W S W	2·37	7·89	4·05	0·280	Rain.	Cum. Str. 8.	Do. 2.
5	·682	·678	·740	54·0	56·3	50·9	326	456	315	76	74	81	W b S	W S W	W	5·29	3·67	6·87	...	Cum. Str. 6.	Do. 9.	Clear.
6	·700	·725	·820	53·0	69·5	57·1	301	414	355	73	58	74	W	W	W b S	4·17	6·20	11·01	...	Cirr. 4.	Cir. 4.	Str. 2.
7	·721	·650	·489	55·6	65·8	53·0	351	473	389	79	76	95	S S W	S E b E	N E b N	0 73	0·18	4·62	0·300	Cir. Cum. Str. 9.	Cum Str. 10.	Rain.
8	·441	·500	·671	51·1	63·0	51·1	350	388	301	89	67	79	N N W	W b N	W b S	10·07	6·07	6·28	0·400	Cum Str. 4.	Do. 2.	Clear.
9	·580	·670	·691	47·1	68·0	50·7	291	582	326	86	85	87	W	W	W b S	3·79	7·30	7·03	...	Do. 8.	Do. 2.	Do.
10	·521	·269	·381	53·0	55·8	58·0	337	422	479	81	99	99	E N E	E N E	W S W	0·81	5·00	1·25	1·343	Do. 8.	Rain.	Showers.
11	·546	·485	·611	54·2	61·7	52·2	428	431	326	99	79	81	W S W	W S W	W S W	1·81	7·50	7·88	0.230	Rain.	Cum. Str. 4.	Str. 4.
12	·700	·811	·800	46·8	54·0	49·1	282	849	336	85	81	93	W S W	W S W	W S W	9·95	6·64	2·87	...	Clear.	Str. 10.	Do. 10.
13	·946	·985	·950	53·0	69·1	55·6	337	892	372	81	55	84	W S W	W S W	W S W	3·38	4·20	6·63	...	Cum. Str. 4.	Cir. Str. 6.	Clear.
14	·830	·785	·739	56·9	72·5	57·0	363	473	316	79	61	67	S W b W	W	W b N	2·81	2·83	10·70	...	Clear.	Clear.	Str. 10.
15	·404	·585	·681	55·9	59·7	57·3	408	402	355	90	79	74	W b S	N b W	N W b W	4·77	6·63	3·87	0·256	Shower.	Cum. 8.	Cir. Str. 3.
16	·721	·661	·770	58·7	69·2	52·1	367	351	251	75	49	64	W	W N W	N N W	Calm	10·33	7·00	...	Clear.	Cirr. 2.	Clear.
17	·921	30·000	30·087	43·0	70·4	54·1	233	442	304	79	60	70	N N W	W b S	E N E	9·33	1·80	Inap.	...	Do.	Clear.	Do.
18	30·101	30·150	30·071	47·0	72·2	56·2	271	367	363	80	47	79	N E	N E b E	S S E	Calm	2·65	0·37	...	Do.	Do.	Do.
19	29·987	29·945	29·871	58·0	71·8	62·0	441	506	397	90	67	71	N E b E	S	S b E	0·44	2·97	5·08	...	Do.	Cirr. Str. 2.	Cir. Str. 10.
20	·800	·770	·760	53·0	61·0	56·3	371	442	432	90	81	94	E	N E	N E b N	5·20	3·91	1·64	0·466	Rain.	Str. 10.	Str. 9.
21	·780	·778	·789	54·8	74·0	67·1	349	532	540	81	64	83	W S W	W b S	W S W	0·78	3·12	3·14	...	Str. 10.	Cir. Cum. 3.	Cir. Cum. 2.
22	·720	·714	·780	61·6	72·1	60·2	512	670	494	99	86	94	S W b W	N E b E	N E	Calm	2·12	1·04	0·880	Rain.	Str. 6.	Str. 8.
23	·978	·964	·987	58·0	81·2	60·7	389	704	441	79	68	84	N E b E	S S W	S S W	Inap.	4·08	Calm	...	Clear.	Cir. Str. 4.	Cir. Str. 4.*
24	·975	·946	·885	55·1	71·8	60·0	394	648	494	88	86	94	E	E b S	E b N	Calm	0·62	2·28	0·600	Cirr. Str. 4.	Rain.	Rain.
25	·743	·790	·840	59·0	65·6	59·0	506	555	506	1·00	89	1·00	E N E	N E	N E	11·36	3·90	4·97	1·903	Rain.	Cum. Str. 9	Cir. Str. 8.†
26	·930	·900	30·024	64·1	70·1	63·5	571	572	488	96	79	84	S W b S	W S W	W	0·32	3·09	6·01	...	Cir. Cum. Str. 4.	Cir. Cum. Str. 8.	Str. 8, dist. th.
27	30·031	30·005	30·000	67·0	81·9	70·6	544	692	659	83	64	90	W b S	W b S	W S W	7·50	6·25	5·70	Inapp.	Clear.	Clear.	Str. 4.
28	29·835	29·726	29·860	66·6	89·2	73·3	605	715	659	95	53	82	S b E	W S W	S W b W	0·54	1·82	5·00	Inapp.	Snowers.	Do.	Clear.
29	·661	·515	·546	70·8	93·8	74·2	659	940	751	90	68	90	W b S	S W b S	W b S	4·30	9·39	6·07	0·793	Clear.	Nimb. 4, dis. th.	Cir. Str. 9.
30	·614	·523	·502	80·9	94·4	79·0	617	854	763	61	52	78	W b S	S W	W b S	1·01	0·82	2·08	...	Do.	Cir. Str. 2.	Clear.

