Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for scanning. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of scanning are checked below.

L'Institut a numérisé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de numérisation sont indiqués ci-dessous.

- [ ] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [ ] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [ ] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [x] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary materials / Comprend du matériel supplémentaire
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from scanning / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été numérisées.

- [x] Additional comments / Commentaires supplémentaires: Continuous pagination.

The Canadian Journal.

TORONTO, JANUARY, 1855.

Lighthouse on the New South Shoal, Nantucket, U. S. *

THE SCREW PILE—THE PNEUMATIC PILE.

No work of a solid character placed on a submerged sand at so exposed a point as New South Shoal, were it possible to found one, could long withstand the power of the ocean. That it would not be overthrown by the direct blow of the waves, the successful resistance of the works just named (Eddystone, Bell Rock, Skerryvore Lighthouses), at points where the inclination of the bottom and the depth of water are calculated to give greater force to the waves, prove beyond all reasonable doubt; but that its destruction would nevertheless be inevitable, from the rapid and ceaseless process of the wasting of the sands of the shoal, caused by the recoil of the sea, from the mass, is no less certain. To provide a base of sufficient size and strength to sustain the necessary superstructure, that shall at the same time offer no very sensible obstruction to the free passage of the currents and the waves, is the great desideratum in founding works on submerged soils exposed to the batter of the ocean. This desideratum the last few years has supplied in the screw-pile of Mr. Alexander Mitchell, of Belfast, and in the pneumatic pile of the late Dr. Lawrence Holker Potts, of London. The next inquiry in order is, whether either of these modes is applicable to the site of New South Shoal. After much reflection, aided in no small degree by the experience acquired in the erection of the light-house on the Brandywine, I am of opinion that the first, being the method of screw-piles, cannot be employed to found a work at that point: and for these reasons:

1. That the screws could not be made to penetrate the shoal to the required depth, by any means applied from a *floating* body, moored in the tide and sea-way at the point in question.

2. That it is not possible to erect a temporary fixed structure during the working season at so exposed a point, at least in time to be available for driving the screw-piles; and,

3. That if it were possible to raise such a structure in time, it is doubted whether any power applied from it could insert the piles to a necessary depth, into a sand so hard and compact.

The screw-pile has been successfully applied in forming foundations of light-houses on the Maplin Sands, mouth of the Thames; on the North Wharf Sands, mouth of the Wyre; on the shoal ground of Holywood, Belfast bay; and, in this country, on Brandywine shoal, mouth of Delaware bay. The attempt to erect a light house on the north end of the Kish Bank, in St. George's channel, by means of these piles, failed, from no defect in the principle claimed for these useful appliances in forming submarine foundations, but principally, as it is understood, from the coming up of a heavy gale from the south-east before the piles were properly braced and the diagonal stays attached. The design to raise a beacon of screw-piles on the eastern end of the Tongue Bank also proved abortive; but, as the case of the structure on the Kish Bank, from no inherent defect in the piles themselves. This beacon was composed of five six-inch piles, and raised in position by the Trinity House. Shortly after it was put up, it was discovered that an accident had happened to it, and, on examination, it was ascertained that three of the piles were broken off short, and the other two bent. The stump of the broken piles, and the lower parts of the bent piles, were found perfectly upright, and the sand around them undisturbed; shewing the structure failed from no fault of the *hold* they had taken of the ground. Their condition indeed affords the best evidence of the capacity of the screw pile on this point, as it appears the force that was sufficient to break off three and bend two wrought-iron piles of the size stated, was, at the same time unequal to the task either of uprooting them or even changing their position in the bottom. As the force of the waves, acting on such small surfaces as these piles presented, was entirely inadequate to produce the effects described, the destruction of the beacon was sought for in other causes. The conclusion arrived at, at the time, and no doubt the correct one, was, that a vessel had passed over it; a conclusion in a measure confirmed by finding the copper of a vessel attached to the top of one of the bent piles. It may be remarked here, incidentally, that accidents from this cause form the only real objection, save the destructible character of the material, either to the screw-pile or the pneumatic-pile, and only then of works founded in navigable depths.

The pneumatic-pile of Dr. Potts is of more recent origin than the screw-pile, or, at least has not been so long known to the public. It has not yet, it is believed, been successfully applied in founding works, such as light-houses, beacons, harbours, &c., exposed to the sweep of the ocean. That it is practically applicable for the purpose there is every reason to believe. The favourable opinion of those well known in engineering and construction in Great Britain, communicated in the report on the ice-harbours of the Delaware, dated the 28th December last, may be received as conclusive, particularly as it is supported by cases of application already made in other, and in some respects kindred works, on this point. To this testimony and to these cases the bureau is again referred for all the information in possession of this office upon the subject. Of the latter it is deemed sufficient for the present occasion to recount merely the following instances in which these piles have been used, to show that their size, both length and diameter considered, would seem only limited in their application to the power under the circumstances to handle them. Besides being employed, among other instances, in the founding of the piers of a viaduct in Anglesey over an arm of the sea, the bed of which is of running sand and gravel of great depth; in an experiment on Grain Spit to test the powers of the piles to sustain great weights; in the sinking of a pile of large dimensions in a quicksand in Cornwall; in the construction of a bridge over the Thames at Datchet; and in the foundation of part of a large viaduct on the Holyhead line of railway, a pile of this description, 3 feet in diameter, has been sunk in the Goodwin Sands to the depth of 77 feet, to the chalk formation; and others of the enormous size of 10 feet diameter as cofferdams, in the construction of the Midland Great Western Railway bridge over the Shannon. To this list may be added the new bridge over the Thames from Putney to Fulham, in which the piers will be formed of four cast-iron cylinders 8 feet in diameter, carried to such a depth as not to interfere with the dredging of the river. It is proper to remark here, that other applications of both the screw-pile and pneumatic-pile either in constructions or in experiments, may have been made and noticed in the publications of the day, par-

* Abstract of a report to the Senate of the U. S. communicating, in compliance with a resolution of the Senate, a Report &c. from Major Hartman Bache, in reference to the construction of a Lighthouse or Beacon on the New South Shoal of Nantucket.

ticularly in periodicals devoted to such and kindred subjects; but as these, in consequence of the restrictions upon the purchase of books, are only occasionally accessible, and then through private sources, nothing is positively known as to the fact.

The objection to screw-piles for founding a work at New South Shoal does not apply—except as to giving them their true relative position—to pneumatic piles, which, being sunk into the bottom by atmospheric pressure caused by exhausting the air from the hollow shaft, the erection of a fixed structure, such as that required to apply the mechanical power to drive the former, is dispensed with, and the objection to the great *length of the pile through which this power must be exerted*, at the same time got rid of. But it must not be supposed, that because a fixed structure is not indispensable, a floating body is deemed sufficient for the successful application of atmospheric piles in the present instance. This is not the case. That these piles may be planted singly in favourable weather at so exposed a point as New South Shoal, by well-devised measures fully matured, from so unstable a footing as a floating body, the sinking of the cylinder on the Goodwin Sands is of itself abundantly sufficient to prove; but that the number of piles required to constitute a foundation for a light-house or beacon may, under the circumstances, be made to receive their proper relative positions, so far at least, as to render them properly available for the intended purpose, is not believed. The manner in which it is proposed to provide against this objection in the use of the atmospheric pile in the present case, or at other points of equal exposure, will be explained in the project now submitted.

Having premised that though a solid structure at New South Shoal, were it possible to erect one at that exposed point, might withstand the direct assaults of the sea, it nevertheless would be overthrown by the wasting of the sands on which it stands, through the insidious workings of the waves acting on the mass, and that to meet the case, it would be necessary to adopt a foundation; which, while it afforded the necessary area and strength to support the required superstructure, would offer no impediment, practically considered, to the *motion of the currents or the waves; having also expressed* the opinion that works combining these pre-requisites may be founded on submerged soils by means of Mitchell's screw-pile and Pott's pneumatic-pile—and further, that for reasons which it is conceived are indisputable, the former cannot be applied to that use at New South Shoal—the bureau will already be prepared to learn that, as the practical application of the latter is not open to the same objections, it is recommended for the present design.

The instructions of the bureau calling for a plan and estimate for a beacon on New South Shoal are predicated on so much of the "Act making appropriations for light-houses, light-boats, buoys," &c., approved March 3, 1849, as is contained in the following words, to wit: "For a rew-pile beacon or other practicable structure on New South Shoal, off Nantucket, discovered by the survey of the coast, $25,000, to be expended under the direction of the Bureau of Topographical Engineers." A plan and estimate for a beacon are accordingly herewith submitted. Considering, however, that a beacon would mark the shoal during the day only, and that the risks and dangers of navigation are more imminent and numerous at night, and especially during the boisterous season, when the nights are longest, it has been deemed advisable, in anticipation of the approval of the bureau, to prepare also a plan and estimate for a light-house for the same point. In doing this, less hesitation has been felt, because, in the erection of any work at a position so exposed as the one under consideration, the only real difficulty consists in establishing the foundation; and because the greater cost of a lighthouse, although certainly considerably more than for a beacon, bears no sort of reasonable comparison when the superior and continuous usefulness of the lighthouse is considered. It was also conceived that the plan might be so arranged, that in case the beacon structure should be adopted, and should, when raised, be found competent to resist the shocks of the ocean, the project of a lighthouse might be finally executed. In contemplation, therefore, of that ultimate object, the dimensions of the proposed beacon, in general and in detail, have been enlarged beyond what might be otherwise considered sufficient; but whatever may be the excess thus caused in the estimate for the beacon, it is confined almost wholly to the foundry cost of the structure. In other respects, unless the size of the work should be greatly reduced, the expenses, excepting those in which time enters, would remain nearly, if not quite, the same.

As the two structures, as already stated, are in part common to each other, a description of the lighthouse, as the larger of the two, will, with occasional reference to the beacon, be sufficient for both.

The foundation is composed of iron piles, so grouped together as *to form an octagonal prism 50 feet* in diameter, and about 42 feet in height. From this prism, as a base, rises a truncated pyramid, composed also of iron piles, which inclining inward 6 on 1, for a further height of 120 feet, fall within the diameter of 10 feet, and are received and secured in a great ring-piece, which, in turn, is surmounted by the watch-room and lantern, making the whole height 185 feet. The piles, one at each angle, and one at the centre of the octagonal prism, are of 12 inches; those of the truncated pyramid in three lengths of 12 inches, tapering to 6 inches. The entire structure including the prism for the length of the piles, is braced horizontally in seven planes, and diagonally between every consecutive two of these planes, except where the dwelling of the light or cage of the beacon, as the case may be, interferes, when these are in part omitted. *The dwelling stands* 40 feet above the highest tides, is composed of three stories of nine feet each, and communicates with the watch-room and lantern above by a spiral stairway in a column of wrought-iron 8 feet in diameter. The two lower stories are 30 feet, and the upper story 20 feet in diameter; the first and third stories, as well as the roof of the dwelling, and the watch-room and lantern being surrounded by galleries. The watch-room and the lantern are 12 feet in diameter; the former 6 ft. 9 in. in height, the latter about 12 feet, with the roof and ventilator, &c., 20 feet in height. The beacon occupies but two of the three lengths of piles forming the pyramidal frustrum of the larger structure The cage, the bottom of which is elevated 60 feet, and the extreme top 108 feet above the level of the highest water, is composed of columns arranged in the form of a cylinder, 24 feet in diameter and 24 feet in height, surmounted by a canopy giving it a further height of 24 feet.

These are the outline or main features of the two structures The details will be better understood from the drawings communicated herewith, than from the most lengthened and minute description. They consist of an elevation and vertical section of each work on a scale of 4 feet to an inch (1-48), and sixteen sheets of details on the same, and double the scale; and will show, not only the manner of bracing proposed, but also the character of the case, the arrangement and finish of the dwelling, and passage thence to the watch-room and lantern of the latter; and also the arrangements for securing the boat for taking in stores; the position of the fog-bell; the keeping of the oil, water, and fuel, &c. &c.; and all other particulars, even to the size of the material employed, &c. Talbotypes of the elevation and vertical section of each reduced in scale to about 1-282, are also appended to the report.