Barometer	Highest, the 18th day	30·150
	Lowest, the 10th day	29·269
	Monthly Mean	29 757
	" Range	0 881
Thermometer	Highest, the 30th day	95°·3
	Lowest, the 17th day	39°·7
	Monthly Mean	62°·39
	" Range	55°·6
	Mean Humidity	·809

Greatest Intensity of the Sun's Rays .... 124°·1

Rain fell on 15 days, amounting to 8·317 inches, and was accompanied with thunder on two days; raining 88 hours 50 min.

Amount of Evaporation, 2·61 inches.
Most prevalent Wind, W S W. Least prevalent Wind, E b S.
Most Windy Day, the 25th day; mean miles per hour, 6·47.
Least Windy Day, the 17th day; mean miles per hour, 0.60.
Aurora Borealis invisible. Might have been seen on 12 nights.
Ozone.—The amount of Ozone has been rather large in quantity.

The electrical state of the atmosphere has been marked by rather high intensity; and on the 26th and 29th days indicated a very high tension of a negative character.

Yellow matter observed in the rain which fell on the 2nd and 29th days.
Parhelia at 7 p.m. on the 21st day.

* Lunar Halo, diameter 41°. † Lunar Halo, diameter 47°.

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

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

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

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapour.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·930	29·816	29·805	29·850	50·1	68·5	50·9	56·5	0·276	0·358	0·312	0·314	78	52	85	72	E N E	Calm.	W	7·2	0·0	6·2	·118	...	
2	·497	·590	·620	·569	64·0	52·3	46·3	54·2	·506	·364	·294	·388	87	95	94	92	Calm.	E N E	E N E	8·0	13·9	24·8	·712	...	
3	·612	·527	·562	·567	46·0	55·5	50·7	50·7	·305	·395	·353	·349	100	92	97	96	E N E	E b N	E b N	11·3	12·4	11·3	·142	...	
4	·469	·384	·491	·448	52·0	61·9	50·5	54·8	·370	·429	·314	·371	97	79	86	84	E N E	S W	S S W	11·3	10·0	13·4	·039	...	
5	·452	·376	·534	·454	50·0	56·6	51·0	52·5	·300	·269	·321	·297	85	61	87	78	W	S W	Calm.	11·3	10·0	13·4	·013	...	
6	·510	·461	·518	·497	49·5	66·6	58·7	58·3	·294	·208	·296	·266	85	33	62	60	W S W	W	Calm.	8·0	13·4	0 0	...	...	
7	·565	·451	·294	·438	53·0	63·2	51·6	55·9	·252	·315	·348	·303	61	56	91	70	E N E	E N E	Calm.	10·0	7·2	0·0	·607	...	
8	·200	·292	·370	·287	52·1	53·4	48·8	51·4	·334	·229	·179	·247	87	58	53	66	W S W	N W b N	W b N	5·2	13·9	8·8	·052	...	
9	·422	·411	·502	·445	48·8	55·0	49·2	51·0	·276	·288	·281	·287	81	67	81	80	W	N W	W	8·0	10·0	2·0	·264	...	
10	·538	·399	·268	·402	49·6	61·3	53·6	51·5	·300	....	·394	....	86	...	98	...	E	E N E	E N E	3·8	22·7	17·9	1·418	...	
11	·287	·186	·360	·278	45·0	61·9	52·9	53·3	·285	·487	·351	·374	96	90	89	92	Calm.	W S W	S W	0·0	7·2	15·2	·689	...	
12	·545	·595	·714	·618	49·0	56·5	47·8	51·1	·268	·248	·280	·265	78	55	86	73	S W	W	W	10·0	10·0	13·9	·066	...	
13	·771	·744	·733	·749	48·5	62·1	52·8	54·5	·282	·253	·318	·284	84	47	81	71	W	W S W	S W	10·9	13·4	3·8	...	...	