It is now necessary to explain in what manner it is proposed to establish either work on the shoal. It was stated, when describing the applicability of screw-piles and pneumatic-piles for founding the proposed structures, that as the latter required no mechanical force to insert them into the bottom, for employment of a fixed staging, from which to apply such force as was required in the use of the former, would be unnecessary; and that although a floating body might, by well digested measures, in favourable weather, be successfully employed in sinking them singly, it would not be practicable to give the number of piles required to found the work their proper relative positions from so unsteady a footing. The utter hopelessness of constructing a fixed platform, under the circumstances, at so exposed a point as New South Shoal, at least by such time in the working-season as to render it available for the intended purpose, was also shown. What other course, then, shall be adopted in the emergency? It is, in my opinion—not lightly formed—to carry out and deposit on the shoal, by one bold measure, the entire lower or foundation portion of the structure described as the octagonal prism, and by Dr. Pott's process, so simple in its character and wonderful in its results, to sink it in the sand to the required depth. It will not escape attention, that in taking this course, the necessary bracings, down to the very level of the shoal, will be secured to the work; whereas, in putting down the piles separately, the attaching of them is barely possible under the most favourable circumstances, at so exposed a point.

The foundation or lower portion of the structure, already in part described, is formed of nine piles, occupying the angles and centre of the prismatic figure, bound together by two sets of horizontal braces—one 20 feet from the bottom, the other at the top—and by three sets of diagonal braces between these planes. It is necessary to state here, that the lower part of each pile is received by a cylinder having a conical base or foot, through which, by a separate pipe, provided for the purpose, extending to the top of the framing, it is designed to excavate the sand by the pneumatic process. By this arrangement, the advantages of the two systems—of the screw-pile and pneumatic pile—have been combined; the means, on the one hand by which the soil may be penetrated to the required depth, and the use, on the other, of a shaft, presenting, with a proper bearing, the least exposure, strength considered, to the action of the sea. For the character of this arrangement, and for all other details, reference is respectfully made to the model of the foundation section, on the scale of 1-24, which will be deposited in the bureau. The work, as designed, including the cylinders with the conical bases to receive the solid piles, and all necessary appendages, such as air pump and receivers, and air and sand piles, &c. &c., for sinking it into the bottom, weighs 238 tons. To receive and float this great weight, distributed as it is throughout such large bounds, will require twin-camels, each at least 100 feet in length, 15½ feet beam, and 10 feet depth of hold, or say about 160 tons. These camels, when light, will draw little over 3½ feet of water; and when loaded about 7 feet Carrying the foundation as proposed, with the lower set of horizontal braces resting on the rail, the cones or shoes of the cylinder will extend nearly 4½ feet below the keels. In this same position, 61 tons of the weight will be suspended below, while the balance, or 177 tons, will stand above the rail It will be time enough, should the present design be approved and ordered to be carried out, to digest all necessary details, to insure a full efficiency to the camels; to determine whether they shall consist, as now proposed, of two similar vessels of ordinary model, or of two having, when combined the general outline of a single vessel; the most perfect way of securing them to each other, and to their burden; the best arrangement for towing, mooring, and flooding; and, finally, the proper mode of removing them from under the framing when it rests in position on the shoal. It is even now evident that it is desirable so to modify the lower framing that a larger proportion of the weight may be carried below the body of the camels than the present arrangement provides for. Again, it further appears, as far as experiments with the model may be relied upon, that to insure the uniform descent of the foundation, it is necessary to have either an air-pump for each pile, or, if one air-pump only is used, to communicate with the soil-receivers by air-pipes of equal lengths. The weight on each pile, when resting on the bottom, is 26·2 tons, which distributed over 19·6 feet, the area of the base of the cones, 5 feet in diameter, gives 1·33 ton for each foot. The entire weight of the lighthouse structure is 640 tons; of the beacon, 466 tons; giving 71·1 tons on each pile, or 3·6 tons on each superficial foot in the case of the first, and 51·6 tons, on each pile or 2·6 tons on each superficial foot, in the case of the second work. To sink the cylinders 19 feet in the sand, the depth proposed, will require the raising in each case of a column of sand of that height, 5 feet in diameter, or 373 cubic feet, or about seven times the contents of the receivers, calculated at 54 cubic feet. As there is, however, a large admixture of water with the sand, raised by pumping, the descent of the cylinders will necessarily call for the filling of the soil-receivers much more frequently.

In recommending the carrying out of the foundation in one body to the shoal, the hazards which belong to the entire proceeding, from the departure of the camels with their burden from the selected harbour, to their arrival, and the complete establishment of the work at the site, are, it is believed, in no wise underrated. So far from this being the case, it is not improbable that, by dwelling on the subject, I may have rather magnified them. The towing the camels in a sea-way with their load, a large proportion of which is, on the one hand, high above their decks, and on the other, far below their water-line; the placing, and then securely mooring them at the selected site; the flooding the camels, and then relieving the foundation, on resting on the bottom, from them, without injury from the heave of the sea to either, particularly the former; and, lastly, the sinking of the piles by the pneumatic process, are all operations, under the circumstances, of much delicacy, liable to great risks, and, as a consequence, involving the issues in much uncertainty. The velocity and ever-changing direction of the currents at the site, and through the group generally; the exposure, and the distance of the shoal from the land; and, above all, if it be possible to draw a distinction where each controlling condition holds so important a place, the distance of the point of destination from a harbour, all go to show that the difficulties and dangers of the operation are of no ordinary character. As its success depends on the vicissitudes of the weather, that is the true turning-point in carrying out the final design. But in making these observations, I desire also to say, that, in my opinion, the question is not, as in most cases, a mere selection from several plans, but is reduced to the alternative of adopting the plan now suggested as the only one that has a chance of success, or the entire abandonment of the design, to mark the position of the dangerous shoal in question.

The plan of operations for the erection of the lighthouse calls for four and a half years, thus distributed: one year and a half in constructing and setting up and taking down the work at the foundry, and transporting it to the selected harbour of refuge and departure; the first season at the shoal in establishing the foundation section at the site: the second season in raising and bracing the pile-framing, and forming the iron work of the dwelling, &c; and the third and last season in finishing the interior of the dwelling, &c., completing the lantern, and setting up lighting apparatus, constructing hoisting-davits, &c., putting up fog-bell and striking-machinery, water and oil-tanks, &c, furnishing, painting, &c., and lighting. The plan of operations for the erection of the beacon covers three years, employed as follows: one year at the foundry in forming structures, &c.; the first season at the shoal in fixing the foundation section; and the second and last in building up and bracing the framing and forming the cage, &c.

Conceiving, as already remarked, that the placing of the foundation constitutes the main obstacle to a successful issue to the proposed project, a description of the operations to carry it out will be confined to an outline of what would probably be the course in regard to that measure. It is necessary previously, however, to state, that although there is as little as 8 feet at low water on the shoal, and an area of considerable extent within the two fathom curve at the same stage of the tide, it has been thought advisable to design the work for a point in a depth of 14 feet on the land-side, and midway of the length of its crest, which standing in the relation somewhat of a breakwater, will afford a partial protection to the work against the deep-sea wave It should also be stated that as Nantucket, the nearest harbour to the shoal, has but 6½ feet at low water at the entrance, Edgartown, the next nearest, with 15 feet at the same stage of the tide, is selected as the harbour of departure and refuge in the proposed undertaking.

The precise site of the work on the shoal having been marked out by disc-buoys, having mooring anchors laid down, &c., and the double section composing the foundation put together on the camels, a favourable state of the weather, with the wind offshore, should be taken to set out from the harbour—so timing the departure as to reach the shoal, distant, as already stated, forty-two miles, by the dawn of day. The time required to make the trip will depend, of course, on the speed at which the steam-tugs can tow the camels with their burden. This will probably be found to be somewhat between three and a-half and seven miles per hour; but this point should be settled previously, by one or more experimental trips off the mouth of the harbour. These trials may also be found necessary to ascertain how the camels carry in a sea-way, so as properly to adjust the burden on them, &c. As the draught of the foundation structure, as carried on the camels, is less by 2½ feet than the depth at low water at the point at which it is proposed to found the work, the arrival at the shoal need not be governed by the stage of the tide, though high-water is preferable, as all other conditions being the same, the swell of the sea, in consequence of the greater depth is then least. Having arrived at the shoal, the operation of depositing the foundation at the site is one which, in case the weather continues propitious, should require but little time to accomplish. As the plan of the work is based on a regular figure, and may consequently take any position relatively with the shoal, the steam-tugs should tow the camels into place on the direction of the current as it then runs, when the anchors will be let go, and the other appliances prepared for the purpose put in requisition, to moor them as immovable as the circumstance of the case will admit. The next proceeding in course is to flood the camels, and bring the foundation on the bottom, when the former may be drawn by the steam-tugs from beneath the latter. A full and well-instructed force, already occupying the work, will then commence sinking the structure by the application of the steam air-pump, by excavating the sand under the piles through the cones forming their feet, and continue vigorously to prosecute the operation until it descends to the required depth. Twenty-four hours of favourable weather, would, it is confidently believed, suffice for the complete and satisfactory accomplishment of this most novel proceeding; and even half that time to place the work in safety on the shoal against any ordinary contingency of weather, in case the state of it at the time should prevent the sinking of the cylinders. The great breadth of the structure compared with its height, and the absolute regularity of its figure, combined with its enormous weight, and the smallness of its surface exposed to the blow of the sea, all go to warrant a confidence in this belief.

Although the range for an elevation of 137 feet (the least height by the design of the focal plane above the level of the sea,) and the deck of an ordinary size vessel, is quite within the powers of the second order of lenticular lights, it is deemed advisable, in view of the importance of apprising navigators of the position of the shoal at the earliest moment, to provide in the estimate for one of the first order, which by the increased volume of light may not only be seen under a less favourable condition of the atmosphere, but also be distinguished aloft from ships of the largest class when actually below the horizon. The difference in the first cost of the two orders is about $3000, the difference in the maintenance about $350, annually—confined in the present instance, from the character and isolated position of the light, requiring no larger force, to the greater consumption of oil—say 250 gallons—and the slightly increased cost of the smaller accessaries.

On the Cause of the Aurora Borealis;

By Prof. A. de la Rive.*

When in June 1836, I published in the Bibliothèque Universelle a note on the origin of hail and atmospheric electricity, I already foresaw that the same cause would explain the aurora borealis, and the irregular and diurnal variations of the magnetic needle. As I had not then seen an aurora, I withheld at that time this application of the principles. Since then I have witnessed two fine auroras, and the appearances observed, especially during that of November 17, 1848, have confirmed my view of the nature of the phenomena, while they also accord with the observations of others, especially with those of Hansteen, Bravais and Lottin, and also with the many interesting details in Humboldt's Cosmos. My subsequent electrical experiments throw additional light on the origin of the aurora.

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

This last statement indicates that I regard the cause as electrical. This view has often been presented before, and was brough forward by Arago at the time of Œrsted's discovery. Yet no one, to my knowledge, has explained the mode of action and production of the electricity, or the attendant phenomena resulting from this cause.

Without going into any historical details, I will briefly describe the aurora borealis itself and its effects, and then pass to my own theory, the accordance of which with facts I shall endeavour to point out.

1. Description of the Aurora and its accompanying effects.

I cite the following details principally from the Cosmos. They are derived mostly from the descriptions of Hansteen, Bravais, Lottin, and other travellers who have been in favorable places for observing the aurora. The learned author of Cosmos has grouped the facts with great skill, presenting in an admirable manner the prominent points, and seems with scientific tact to reach towards the true theory of the phenomena which he describes.

An aurora borealis is always preceded by the formation in the horizon of a kind of nebulous veil, which rises slowly to a height of four to six or eight, or even ten degrees about the magnetic meridian; the sky though before pure, becomes darkened, and over this obscure segment, whose color varies from brown to violet, the stars are seen as through a thick haze. An arc of light, first white, and afterwards yellow, borders the dark segment. Sometimes this luminous arc is agitated for hours by a sort of effervescence, and a constant change of form, before it rises into the rays or columns of light which mount to the zenith. The more intense the emission of the polar light, the brighter are the colors that appear, which from violet and bluish white pass by intermediate shades to green and purplish red—just as electric sparks are coloured only when the tension is strong, and the explosion violent. Sometimes the columns of light proceeding from the luminous arc are mixed with blackish or smoky columns; sometimes they rise simultaneously from different points of the horizon; or they may unite in a sea of flames of indescribable magnificence, the form and brilliancy of which are in incessant change. The motion gives greater visibility to the phenomenon. Around the spot in the heavens towards which the dipping needle points, the rays appear to cluster and form a corona. Rarely the aurora continues till the corona is on all sides complete, and when this happens, it announces that the end of the exhibition is near at hand. The rays then become feebler, shorter, and less bright in their colors. Soon, only large nebulous motionless spots, of a pale or ashy tint, are seen over the celestial vault; and finally, traces of the dark segment in the northern horizon, where the appearances began, alone remain.

The connection between the polar light and a certain kind of cloud is recognized by all observers, who affirm, that *the polar light sends forth its brightest columns when the upper regions of the air contain masses of cirro-stratus clouds of great tenuity, which tend to form a corona around the light.* Sometimes the clouds are grouped and arranged like the auroral columns; and in this case they appear to disturb the magnetic needle. After a brilliant aurora, the trains of clouds in the morning have sometimes been found to indicate the positions of as many luminous columns during the night.

The absolute height of the aurora has been variously estimated. For a long time it was supposed that it might be ascertained by the observations of distant observers on the corona: but it is now well known that the corona is only an effect of perspective, due to the apparent convergence of rays which are parallel to the dipping needle; so that each sees his own corona, as each his own rainbow. Moreover the aspect of the phenomenon depends on the position of the observer. The seat of the aurora is in the upper regions of the atmosphere; but sometimes it appears to be produced within less elevated regions, where clouds are formed. Such observations as those of Capt. Franklin appear to establish the latter conclusion, who saw an aurora which lighted up the under surface of the clouds, whilst Mr. Kendall, two or three miles distant, saw no light whatever, although awake and constantly observing the sky. Captain Parry also asserts his seeing an aurora depicted on the flank of a mountain: and it is said that a luminous arc has been seen on the surface even of the sea, around the magnetic pole.

Mairan and Dalton believed the aurora borealis to be cosmical, and not atmospheric. But Biot, who had an opportunity of observing the aurora at the Shetland Isles in 1817, proved it to be an atmospheric phenomenon, from finding that it did not partake of the movement of the stars from west to east, and consequently moved with the earth's rotation. Since then, nearly all observers have come to the same conclusion; and in particular MM. Lottin and Bravais, who have observed more than 143 auroras, and given detailed description of them.

It is therefore quite certain that the aurora is not extra-atmospheric. To the evidence from its appearances, we may also add the crackling noise sometimes affirmed to be heard by the inhabitants in the far north, and the sulphurous odor which also has been observed. And, in fine, if the phenomenon is wholly beyond our planet, why should it be located about the polar regions? M. de Tessan, in the voyage of the Venus around the world, saw a fine aurora australis, which he describes with care. It was 14° in height, and the centre of the arc was in the magnetic meridian. He heard no sounds connected with it, which he attributes to its distance: but he mentions that M. Verdier, a French naval officer, on the night of Oct. 13th, 1819, while on the coast of New Holland, heard distinctly a kind of crepitation, during a brilliant aurora. All the details mentioned by M. de Tessan prove the exactness of the observations.

As concomitant effects of the aurora, we have mentioned the crackling sound, and the sulphurous odor. M. Matteucci has also observed during the appearance of a late aurora, satisfactory evidence of positive electricity in the air. But of all the phenomena, those which are of most invariable occurrence are the magnetic. The magnetic needle undergoes perturbations, either to the west or east, and usually the latter. These disturbances vary in intensity, but never fail of taking place; and they are at times manifested in places where no aurora is seen. This coincidence of magnetic disturbance with the aurora, shown by Arago to be without exception, from many years of observations, enabled this philosopher to tell, while in the basement of the Paris Observatory, when there was an aurora in our hemisphere. M. Matteucci has observed this magnetic influence under a new form. During the aurora of Nov. 17, 1848, the armatures of soft iron used with the Electric Telegraph between Florence and Pisa remained attached to their electro-magnets as if strongly magnetised, although the apparatus was not in action, and the batteries out of use.

M. de Tessan cites an observation made in 1818, by M. Baral, another French naval officer, on the same coasts of New

Holland, who found that he had bee. making a wrong course from following his needle, there had been no storm, and the compass had not been touched. But on the evening of the same day, there was a brilliant aurora, and to this he attributes the deviation—a conclusion which could not have been dictated by theory, since at the time (in 1818) the relations between electricity and magnetism were not known.

The intimate connection between the aurora and terrestrial magnetism, has led Humboldt to designate as a *magnetic storm* a succession of disturbances of equilibrium in the magnetic forces of the earth. The presence of this storm is indicated by the oscillations of the magnetic needle, and afterwards, by the aurora, of which the oscillations are precursors, and which also put an end to the storm, just as the lightning in an ordinary electric storm announces that the equilibrium, before disturbed, is again established in the normal distribution of the electricity. Humboldt finds proof, amounting to experimental certainty, in the discovery of Faraday, who produced light by the action of magnetic forces alone, that the earth, by virtue of its magnetism, has the property of emitting light quite distinct from that which is afforded by the sun.

While recognizing the truth of the analogy which Humboldt here traces out, we should recollect, that it is not of itself, but because it produces electric currents, that magnetism gives out light; the light is purely electrical in origin. Magnetism produces luminous phenomena only because it can disengage electricity, and it is probably in this point of view that Humboldt says in a general way that it is a source of light.

It is hence in electricity, and in the influence which this agent in a state of motion, and magnetism, mutually exert, that we must look for the cause of the aurora borealis. This is the view which I would sustain, and to the force of my demonstration, I propose to bring some direct experiments, as well as the results of numerous observations through past years.

2. Proposed Theory.

The atmosphere in its normal state is constantly charged with a considerable quantity of positive electricity, which increases as we ascend, starting at the earth's surface where it is zero.

I will not inquire into the origin of this electricity: what is certain is that its production is connected with the action of the sun, since its intensity is subject to diurnal variations. It may be a question whether the sun acts directly, either through its light or its heat, on the constituents of our atmosphere, and so produces the electricity; or whether it is an indirect effect of the solar rays causing evaporation from the waters of the seas, or the vegetation of the land. It is probable that both causes act: yet I am inclined to regard the first as most general and most constant. But this is of little importance here: the fact of the constant charge of positive electricity in the atmosphere and of negative electricity in the earth, is abundantly proved, and this is sufficient for our explanations.

This constant production of the two electricities must necessarily be attended by a recomposition or neutralisation, otherwise the contrary electric states would acquire an infinite tension, which is contrary to observation. This recomposition or neutralisation takes place in two ways, one irregular and accidental, the other normal and constant.

The first method is exhibited under various forms. Generally it is the simple humidity of the air, or the fall of rain or snow, which causes the neutralisation. At other times, it is the thunder-bolt, which exhibits in an energetic manner the tendency to union in the two accumulated electricities, one in the air, the other in the ground. The winds in certain cases, by mixing the air from the earth's surface which is negative like the earth, with the positive air of a region more elevated, leads to a neutralisation of the two electricities, causing either storms or an exhibition of heat lightning. In winter, the air being constantly more saturated with moisture, the direct neutralisation is effected through the aqueous vapors and there are therefore fewer great disturbances and consequently fewer storms; and at the same time, as Arago has remarked considering the number of storms, the lightning strikes the earth more frequently in winter than in summer.

In general, the influence of the hygrometric state of the air on the manifestations of atmospheric electricity is almost as great as that of the cause itself which produces this electricity; for this influence makes itself felt both in the production of the accidental phenomena just enumerated, and in the indications of the electrometer by which we ascertain the normal electric state of the air for the hours of the day, and days of the year. Hence it is difficult to deduce from these observations even the intensity of the atmospheric electricity for any given moment, seeing that it is impossible to separate this original intensity from the degree more or less decided which the electric registers may manifest.

Let us now pass to the second mode of neutralisation of the two electricities, which I regard as normal and regular.

The positive electricity, with which the upper beds of the atmosphere are charged, will traverse them freely, because of their high state of rarefaction. But in the polar region, where the intense cold constantly condenses the aqueous vapors, it finds a portion of the atmosphere saturated with humidity, giving rise to mists; and by this means it may easily pass to the *earth and combine with the negative electricity with which the* earth itself is charged. It consequently results that there are constant currents of positive electricity rising from different points of the earth's surface into the upper regions of the atmosphere, which pass towards the poles, and then return beneath the earth's surface towards each of the points whence they have started. The currents of the northern hemisphere should go to the north pole, and those of the southern, to the south pole. In the equatorial regions, the position of the sun will determine the dividing line between the two systems. We may add that the experiments made with the electric telegraph have demonstrated that the terrestrial globe is an almost perfect conductor of electricity, compensating by its mass, for what it wants in the conductibility of the materials which constitute it. Thus the existence of the currents, whose course I have traced, rests on well established principles, with a foundation of simple experiment.

But more than this: their existence is demonstrated by facts long studied and established,—those pertaining to the diurnal variation of the magnetic needle.

I do not examine here into the origin of the earth's magnetism, a subject to which I shall have occasion to return in another work; for the present, I only say that I do not regard the disturbing causes of the direction of the magnetic needle as of the same nature with those which determine this direction. I content myself now with regarding the earth as a large magnet having its two poles; and I study only the causes that modify the direction which, in this quality of a magnet, it tends to impress on the magnetic needle. These causes are the electric currents, whose existence I have just shown; they well explain the diurnal variations. These variations, in fact, consist in this, that in our hemisphere, the north pole of the needle moves to the west, during the morning until half-past one P. M., and then returns to the east during the rest of the day, to remain stationary during the night. But this deviation is precisely that which should be occasioned by currents passing along the surface of the globe from the north pole to the equator, augmented, in intensity with the heat of the day and diminishing as it decreases. The diurnal variation is at its maximum (13′ to 16′) in those months in which the sun is longest above the horizon, May, June, July, August. It is at its minimum (4′ to 5′) during the winter months. The variation is greater as we pass from the equator towards the pole; but it is evident, that if the currents, proceeding from different points of the earth's surface heated by the sun, rise in the atmosphere to redescend at the polar regions, and thus traversing the globe, reach their points of departure, the nearer the needle to the magnetic pole, the greater the number of currents that will act upon it: near the equator, it will not be subject to any influence from the currents which are formed beyond the region around the needle. In winter these differences are less sensible, because the currents from the equatorial regions are the only ones whose effects will be very decided, on account of the little difference of temperature which exists in this season between the earth's surface and the upper regions of the atmosphere in the temperate and especially the polar zone.

Finally, according to our theory, the same effects should be manifested in the southern hemisphere, only that all is reversed; and this is fully established by the various results of recent observers, including those of Colonel Sabine and a large number of travellers.