14	685	·586	·527	·599	50·2	61·2	52·3	54·6	·293	·298	·230	·274	81	56	86	74	E	E N E	N	3·8	5·2	3·8	...	...	
15	·387	·363	·410	·387	52·0	61·2	58·1	58 1	·332	·315	·295	·314	87	54	63	68	Calm.	S W	W N W	0·0	5·2	6·2	...	...	
16	·461	·432	·588	·491	53·1	64·9	51·0	56·3	·309	·250	·185	·248	79	59	50	63	S b W	W N W	W N W	6·2	12·9	13·9	...	...	16th. Squalls, the wind varying in velocity from 22 to 32 miles per hour.
17	·722	·752	·888	·787	49·0	64·3	53·0	55·4	·184	·224	·183	·197	54	69	46	56	N W	N W	N W	21·3	8·0	6·2	...	...	
18	·996	·913	·893	·934	47·6	70·8	58·7	59·0	·216	·240	·306	·254	66	33	63	54	Calm.	S W	N	0·0	2·2	2·0	...	...	
19	·891	·780	·741	·805	52·9	73·0	63·8	63·2	·202	·266	·300	·256	51	34	52	46	Calm.	N N E	S	0·0	2·0	10·0	...	...	
20	·760	·675	·603	·679	55·2	63·4	54·3	54·2	·259	·386	·407	·351	61	98	98	86	S E	E N E	E b N	3·8	11·3	17·9	·818	...	
21	·588	·597	·588	·591	54·0	64·1	59·4	59·3	·387	·430	·432	·416	95	74	87	85	Calm.	W	S W	0·0	8·8	5·2	...	...	
22	·586	·557	·617	·587	59·0	67 8	57·3	58·0	·454	·435	·440	·443	92	93	96	94	Calm.	E	N N W	0·0	13·9	5·2	·515	...	
23	·755	·766	·758	·758	52·2	71·8	67·0	64·3	·363	·454	....	....	91	82	...	...	Calm.	S S W	W	0·0	8·0	8·0	·765	...	
24	·766	·765	·739	·753	58·0	77 0	66·2	67·1	....	....	·429	....	...	...	64	...	W	Calm.	E	6·2	0·0	2·0	·264	...	
25	·745	·733	·730	·736	60·1	61·2	59·8	60·4	·462	·423	·438	·441	91	81	87	86	E	E N E	E N E	13·9	21·3	22·7	·475	...	
26	·762	·754	·706	·741	57·4	67·0	59·6	61·3	·445	·513	·466	·475	97	80	94	90	E N E	E N E	Calm.	19·7	8·8	0·0	·092	...	
27	·763	·745	·745	·751	62·2	79·9	71·1	71·1	·494	·469	·514	·492	91	48	70	70	S W	W	W N W	10·0	14·3	3·8	...	...	
28	·757	·693	·682	·711	68·3	86·3	73·3	76·0	·565	·424	·392	·460	85	35	74	65	Calm.	S W	W S W	0·0	8·8	5·2	...	...	
29	·635	·502	·561	·566	69·3	81·2	71·8	75·1	·630	·715	·568	·638	91	63	75	80	W S W	W S W	N N W	5·2	10·0	10·0	·016	...	29th. Lunar Halo at 10 p.m. Aurora at 11 p.m.
30	·664	·634	·582	·627	60·0	66·0	57·9	61·3	·310	·355	·346	·337	61	57	74	64	E N E	E N E	E N E	16·0	19·0	21·3	...	...	
M	29·631	29·576	29·601	29·6037	58·94	61·43	56·65	58·34	0·344	0·355	0·340	0·346	82	64	78	75				6·77	10·16	9·14	7·065		

Maximum Barometer, 6 a.m. on the 18th	29·996
Minimum Barometer, 2 p.m. on the 11th	29·186
Monthly Range	·810
Monthly Mean	29·6037
Maximum Thermometer on the 29th	88°·1
Minimum Thermometer on the 8th	43·2
Monthly Range	44·9
Mean Maximum Thermometer	66·94
Mean Minimum Thermometer	51·82
Mean Daily Range	15·12

Mean Monthly Temperature	58·34
Greatest Daily Range of Thermometer on 29th	28°·1
Least Daily Range of Thermometer on 20th	4°·7
Warmest Day, 28th. Mean Temperature	76·0
Coldest Day, 1st. Mean Temperature	49·8
Climatic Difference	26·2

Possible to see Aurora on 11 Nights.
Aurora visible on 7 Nights.
Total quantity of Rain, 7·065 inches.
Rain fell on 15 days.