I should however acknowledge that there are some anomalies, either in the hours or in the direction of diurnal variation, at certain places, especially at St. Helena and the Cape of Good Hope, anomalies which it is difficult to explain by the theory proposed. But I am convinced that when further examined, they will be found to be due to local and accidental causes, such as the vicinity of the sea, which influences very notably the diurnal variations of temperature and especially their amplitude and the hours of the maximum and minimum of heat. The question whether there are not places of no variation, proposed by Arago, is of little importance in this connection The points of the earth's surface without diurnal variation, will be those where the two currents originate, and whence they proceed from the right and left towards the two poles: they are situated in the equatorial regions, but they cannot well be laid down, as their position will vary with the sun, the temperature, the winds, and other disturbing causes.

But I do not dwell on this point, as my object is not to treat of the diurnal motions of the needle. My end is simply to prove from the diurnal variations, the existence of the terrestrial currents. In continuation, we may obtain another proof still more direct, although less general, of the presence of these currents, by making use of the telegraph wires for collecting them. This I have done in England, as has also Mr. Barlow; and M. Baumgartner has performed similar experiments in Germany. In these trials, the currents have in all cases been detected by means of the galvanometer. M. Baumgartner, having introduced a very sensitive galvanometer into the circuit formed by the telegraph wire between Vienna and Prague, which has a length of about 61 miles, obtained the following results when the two extremities of the wire were buried in the earth.

1. The magnetic needle never stood at zero, but was more or less deviated.

2. The deviations were of two kinds, some of large extent, even 50°, others small, varying from 1° to 8°,—the former not common, and changing in direction and intensity, so that no law can be discovered; the latter on the contrary subject to a simple law, and being very regular when the air is dry and the sky serene, but with many anomalies when the weather is cold and rainy.

Mr. Barlow has made numerous observations, and obtained results demonstrating the exactness of the principle, which I have laid down. Four main lines stating from Derby, were used in his experiments, two running towards the north and northeast, and two towards the south and southwest. The direction of the currents perceived on the first two lines, was always contrary to that of the currents on the two others, as ought to be the case, on the theory proposed. But the most remarkable fact, is the perfect concordance which these observations have proved to exist between the movement of the needle of the galvanometer placed in the circuit of the telegraph wire and the diurnal variations of the magnetic needle. The diurnal movement of the needle of the galvanometer is subject to disturbances in intensity more or less continued, during storms, and also when the aurora borealis is visible; and so also is this true of the compass needle. There is this difference, that the currents acting on the latter, circulating beneath the earth's surface, should not be subject to disturbances like those which happen to the telegraph wires through the influence of the electrical condition of the atmosphere about them.

The existence then of electric currents circulating beneath the earth's surface appears to us to be well demonstrated, and once proved, it leads necessarily to the conclusion that it is a consequence of the normal and regular reëstablishment of the electric equilibrium between the earth and its atmosphere, which is broken essentially in tropical regions, whilst the electric discharges, more or less intense, which take place between the earth and the air are the accidental and variable means for the reëstablishment of this equilibrium. We may now see how the explanation of the phenomena of the aurora both north and south, flows necessarily from the formation of these electric currents circulating from the equator to the two poles in the upper regions of the atmosphere, and from the two poles to the equator along or beneath the surface of the globe.

As we have said above, the positive electricity with which the atmosphere is charged, especially in the upper regions, is carried towards the two poles either by the greater conductibility of the upper and most rarified strata of the atmosphere, or by the currents of air in the upper regions which move from the equator to the two poles. It is consequently through the vapors which are constantly condensed in the forming mists in the polar regions that the positive electricity should find its passage into the earth, and also therefore its discharge. This discharge when possessing a certain degree of intensity should be luminous, especially if, as is almost always the case near the poles and sometimes in the upper regions of the atmosphere, it encounters in its course icy particles of extreme minuteness, which form the haze as well as the more elevated clouds.

The formation of lunar halos which generally precede the appearance of an aurora, and the fall of rain or snow which also is often a prelude to it, are a proof of the presence in the atmosphere of these fine needles of ice, and of the part they play in the phenomenon before us.

This attenuated mist, rendered luminous by the transmission of electricity, ought to appear under a regular form, like an illuminated surface of greater or less extent, and more or less broken. It should spread outward from the poles, forming as a first appearance the auroral bank like a veil in the north. The tenuity of this veil is such that the stars may be seen through it, as has been remarked by all observers. MM. Bixio and Barral, in the balloon ascension which they recently made, suddenly found themselves,—although the sky was quite serene and the atmosphere without a cloud—in the midst of a veil or mist, which was perfectly transparent, consisting of a multitude of small icy needles so fine that they were hardly visible. Such are the needles which become luminous by the passage of the electricity, which determine the formation of halos as has been rigorously demonstrated, and produce by condensation the aqueous vapors in their passage through the air towards the earth, the fall of snow or rain, or sometimes under peculiar circumstances, hail.

Now if we inquire what should pass in the portion of the luminous mist nearer to the earth's surface, we shall conclude that the vicinity of the magnetic pole must exert a decided influence on this electrised matter,—for it is in fact a true mobile conductor traversed by an electric current.

In order to obtain a correct idea of this action, I have endeavored to imitate artificially the process of nature, and with this view, I contrived the following experiment.

Into a glass globe, 30 to 40 centimeters in diameter, I introduced through one of its two opposite tubulures, a piece of soft iron wire, about 2 centimeters in diameter, making it to terminate at the inner end very near the centre of the globe, while the other end was exposed out of the globe. The wire was covered through its whole length, excepting its extremities, by a very thick insulating bed formed first of shell-lac, then with a glass tube covered itself with shell-lac, then with a second tube of glass and finally with a bed of carefully applied wax. The insulating layer in all was a centimeter thick, giving 4 centimeters for the thickness of the bar thus covered. Within the globe, a ring of copper surrounded the bar and its insulating bed, at the part most distant from the tubulure. This ring was arranged to be put in communication with a source of electricity exterior to that of the bar by means of a metallic wire insulated with care which passed through the tubulure and ended without in a hook. A stopcock attached to the other tubulure of the globe, was arranged for obtaining a vacuum. When the air within is sufficiently rarified, the hook is connected with the conductor of an electric machine, and the outer extremity of the bar of iron with the soil; by this means the electricity forms within the globe a luminous sheaf, more or less irregular, which passes from the ring, and terminates at the inner extremity of the soft iron. But immediately on placing the outer extremity of the soft iron on the pole of an electro-magnet, the electric light takes a wholly different aspect. Instead of proceeding indifferently from different points of the upper surface of the cylinder of iron, it proceeds from all points in the circumference of this surface, so as to form around it a continuous luminous ring. This is not all: this ring has a movement of rotation around the magnetized cylinder, sometimes in one direction and sometimes in the other, according to the direction of the electric current, and the nature of the magnetization. Finally, jets of brilliant light are seen to proceed from this luminous circumference, which are distinct from the rest of the mass of lig[ht]. When the magnetization ceases, the luminous phenomena return to the condition familiar in the experiment, known under the name of the *Electric Egg*.

There is some advantage in using for the experiment here described Armstrong's hydro-electric machine, in which the boiler is made to communicate with the hook which is united by a metallic connection to the ring of copper within the globe, while the conductor which receives the vapor is put in connection with the bar of soft iron. Thus we have in the globe an electric current of great intensity which may be changed in direction, by inverting the connections.

(To be continued.)

The Mints of the United States.

BY PROFESSOR WILSON.*

The transmissions of gold from the new state of California have caused a corresponding increase in the gold currency of the States, and have invested the Mint operations with more general interest than under the previous ordinary circumstances they possessed. The same condition of things exists in this country; and as it is intended to establish a mint in the gold producing colony of Australia, I thought it desirable to obtain as much information as I could in reference to the organisation and working details of those in the United States.

The head establishment is at Philadelphia, and is called "The Mint;" there are also three "Branch Mints;"—at New Orleans, in Louisiana; at Charlotte, in North Carolina; and at Dahlonega, in Georgia, respectively. The Branch Mint in California, and the Assay Office in New York, are not yet completely organised.

At the Mint in Philadelphia, gold, silver, and copper, are coined; at New Orleans, gold and silver are coined; while the branches at Charlotte and Dahlonega coin gold only. At "The Mint," the executive staff consists of a director, treasurer, chief coiner, melter and refiner, engraver, assayer, and assistant-assayer. At the New Orleans Branch Mint the staff consists of a superintendent, treasurer, melter and refiner, and coiner; and at each of the other two branch mints there are but three officers,—superintendent and treasurer (combined), assayer, and coiner. The several duties of these officers, the remuneration they shall receive for their services, and the amount of security they shall give for the due performance of them, are duly prescribed by an Act of Congress supplementary to the Act entitled "An Act establishing a Mint and regulating the Coins in the United States;" this latter act giving all the details referring directly to the coinage of the country.

At the United States Mint at Philadelphia, the salaries are fixed as follows:—Director, £3500; treasurer, $2000; chief coiner, $2000; melter and refiner, $2000, assayer, $2000 At the New Orleans Branch Mint the salaries are, to the superintendent, $2500, and $2000 each to the other officers; and at the other branch mints the superintendents receive $2000, and the other officers $1500 respectively. In each of the establishments the appointment of assistants, subordinate officers and servants, is left entirely in the hands of the chief of the different departments.

In visiting the Mint at Philadelphia I had the advantage of being taken through the several departments by the chief coiner, Mr. Franklin Peale, and the melter and refiner, Professor J. C. Booth, who kindly furnished me with the following de-

* From the Special Report on the New York Industrial Exhibition.

tails of their operations. As the gold is brought to the Mint in various quantities and in a crude state, it passes necessarily through the department of the refiner before it reaches that of the chief coiner; I therefore give the actual details of the refining operations upon sundry deposits of gold, amounting in the aggregate to $2,000,000.

The deposits are immediately weighed and a certificate of their gross weight issued. The fires having been lighted in the five furnaces of the deposit melting-room at four or five o'clock, A.M., all the deposits, amounting perhaps to seventy or eighty, are melted before noon; assay slips are then taken off and the assays finished * the next morning, after which their values are calculated by the weight after melting, care being taken to include all the grains that can be procured from the flux, pots, &c., by grinding them up under a pair of small chasers, sifting, and washing. There is a clerk and his assistant and one hand wholly engaged in performing all the weighings for the treasurer, such as weighing deposits before and after melting, ingots for coinage, fine bars, and the clippings after cutting out the planchets. There are five men in the deposit melting-room, two of whom attend to two furnaces each at the same time, one to one furnace and washing grains, and the remaining two are labouring assistants. The whole deposit of $2,000,000 is melted in three or four days in the deposit-room and assayed by from the third to the seventh day.

As soon as the first deposits are assayed, say on the third day (if expedition is necessary), or always on the fourth, they are granulated in the proportion of one part of gold to two parts of silver. The pots contains 50 lb. of gold and 100 lb. of silver, equal to 1800 oz., and each melt requires about an hour. With four furnaces (attended by four melters and two aids), there are ordinarily made thirty-two melts per day, but when hurried forty-eight melts can be made, making from one-third of a million to one-half of a million dollars per day. Two days' work, or about $650,000 worth of gold, equal in weight to one ton (avoirdupois weight), are granulated for a single setting with acid. The granulated metal is charged into large pots, together with pure nitric acid of 39° Beaumé, between the hours of seven and nine A.M. on the sixth day, and steamed for five hours. The pots made in Germany, are 2 feet in diameter by 2 feet in depth, set in plain wooden vats, lined with 3-sixteenth inch sheet-lead; a single coil of copper pipe passing around the bottom of the vat blows the steam directly into the water in which the pots are set to about half their depth.

The vats are arranged in a small house in the middle of the room with a large flue connecting with the chimney-stack, so that when in action the odour of nitrous fumes is scarcely perceptible in the building. The $2,000,000 require about sixty such pots; they are stirred about once each hour, say altogether five times with simple wooden paddles; the next day (seventh), the acid solution of nitrate of silver is drawn off by a gold-syphon into wooden buckets, and transferred to the large vat, in which it is precipitated by salt (chloride of sodium), and fresh acid added to the metals, now containing very little silver. Steaming for five hours on the seventh day completes the refining of $650,000. Early on the eighth one pot is drawn off, washed with a little warm water, and the gold-powder transferred to a filter. Fresh granulations are put into this empty pot, and the acid of the adjoining pot baled over upon them, and thus through the series, the whole being re-charged in from two to two and a-half hours. After steaming for five hours, the acid which contained but little silver from the preceding day becomes a nearly saturated solution of nitrate of silver. By this arrangement 4½ lb. of nitric acid are consumed altogether for each pound of gold refined, and the latter is brought up to 990 at 993 m. fine,—rarely below 990. Thus every two days, 13,000 lb. of nitric acid are used. In the course of the last year 1,000,000 lb. of pure nitric acid, at seven cents per pound, equal to $70,000, were consumed.

The gold is washed with hot water on the filter during the eighth day, and until it is sweet (say by 7 P.M). The filter consists of two layers of tolerably stout coarse muslin, with thick paper between, in a tub with a false bottom, 2½ feet in diameter and 2½ feet deep, and mounted on wheels. One of the men remains, after washing hours, until, 7 P.M., when the watchman of the parting-room continues washing the gold and silver until sweet, i.e., until the wash-water ceases to colour blue litmus paper. Early on the ninth day the wet gold is pressed with a powerful hydraulic press, and the cakes then thoroughly dried on an iron pan, at a low red heat. This process saves wastage in the melting-pot, since there is no water remaining in the pressed metal to carry off gold in its steam. The same day (ninth) the gold is usually melted with a less proportion of copper than is requisite to make standard metal, and cast into bars, which are assayed by noon on the tenth. They are then melted with the proper quantity of copper, partly on the same day, partly early on the eleventh, and assayed and delivered to the coiner the same day. On the fourteenth they are ready for delivery to the treasurer as coins.

The silver solution drawn off from the pots is precipitated in a large wooden vat of 10 feet diameter by 5 feet deep, and the chloride of silver immediately run out into large filters [6 × 3 × 14] where it is washed sweet. The filter is covered with coarse muslin, and the first turbid water thrown back; the filter, which is on wheels, is then run over to the reducing vats, and the chloride shovelled into them. There are four such vats [7 × 4 × 2] made of wood and lined with lead, 1 inch thick in the bottom. A large excess of granulated zinc is thrown on the moist chloride in the vats, without the addition of acid; the reduction is very violent, and when it slackens, oil of vitriol is added to remove the excess of zinc. The whole reduction occupies a few hours, and after a night's repose the solution of mixed sulphate and chloride of zinc is run off into the sewer.

About 2 tons of zinc per $1,000,000 of gold are employed; the silver, however, in this amount, say 10 per cent. by weight, should only take, by equivalents, about 2400 lb., so that nearly two equivalents of zinc for 1 equivalent of silver are used. This is found to be advantageous, as both time and space are greatly enconomised by this excess.

The day after the reduction the reduced silver is washed, and the second day it is pressed and dried by heat, the same hydraulic press as for gold being used, but with different drying-pans. The same silver is used again for making fresh granulations, but as it accumulates from the Californian gold, 10,000 or 20,000 are now and then made into coin, great care being taking in this case to aviod getting gold in it when drawing off the silver solution, and in the press.

Such are the actual working details in refining a specified amount ($2,000,000) of gold, the first-third of which is de-

* The mode of assaying is according to the "wet process" of Gay Lussac. This is too well known to need description here.

livered as coin in fourteen days after its arrival, and the third-third in eighteen days.

But as there is a bullion-fund of $5,500,000 allowed by government, depositors are paid from the third to the fifth day after an arrival, *i.e.*, as soon as the gold is melted, assayed, and its value calculated. When two heavy arrivals occur in close succession, the time of refining and coining can be shortened from 14 to 10 days.

The number of men engaged in the refining department is 14: 1 foreman, 8 for the parting process, 3 for reducing, and 2 for pressing and drying. In the gold melting-room there are 3 melters and 2 assistants. The total number of hands in the melting and refining departments is 34, including a melting and parting foreman, and 3 in the place for grinding, sifting, washing, and sweeping. This last place or sweep embraces all pots, ashes or fires, trimmings of furnaces, ashes of all woodwork, &c.

The late law for reducing the weight of silver coin necessitated an increase of force, and 15 more were in consequence employed for this purpose. While $50,000,000 in a year have been parted with the above force, they could with the same force and apparatus refine $80,000,0000 if it were required.

After many experiments upon anthracite, Professor Booth stated that he had at length fully succeeded in employing it for melting both gold and silver in the same furnaces, slightly modified, in which he had been accustomed to melt with charcoal. This change had been accompanied by great economy in the cost of material and labour, and by greater comfort to the workmen, from being less exposed to heat. The cost of charcoal (of the best quality—hard pine-knot coal) is 16 cents per bushel, delivered at the Mint; and while the cost of this fuel for all their operations in 1852, when gold was chiefly refined and melted, was about $7000, the cost of anthracite will be from $600 to $1000. In using the anthracite he found that a simple draught of air, without a blast, was quite sufficient to sustain combustion.

Californian gold frequently contains the alloy "iridosmine," which is not always detected by the assay. In order to remove it as far as possible without actually dissolving gold, it is allowed to subside, first in the granulating crucibles, and then in the crucibles for toughening (melting fine gold and copper). If the assayers report its presence in the toughened bars, they are again melted, and the iridosmine allowed to subside. By these three, and often four successive meltings, the gold is separated from its troublesome companion as far as practicable. The gold thus refined, and reduced to the proper standard [*Section* 8: "And be it further enacted, that the standard for both gold and silver coins for the United States shall hereafter be such that of 1000 parts by weight 900 shall be of pure metal and 100 of alloy; and the alloy of silver coins shall be of copper, and the alloy of gold coins shall be of copper and silver, provided that the silver do not exceed one-half of the whole alloy,"] is delivered over to the chief coiner in the form of bars or ingots of a certain weight, to be divided and shaped into pieces required for the currency of the country.

The *Coining* department of the establishment is of a power and efficiency sufficient to perform all the mechanical processes incidental to the issue of nearly 70,000,000 of pieces during the past year; and I was assured by Mr. Franklin Peale, the chief coiner, that it could have executed much more if it had been steadily employed, or fully supplied with material during the whole of that period. It is not necessary to go through the whole course of operations in this department, but to notice only such as possess novelty or present special characteristics.

The necessary power for working the machinery is obtained from a large steam-engine of the form usually known as the steeple-engine; it is a double vertical high-pressure engine, with cranks at right angles, the power being carried off by a caoutchouc belt, 2 feet wide, from a drum of 8 feet in diameter; the estimated power is equal to 90 horses. At times, this is all required, at others much less is sufficient, and in uncertain proportions; to meet this irregularity, and to insure that steadiness of motion so necessary in such delicate operations, a governor and throttle-valve of a peculiar construction have been devised which have now been in use for some time, and have produced most satisfactory results, fully effecting the purpose for which they were designed. The rolling mills, four in number, are driven by belts, at the rate of six revolutions per minute; the distances between the rollers being adjusted by double wedges, moved by a train of wheels which are connected with a dial-plate and bands, divided and numbered into hours and minutes, so as to indicate the proper thickness of the stripes of metal without the use of gauges. Gold stripes are heated in an iron heater by steam, and waxed with a cloth dipped in melted wax, and the silver strips are coated with tallow by means of a brush. The draw bench is used for both metals, and trial pieces are cut from every strip and their weight tested, preparatory to the cutting of the whole.

The cutting processes are very simple and efficient, consisting of a shaft moved by pulleys, and a 2½-inch belt, with a fly-wheel of small diameter but sufficient in momentum to drive the punch through the slip of metal by means of an eccentric of ⅜-inch, at the rate of 250 pieces per minute, which skilled hands can readily accomplish and continue until the slip is exhausted. The annealing during the rolling of the ingots into slips is performed in copper cases, in muffles of fire-clay and brick, heated by anthracite coal, three muffles or hearths being kept at a bright red heat by one fire-grate or furnace, and the distribution and intensity regulated by dampers. These annealing furnaces are recent in their construction and very satisfactory in operation; they are heated by anthracite at the cost of about one-fourth the expense of the wood previously employed.

The whitening of planchets is performed as usually by inclosing the gold in luted boxes, and by exposing the silver in an open pan, to the heat of a simple furnace with wood fuel; the drying and sifting after the action of dilute sulphuric acid, is rapidly and effectually accomplished by a rolling screen—one portion of which consisting of a pair of closed concentric cylinders, between which high-pressure steam is admitted. The blanks, with a sufficient quantity of light wood sawdust (linden or bass wood is the best), being introduced into the interior cylinder, a revolving motion is given to it by the engine for a certain time; the door is then opened and the blanks and sawdust gradually find their way into the wire screen by which they are separated, the movement being continued until the separation is complete, when the blanks are discharged at the end of the machine. An arrangement exists by which a slight inclination is given to the machine so as to direct the motion of the blanks towards the discharging end.

The milling machines are, I was informed, peculiar to this mint, and are in a great measure original, the operation being performed by a continuous rotary motion, with great rapidity and perfect efficiency, varying in rate according to the denomination of the coin, between 200 and 800 pieces per minute, and at the same time separating any pieces that are notably imperfect.

It must be understood that the operation here termed "milling," is merely for the purpose of thickening and preparing the edge, so as to give a better and more protective border to the coin, the ornament or reed, commonly known I believe in this country as "milling," being given to the piece by the reeded collar of the die in which the piece is struck.

The coining presses, 10 in number, and milling machines are worked by a high-pressure horizontal steam-engine, made from the design and under the direction of the present chief coiner, in the workshops of the establishment in 1838.

The presses are three sizes, the largest applicable to the striking of silver dollars and the double eagles :—the second to pieces of medium value :—and the smallest to the dime, half dime, and 3 cent. pieces. The first is usually run at the rate of 80 per minute, the last at 104 per minute,—the average rate of the whole is 82 per minute. This rate can be increased if required.

If all the presses were employed in coinage at the usual rate, they would strike in one day (9 working hours) 439,560 pieces; and if employed upon gold, silver, and copper, in the usual manner, and on the usual denomination of coin, they would amount in value to $966,193.

During the past year, on one occasion 8 of the presses were run 22 out of 24 consecutive hours, and coined in that time 814,000 pieces of different denominations of coin.

The presses have been made principally in the workshops of the Mint. They possess in common with the presses of Uhlhorn, in Germany, and Thouellier in Paris, the advantage of "the progression lever," "le genou" or "toggle joint," a mechanical power admirably adapted to this operation; but in almost every other particular they are original in arrangement, being the result of experience, beginning as far back as 1836.

In order to supply these presses various means have been devised; among them and not the least important, is the "shaking box," in which advantage is taken of a disposition observable in similar bodies, or bodies of similar form, to arrange themselves in similar positions. This is a box, whose bottom is constructed with parallel grooves adapted to the size of the blanks or planchets to be arranged. A quantity of them is thrown indiscriminately into the box, which is then quickly shaken in the direction of the grooves, the pieces immediately lay themselves side by side in parallel rows, from which they can easily be lifted in rouleaux as required to be passed to the feeding tubes of the mills or presses.

It is very evident to all visiting the establishment that such a large number of pieces could not be coined and manipulated by such a limited number of hands without the aid of some labour facilitating arrangements, one of the most worthy of remark of which is the method of counting the pieces coined —if counting it can be called, for in principle it is a measuring machine. The arrangement of this counting frame, or tray, may be understood from the following sketch of its construction.

A board or tray of such dimensions as may be required, is divided by a given number of parallel metallic plates dissected into its plane and slightly elevated above it, the edges of which rise no higher than the thickness of the coin for which it is intended. The board is of such a length as will admit of a few more than the required number of pieces to be laid longitudinally in the rows and is divided across and at right angles with the rows, and hinged at a point opposite to a given number. One of those employed by this department counted 1000 pieces, that is to say, it had 25 parallel grooves or rows sufficiently long to receive 45 pieces. Now, having thrown on this board a large excess of pieces, it is agitated by shaking until all the groves are filled, and then inclined forwards until all the surplus pieces have slid off, one layer only being retained by the metallic ledge; the hinged division is then suffered to fall, which at once throws off all but the 45 pieces in the length of each row. This operation, somewhat difficult and tedious to describe, is performed in a few seconds, and results in retaining on the board 1000 pieces, each piece exposed to inspection, and the whole accurately counted without the wearisome attention—so likely to result in error—required under usual circumstances.

The very large number of pieces coined during the last year has been counted almost exclusively by two female manipulators, assisted by a man who had the duty of weighing them in addition as a testing check. The same amount of labour by ordinary means could not have been performed with fewer than thirty or forty hands, to say nothing of inferior accuracy. This machine was originally arranged and patented by the late R. Dyler, coiner of the New Orleans Branch Mint, but materially improved in its application and construction by Mr. Franklin Peale.

The balances of the Mint of the United States have received the attention necessary to an instrument of such importance in mint operations. They have been arranged and made generally in the workshops of the establishment, and operate entirely to the satisfaction of the department. It is not necessary to enter into details of their construction, as a full and minute description is given in the Journal of the Franklin Institute for July 1847. I, perhaps, ought to mention that since that appeared, some slight improvements have been made by inclosing all but the stirrups and pans in glass, by these means excluding dust and protecting them from the influence of air currents.

In concluding this brief sketch of the practical working of the two most important departments of the United States Mint, I cannot omit a reference to the very excellent remarks of the chief coiner on the employment of females in some of the operations in his department. This, he informed me, had generally excited the surprise of, and been commented upon, by foreigners, who had visited the Mint. His experience, however, had led him to believe, that in places of trust, where no great physical exertion was called for, but where accuracy and strict integrity were of first importance, the moral perceptions of the female, generally stronger and of a higher standard than in the man, would qualify her as his substitute, and thus, while opening a new field of labour for the occupation of females, would strengthen their claims to it by the superior accuracy and economy of their work.

On Marine Boilers.

By J. A. Roebling, C.E., Niagara Falls.

The furnace of a boiler should be so constructed as to render combustion as perfect as possible, but it can do no more than produce carbonic acid. If only one-half of the oxygen necessary to form carbonic acid combines with carbon, the result will be carbonic oxide, a product of imperfect combustion. A certain supply of atmospheric air, therefore, is necessary; but this supply may be too copious or too scant; it may enter the furnace too rapidly or too slow; but it cannot be too high for rapid combustion. It is also evident that the quality of the fuel must have a controlling influence upon these various conditions. Wood as fuel for marine boilers is out of the question; we can only consider mineral coals, anthracite and bituminous, as fit for ocean steaming. It is not my intention here to analyse these varieties; I only notice them in so far as their peculiar qualities require peculiar mechanical arrangements for good combustion.

Soft or bituminous coal requires more time to be consumed economically than hard coal. The large bulk of hydrogenic and bituminous compounds, mixed up with floating particles of carbon, which result from the burning of soft coal, require to be thoroughly mixed with heated air before perfect combustion can take place. The mechanical arrangements to effect this are of great importance, but may be overlooked when hard or anthracite coal is consumed. The fuel admits of a much more rapid consumption and of a powerful blast, while the draught of a soft coal furnace should not be very strong.

Experience has not yet settled the most economical speed of consumption of mineral coals. Watt's rule was to allow one superficial foot of grate surface for every ten superficial feet of heating surface; and this rule produces good results with natural draughts. The boilers of the Collins' steamers are undoubtedly the most efficient and best constructed boilers now in use, either here or in Europe. According to Mr. Isherwood, those of the *Arctic* contain 0.357 feet of grate for 11·84 feet of heating surface for every effective horse-power, or 33 feet of heating surface for one foot of grate.

According to the same author, whose account of the performance of the *Arctic*, published in the "Journal of the Franklin Institute," appears to be reliable, the average consumption of anthracite during six trips was 7,980 lbs. per hour. The aggregate grate surface of the four boilers of that steamer is 588 feet, which gives 13·57 lbs. of coal per hour for each foot of grate. In boilers of ordinary construction with natural draught, half the weight of soft coal would be a fair consumption.

Chemists who have examined the evaporative power of various fuels agree that one pound of good mineral coal, perfectly consumed, will evaporate over 11 lbs. of boiling water. Experiments on a larger scale will seldom evaporate more than 9 lbs. to 10 lbs. The boilers of the *Arctic*, during those six trips, evaporated 7½ lbs. of steam from water of 110° by 1 lb. of anthracite; and this is one of the highest results that has been obtained in the regular working of marine boilers. It is evident, therefore, that there is room left for improvements. There is still a waste of fuel in the Collins' steamers, which arises from imperfect combustion; the result in part of a faulty construction; and, no doubt, in part is attributable to imperfect stoking. Much, of course, depends upon the mode of firing; nor is it always practicable to carry on this important part of the service according to the best rules.

In attempting to improve the construction of boilers, we may receive good hints from an examination of the condition and working of other furnaces, in which good combustion and a high degree of heat are important objects. Furnaces used in the manufacture of iron, such as blast, puddling, heating, and annealing furnaces, may be referred to.

Perfect combustion can only take place under such circumstances as are favorable to the development of intense flame and heat. Aside from the necessary quantity of air supplied at a certain rate, and heat if possible, there are other contingencies upon which success depends: a very important one is the nature of the material which surrounds the furnace, forms its walls and roof, and comes into immediate contact with the fire. The question then at once arises, can the process of combustion be successfully carried on in a narrow furnace, surrounded by iron walls and roof, in contact with water, which absorbs the heat at a rapid rate? Most certainly not. Who would undertake to heat and puddle iron in a furnace built of iron plate in contact with water? Iron water-boshes are sometimes resorted to; but they have a tendency to retard the process, and should be avoided if possible. Such furnaces are constructed of good fire-brick, which is a slow-absorbing and slow-conducting material, and after being glazed over by the strong heat will strongly reflect it. By this strong reflection and non-absorption the process of combustion is supported in an eminent degree; so much so, that a degree of heat is obtained far exceeding the temperature of any boiler furnace. As little heat as possible should be absorbed by the walls or roof of a boiler furnace; every endeavour should be made to reflect and concentrate the fire. Imperfect combustion in any furnace most generally arises from the fact that the heat is not allowed to accumulate and concentrate. The sole object of a boiler furnace should be to favour combustion, and to develop flame and blaze; and this can only be accomplished under the influence of a highly concentrated and excited action. The caloric stream thus fully elaborated, on leaving the furnace, is then allowed to expand itself; and to be absorbed by the surface of the boiler.

I may remark here, by way of general comment upon furnaces for heating houses, that the whole tribe of patent furnaces with which the country is blessed have all, more or less, grown out of erroneous notions, and are the offspring of profound ignorance of the laws of combustion and of heat. Aside from the vitiated air they supply, they are all wasting fuel at an enormous rate This subject is better understood in the north of Europe, where long winters and scarcity of fuel have taught men to build furnaces on correct principles.

The temperature of a puddling or heating furnace has to be raised to about 3,000°: this can only be accomplished under the reflecting and reverbatory action of the walls and roof. A concentrated blast may produce a greater heat at a certain point, but it will not be diffused. Under the above circumstances, and by means of strong blast, from three to four times as much fuel may be consumed on the same surface of grate in in one unit of time as can be accomplished in a common boiler furnace. In a well-constructed heating furnace at my rolling-mill at Trenton, N. J., 8,000 lbs. of anthracite are consumed in ten hours for the heating of 18,000 lbs. of charcoal hammered blooms, on a grate of twenty superficial feet, which is equivalent to 40 lbs. per hour on one foot of grate. This cannot be accomplished in the furnaces of the Collin's steamers, which consume 13½ lbs. per hour to one foot of grate.

In the above a principle is delineated which to my knowledge has been entirely overlooked, and which must be satisfied before we can attain much higher results.

Another glaring defect in all marine boilers, those of the

Collins' steamers not excepted, is the want of room necessary for a due mixture of the gases, and a full developement of the blaze.

Large quantities of fuel in a narrow and low furnace cannot be consumed without waste. In order to become fully excited and most positive in its action, the blaze of a fire must be at liberty to extend and elongate in the direction of the draught to a distance corresponding to its bulk, and without meeting absorbing obstructions. For illustration I again refer to heating and puddling furnaces. This fact can be readily ascertained in an experimental furnace with adjustable roof. The brightest fire will burn under the highest roof, while the depressing action of a low roof will damp it, and reduce the temperature of the furnace.

Economy of space is an important consideration in the planning of a marine boiler; but this may be carried so far as to seriously interfere with the grand object of the boiler. In an efficient boiler the extension of the furnace should form an empty area, which serves as a receptacle for the caloric stream, where the gases become thoroughly mixed and fully ignited before their caloric is expended upon the boiler surface; and for the purpose of allowing ample time to the heat to be absorbed by the tubes, the above space, together with the tube area, should be as large as possible. The arrangement must be so that the draught between the furnace and the chimney should be very slow, so that all the caloric, or nearly all, may be absorbed before the unconsumed gases are allowed to escape.

The boilers of the *Arctic* have 33 feet of heating surface for one foot of grate surface: this allowance is scarcely enough for hard coal—40 to 1 will not prove an excess. But this proportion depends, in a great measure, upon the velocity of the draught through the area which contains the tube or heating surface. The larger this space, or the longer its extent, the slower the motion of the gases will be; or the more extended their travel, consequently the longer they will remain in contact with the tubes. It is a very general defect in marine boilers, that the draught from the furnace to the chimney through the tube area, or through the flues, is nearly uniform, and too rapid. The "hanging- sheets" in the boilers of the Collins' steamers were designed to arrest this rapid flow, but they are not sufficient. The fact is, that the common plan of flue or tube boilers does not admit of a thorough application of the important principle in question; hence the necessity of a radical change.

Other questions of importance have to be considered in the planning of a marine boiler. Strength, facility of construction and repairs, provisions against unequal contractions and expansion, against incrustation, facility of blowing out and of cleaning, safety against exposure of heating surface when the ship is rolling or careening—all these are important points, but more or less understood. By the above remarks I have only attempted to direct attention to such points as are not generally understood, and consequently neglected. In a new plan of boilers which I have invented, all the essential conditions of perfect combustion, radiation, and absorption are fulfilled, and are calculated to produce much higher results than have been obtained heretofore.

In conclusion, I will yet remark that the subject of artificial draught is, in a great measure, an open question yet. The common fan-blast will answer very well under certain conditions; but in marine boilers, I am satisfied, exhaustion by proper mechanical means will work better. The control of large and connected fires can be better maintained by exhaustion than by blast, and also more economically.—*Scientific American.*

INCORPORATED BY ROYAL CHARTER.

CANADIAN INSTITUTE.

SESSION 1854-55.

First Ordinary Meeting—Saturday, December 2d, 1854.

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

Charles Fitzgibbon	Toronto.
Richard Forneri.	"
Arthur A. Farmer	Woodstock.
Lawrence Laurason	London.
John T. Newton, M.D	Sault Ste. Marie.
Hector Cameron	Toronto.
Rev. W. Leach, LL.D	Montreal.
W. Kingston, M.D	"
Alex. Rennie	"
Andrew Dickson	Packenham.
Hewith Bernard	Barrie.

A communication from the Council was read, being the "Report of the Special Committee appointed to consider Major Lachlan's suggestions with respect to the establishment of a series of Meteorological and other Observations throughout British North America."

REPORT.

The Committee appointed to consider Major Lachlan's suggestions with respect to the establishment of a series of simultaneous Meteorological observations throughout the British American Provinces, beg leave to report, that after giving due consideration to the plan suggested by Major Lachlan, they have thought it advisable, before recommending any special steps to be taken, that correct information should be procured with reference to the working of a similar system in the United States, which has now been in operation for some years. The Committee have requested one of their members to communicate with Professor Henry, the Secretary of the Smithsonian Institution, as well as with other gentlemen in the United States and Canada, whose views on this subject the Committee consider it essential to obtain. Not having yet received the required information, the Committee are unprepared to recommend to the Council any definite course of action.

The following gentlemen, who had been provisionally elected by the Council during the recess, were duly elected:—

J. C. Small	Collingwood Harbour.
Rev. Professor J. M. Smith	Kingston.
Rev. Professor J. Williamson	"
H. N. Courtlandt	Simcoe.
R. L. Denison	Toronto.
George Wilson	New York.
D. O. French	Toronto.
D. B. Read	"
John Thomson	"
Rev. Professor G. Weir	Kingston.
Rev. J. H McKerras	Darlington.
Rev. W. Reid	Toronto.
John Moore	"
Rev. J. Gray	Orillia.
George Thomas	Chatham.
William Campbell	Quebec.
William C. Chewett, M.D.	Toronto.

Notice was given by Professor Hind, that at the annual meeting of the Institute he would move for an alteration in the Bye-law relating to the day of meeting.

Notice was given by A. H. Armour, that at the annual meeting of the Institute he would move for an alteration in paragraph No. 2 of section 5 of the Regulations of the Institute.

Mr. Cowing submitted and described at length, his plans of a new Steam Plough and Portable Steam Engine for general purposes.

The thanks of the meeting were given to Mr. Cowing.

Second Ordinary Meeting—Saturday, December 9th, 1854.

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

John Page	Quebec.
James Browne	Toronto.
Philip Browne	"

The following gentlemen were elected members:—

Charles Fitzgibbon	Toronto.
Richard Forneri	"
Arthur A. Farmer	Woodstock.
Lawrence Laurason	London.
John T. Newton, M.D	Sault Ste. Marie.
Hector Cameron	Toronto.
Rev. W. Leach, LL.D	Montreal.
W. Kingston, M.D	"
Alex. Rennie	"
Andrew Dickson	Packenham.
Hewith Bernard	Barrie.

The following nominations of office-bearers for the ensuing year were made:—

President	The Hon. Sir John Beverly Robinson, Bart. The Hon. Mr. Justice Draper.
1st Vice-President	G. W. Allan. Professor Wilson.
2d Vice-President	Professor Wilson. G. W. Allan.
Corresponding Secretary	Thomas Henning.
Recording Secretary	F. W. Cumberland. D. Crawford.
Treasurer	D. Crawford. J. Stevenson.
Librarian	Sandford Fleming.
Curator	Professor Chapman.

MEMBERS OF COUNCIL.

Professor Croft.	Professor Hind.	A. H. Armour.
O. Mowat.	Prof. Cherriman.	Prof. Hincks.
Samuel Spreule.	A. Brunel.	Robert Spratt.
Prof. Buckland.	J. T. Brondgeest.	S. P. Harman.
Prof. Bovell.	J. G. Hodgins.	G. P. Ure.

Annual General Meeting—Saturday, December 17th, 1854.

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

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

The following gentlemen were elected members:—

John Page	Quebec.
James Browne	Toronto.
Philip Browne	"

The Annual Report of the Council was read by the Secretary:—

ANNUAL REPORT OF THE COUNCIL, 1854.

The Council of the Canadian Institute have the honour to present their Third Annual Report since the grant of the Royal Charter of Incorporation at the close of the year 1851, and their Sixth Report since the establishment of the Society in 1849.

The Council consider the present a suitable occasion to review the progress of the Society during the short period which has elapsed since it acquired the position and privileges of a Chartered Institution.

At the close of the first year of Incorporation, the number of members of the Institute was 112. During the second year 135 new members were added, making a total at the close of the second year of 247. A similar encouraging increase has taken place during the past year, and the Council have now to report 333 names on their books. This number includes 18 members elected provisionally during the recess. The table subjoined furnishes a classification of the members of the Society in the orders acknowledged by the Institute.

Honorary Members	4
Life Members	10
Ordinary Members	288
Junior Members	31
Total	333

During the Session of 1853-4, the following papers were read at the ordinary meetings:—

J. T. Brondgeest — "On the Preservation of Food," 10th December, 1853.

Dr. Bovell—"Renal Circulation," 7th January, 1854.

A. Brunel—"On the Comparative Advantages of Single and Double Track Railways," 14th January, 1854.

G. H. Dartnell — "Duration and Expectation of Life in Canada," 21st January, 1854.

W. E. Logan—"On the Physical Structure of the Western District of Upper Canada," read by Prof. Croft, 18th January, 1854.

T. Henning—"Meteors and Falling Stars," 4th February, 1854.

Prof. D. Wilson, LL.D.—"Some Coincidences between the Primitive Antiquities of the Old and New World," 11th February, 1854.

Prof. Cherriman—"Meteorological Report, 1853," 11th February, 1854.

Rev. Prof. Irving—"On Solar Eclipses," February 18th, 1854.

Rev. Prof. Parry—"On the Early History of Rome," February 25th, 1854.

Prof. Chapman—"A Short Account of the Chlorastrolite of Lake Superior, and Observations on Minerals presented by Dr. Wilson, of Perth," February 25th, 1854.

Thomas Cottle—"A few rough Notes on some of the Saturniæ, and Suggestions on the Possibility of using their Silk for Textile Fabrics," read by Prof. Croft, March 4th, 1854.

Dr. Bovell—"On the reproduction of the Digestive Organs of the Holothurea, March 4th, 1854.

Dr. W. Craigie—"A List of Indigenous plants found in the neighbourhood of Hamilton, with the dates of their flowering." (*Laid on the Table.*)

E. Billings—"On some new Genera and Species of Cystidea, from the Trenton Lime-stone," read by Prof. Hind, March 11th, 1854.

Prof. D. Wilson, LL.D.—"On Traces of the Practice of the Medical Art amongst the early Romans," March 11th, 1854.

Major Lachlan—"On the Establishment of a System of Simultaneous Meteorological Observations, &c., throughout the British American Provinces," read by the Rev. Prof. Irving, March 18th, 1854.

Rev. Prof. Hincks—"Remarks on a Peculiar Vegetable Production from South America," March 18th, 1854.

Rev. Dr. Scadding—"Memoranda of Vesuvius and its neighbourhood," March 25th, 1854.

Prof. Chapman—"Remarks on the Tooth of an Elephas Primigenius, found in the River Credit," March 25th, 1853.

Prof. D. Wilson, LL.D.—"On the Intrusion of the Germanic Races into the area of the older Keltic races of Europe," April 1st, 1854.

E. Billings—"On some new Genera and Species of Cystidea, from the Trenton Limestone," read by Prof. Hind, April 8th, 1854.

Rev. J. McCaul, LL.D.—"On some doubtful Points in Grecian and Roman Antiquities," April 29th, 1854.

Major Lachlan—"On the rise and fall of the Great Lakes," read by the Rev. Prof. Irving, April 29th, 1854.

The Council have particular pleasure in acknowledging the great merit of several original papers contained in the foregoing list. The valuable contribution of W. E. Logan, F.R.S., "On the Physical Structure of the Western District of Upper Canada," is a very important addition to our knowledge of Canadian Geology, and seems to dispose of the question frequently raised respecting the existence of workable coal fields in Upper Canada.

The papers communicated by Mr. Elkanah Billings, "On some New Genera and Species of Cystidea from the Trenton Limestone," would do credit to the transactions of the most distinguished Societies in Europe and America. The highly interesting collection of facts, "On the rise and fall of the Great Lakes," by Major Lachlan, furnishes a large amount of instructive information respecting the history of one of those remarkable inland seas, and in the absence of any extended systematic observations, is a happy response to the wishes expressed in the Report for the year 1852. It is, however, a matter of sincere regret, that the present Council have to repeat the strong expression of disappointment contained in the Report of their predecessors, at the absence, with one exception,* of any papers on the Science of Engineering. The Council consider this is particularly to be regretted during the present period, when works of stupendous magnitude and vital importance are being executed throughout Canada.

* Mr. Brunel, "On the Comparative Advantages of Single and Double Track Railways."

The Council have much pleasure in being able to give assurance o the continued success of the *Canadian Journal*. It now serves as the medium through which the simultaneous Meteorological observations made at Toronto, Montreal, and Quebec, are presented to the public in a connected form. At the request of the Literary and Historical Society of Quebec, a limited portion of its pages is devoted to the gratuitous publication of a Synopsis of their Proceedings at their literary meetings. It is thought probable that other Canadian Scientific Societies will make application for similar privileges, and the Council would recommend to their successors the propriety of continuing a liberality which cannot fail to be generally advantageous to the advancement of Literature and Science in this country.

The circulation of the *Journal* is steadily improving, and now amounts to 554 copies monthly. In this number is included 60 copies, distributed by order of the Library Committee of the Legislative Assembly—an encouraging liberality, which the Council desires to acknowledge in the warmest terms.

The Council have not been unmindful of the interests of the Library in their expenditure of the funds entrusted to their charge. They have expended the sum of £69. 19s. 2d. for Books and Maps, but have been deterred from making other purchases in consequence of the anticipated amalgamation of the Athenæum with the Canadian Institute, —the valuable and extensive Library of that Society becoming the property of the Institute after the necessary Parliamentary sanction to the union has been obtained, which will probably be received early in the ensuing Session. The following list comprises the works which have been added to the Library by purchase:—

Books Purchased for the Library.

	Vols.
Ure's Dictionary of Arts	2
Geological Observer (De la Beche)	1
Notes and Queries	2
Lyell's Manual of Elementary Geology	1
Progress of Astronomy (Leoni's)	1
British Almanac, 1854	1
Humboldt's Views of Nature	1
Mantell's Fossils	1
Report of British Association, 1852	1
Nicholl's Architecture of the Heavens	1
Art Journal, 1852	1
Notes and Queries	6
Tredgold on Steam Engine—Marine Engine, Text, 1, plates 1; Stationary Engines, Marine Engines and Boilers, 1; Locomotive Engines, 1	4
Silliman's American Journal	16
Registrar General's Reports, from 1 to 15, with appendices	18
	Nos.
Philosophical Magazine and Journal, 1854	10
Journal of Microscopic Science	8
Repository of Arts, Science and Manufacture	9
Quarterly Journal of the Geological Society	3
Quarterly Journal of the Highland Agricultural Society	8
Quarterly Journal of the Chemical Society	3
Chemical Gazette, 1854	17
	Vols.
Liebeg and Kopp's Annual Reports — Chemistry and Allied Sciences	4
Kirby and Spence's Entomology	2
General Structure of Animal Kingdom—T. Rymer Jones	1

Maps.

Bouchette's Map of Canada	1

The Periodicals mentioned in the former Report have been continued.

The Council are desirous of acknowledging the liberality of numerous gentlemen in Canada and elsewhere, whose contributions to the Library and Museum are rapidly creating most valuable and interesting adjuncts to the Society. The list subjoined contains the donations which have been received during the year:—

Donations.

	Vols.	
Norway and its Scenery, by T. Forrester	1	A. H. Armour, from Mr. Bohn.
Bechstein's Cage Birds	1	
China, Ava, and Siam, by Miss Corma	1	
DeLolme on the Constitution	1	
Egypt, Ethiopia, &c., by Lepsius	1	
Humphrey's Coin Collection	2	
Humboldt's Travels, Vol. III	1	
Introduction to History, 19th Century	1	
Logan's Geological Survey, 1845-46, & 1848-49,	2	A. H. Armour.
Do. do. 1846-47	1	Prof. Croft.
Do. do., North shore of Lake Huron, 1848	1	
Reports — Sea and River Fisheries of New Brunswick, 1852	1	Thos. Henning.
Do. Standing Committee on Railroads, 1852, (Canada)	1	
Do. Sums paid and Correspondence relative to Railroads, 1853, do	1	
Geological Survey of Canada, 1851-52	1	
Report of Special Committee on Magdalene Islands, &c., 1853	1	
Catalogue of Ancient and Modern Books	1	
Beckmann's History of Inventions, Vol. I.	1	A. H. Armour, from Mr. Bohn.
Do. do. Vol. II.	1	
Mathew of Westminster's Chronicles, Vol. I.	1	
Do. do, Vol. II.	1	
Alfred the Great, &c., by B. Thorp	1	
Henry of Huntingdon's Chronicles	1	
Humboldt's Travels, Vol. I.	1	
Lectures on Painting, by the R. Academicians	1	
Geology of Scripture, Pye Smith	1	
Richardson's Geology, &c.	1	
Humboldt's Cosmos, Vol. II	1	
Euclid's Elements, 1651,	1	Peter Cameron.
Comte's Philosophy of the Sciences	1	A. H. Armour, from Mr. Bohn.
History of England and Normandy, Vol. I., by T. Forrester	1	
Smith's Canada, Vols. I. and II.	2	Thos. Maclear.
Culture of the Grape in United States, by C. Cist	1	A. H. Armour.
Cincinnati in 1851, by do.	1	
Plans accompanying Report on a Railway Suspension Bridge over the St. Lawrence, near Quebec	2	R. L. O'Brien.
Magnetical and Meteorological Observations made at the Hon. East India Company's Observatory, year 1850	1	Hon. East India Company.
Transactions of the Royal Society of Edinburgh, Vol. XX., Part II., Session 1850-51.	1	From the Societies.
Do. Vol. XX., Part IV., Session 1852-53	1	
Progress of do., 1850-51, Vol. III., 68th Session, from 2d December, 1850	1	
Do. 3d. March, 1851	1	
Do. Vol. III., 1852-53	1	
Contents of Vol. II., Dec., 1844 to April, 1850.	1	
Documentary History of New York, by Dr. O'Callaghan	4	A. H. Armour.
Hunt's Poetry of Science	1	A. H. Armour, from Mr. Bohn.
Mantell's Geological Excursions, Isle of Wight	1	
Gibbon's Rome, Vol. II	1	
Do. Vol. III	1	
Addison's Works, by Hurd, Vol. II	1	
Do. Vol. III	1	
Cowper's Works, Southey, Vol. II	1	
Do, Vol. III	1	
Naples under Spanish Dominion	1	A. H. Armour, from Mr. Bohn.
Condè's History of Arabs in Spain, Vol. I.	1	
Locke's Philosophical Works, Vol. I	1	
Athenæus Lit. translated, Vols. I., II., III.	3	
Plato, translated by Burges, Vol. IV	1	
Catulus Fabulus	1	
Tacitus, Oxford Translation, Vol. II	1	
History of England and Normandy, Vol. II.	1	
Ingulph's Chronicle	1	
Theorodet and Evagrius	1	
Mudie's British Birds, Vols. I. and II	2	
Dante, by Wright, illustrated by Flaxman	1	
Tasso, by Wiffin, 32 Plates	1	
Journal of the Royal Geographical Society, with Maps, Vol. 23	1	From the Societies, per H. Rowsell.
General Index to Second Ten Volumes	1	
Quarterly Journal of the Geological Society, Nov. 1, 1853, Vol. IX., P. 4, No. 36	1	
Do., February 1, 1854, Vol. X., P. 1, No. 37	1	
Statistics of the United States Census, 1850, 1022 pages	1	Hon. J. Brodhead, per A. H. Armour.
History, Condition, and Position of the Indian Tribes of the United States, Parts 1, 3, and 4, by H. R. Schoolcraft, LL.D., illustrated	3	
Patent Office Report, Part 1, 1853, Mechanics.	1	
Report of the Superintendent of the United States Coast Survey, 1852	1	
The Britannia and Conway Tubular Bridges. E. Clark, Vols. I. and II., 1850	2	R. Stephenson, per Sir C. Roney.
Plates to do.	1	
Annual Report of O. S. and H. Railway	1	Directors.
Narrative of Failure to Establish a Military Asylum, &c., by Major Lachlan	1	Major Lachlan.
Trade and Navigation of the Province of Canada, 1853, Parliamentary Return	1	Hon. W. B. Robinson, M.P.P.
Geological Report of Canada, 1852-53	1	
Hayes' Book of British Birds	1	Mr. Hope.
Trade and Navigation Reports, 1850 and 1851.	2	Hon. W. B. Robinson, M.P.P.

Maps.

British Provinces of North America, 1776	1	Capt. Lefroy.

Museum.

Geological Specimens from Lakes Huron & Simcoe	Capt. Walker
Minerals and Fossils from Ireland, Isle of Man, and Canada	T. W. Herrick.
Indian Relics	Dr. Richardson
Conch Shell from Fishing Island, Lake Huron	S. Fleming.
Mineral resembling Coal, from the Island of Barbadoes, and some Minerals from a Tar Spring in same Island	Dr. Bovell.
Ornithorhyncus from Australia	M. S. Baldwin.
Numerous Indian Remains—Specimens of Fossils and Mineralogy	Rev. G. Bell.
Bituminous Shale from Scotland, and two small Bottles containing Ashes	Prof. Chapman.
Geological and Mineral Specimens from Sault Ste. Marie	A. Mackintosh.

Building Site for the Canadian Institute.

Lot for Building on George Street	G. W. Allan.

The Council have to call the attention of the Institute to their tenure *of the present commodious rooms they now occupy, with the consent of* the Government. The probability of their being required for other purposes, demands the early attention of their successors. As yet no steps have been taken to acquire a permanent abode for the property of the Institute, or for their ordinary meetings, in case of a sudden removal being necessary. The Council, however, are enabled with much satisfaction to state, that the subject of a building has been divested of much pecuniary difficulty through the generosity of one of their members. The Institute is already aware of the munificent gift by G. W. Allan, Esq., of the necessary ground, situated on George Street, as a site for a permanent building, and the Council beg leave to call the early attention of their successors to this important subject.

The Council have much pleasure in presenting their financial statement for the past year. The prospects of the Society in this important particular are very encouraging, and the subjoined sheet exhibits a balance in favour of the Institute of £343 6s. 10d. In this estimate the usual annual grant of £250 for the current year is included, but not that of £100, hitherto received by the Toronto Athenæum, and which with other sources of income of that Society, will be transferred to the Institute, upon the completion of the arrangements for the amalgamation of both Societies.

FINANCIAL STATEMENT FOR THE YEAR ENDING 30TH NOVEMBER, 1854.

Dr.	£	*s.*	*d.*
To Cash paid on Account of Publication of Journal	289	1	8
Sundries on Account of Institute..............................	80	11	1
Library Expenses	69	19	2
To Balance due Maclear on Account of Journal	35	1	2
“ “ Scobie's Estate “ do.	53	14	4
“ “ A. H. Armour “ Library	29	8	9
“ “ Ogilvie..	2	3	9
“ “ Cumings & Wells	0	18	6
“ “ Beckett & Co.	0	4	3
“ “ Reader for Journal	5	0	0
“ “ Assistant Secretary's Salary	12	0	0
Balance..............................	343	6	10
	£921	9	6

Cr.				£	*s.*	*d.*
Balance from year 1853				191	17	0
By Cash for Sale of Journal.....	£47	0	0	308	11	3
“ from Members........................	261	11	3			
“ from Harbor Commissioners				25	0	0
“ due on Account of Journal	£31	10	0	119	17	6
“ Arrears of Members	87	17	6			
“ due for Nos. of Vol. III. delivered..............................				26	13	9
“ Government Grant.. ...				250	0	0
				£921	9	6

The Report was adopted unanimously.

The following donations were announced :—

From A. H. Armour—The Census of Canada for 1851-52; also a Volume of Scientific Tracts.

From Capt. J. H. Lefroy, R.A.—Hand-Book for Field Service, by Captain J. H. Lefroy, R.A.

The thanks of the Institute were ordered to be given to those gentlemen for their respective donations.

A motion to change the day of meeting from Saturday to Tuesday, with a view to accommodate non-resident members, was brought forward by Professor Hind.

Resolved—That the present day of meeting be retained.

A motion to introduce certain alterations in paragraph No. 2, section 5, of the Regulations of the Institute, with a view to introduce uniformity in the financial year of the Institute and of the *Journal*, was brought forward by Mr. Armour.

Resolved—That Mr. Armour's suggestions be referred to the Council.

The votes for office-bearers and members of Council were collected, and Messrs. Thomas Ridout and T. J. Robertson appointed Scrutineers by the Chairman.

Prof. Bovell read a paper "On some specimens obtained from Rice Lake and the Humber River," illustrating his descriptions with microscopical preparations of the specimens of animal and vegetable life which formed the subject of the paper.

Prof. Bovell also made some remarks upon the "Respiratory Organs of the Lobster," and "Some peculiarities in the œsophagus of the Bear." Injected specimens of parts of the different organs described were laid upon the table, together with a very beautiful *Plumatella* from Rice Lake.

The Scrutineers delivered their report to the Chairman, who announced the names of the following gentlemen as office-bearers and members of Council for the year 1855:

President:
The HON. SIR JOHN BEVERLY ROBINSON, BART.

First Vice-President—Professor D. WILSON, LL.D.

Second Vice-President—G. W. ALLAN.

Corresponding Secretary—T. HENNING. **Secretary**—F. W. CUMBERLAND.

Treasurer—J. STEVENSON. **Curator**—Professor E. J. CHAPMAN.

Librarian—SANDFORD FLEMING.

Members of Council:

Professor CROFT. Professor CHERRIMAN. Professor BOVELL.
Professor HIND. A. BRUNEL. S. B. HARMAN.

Alphabetical List of Members of the Canadian Institute.

Names.	*Residence.*		
Adamson, Rev. W. A., D.D.	Quebec, C.E.		
Allan, G. W.	Toronto, C.W.,		Moss Park.
Andrew, Professor W.	Montreal, C.E.		
Armour, A. H.	Toronto,	C.W.,	Wellington St.
Armstrong, W.	“	“	Queen “
Arnold, John	“	“	Peter “
Badgley, Prof. F., M.D., ...	“	“	Bay “
Baker, Hugh C.	Hamilton,	“	
Baldwin, Hon. Robt.	Spadina, near Toronto, C.W.		
Baldwin, W. W.	Oakridges, C.W.		
Baldwin, Robt., Junr.	Spadina, near Toronto, C.W.		
Baldwin, W. A.	Mashquoteh, near Toronto, C.W.		
Baldwin, Maurice S.	Toronto,	C.W.	Duke Street.
Barclay, Rev. J.	“	“	Wellington St.
Barron, F. W.	“	“	U. C. College.
Bartlett, Rev. T. H. M.	Kingston,	“	
Battersby, Leslie........................	Toronto,	“	
Beaven, J. F.	London,	“	
Beaven, E. W............................	Toronto,	“	Trinity College.
Beard, Charles	Woodstock,	“	
Becher, H. C. R.	London,	“	
Bell, Rev. Andrew	L'Orignal,	“	
Bell, Rev. George	Simcoe,	“	
Bennett, H.	Toronto,	“	
Bernard, L.................................	Barrie,	“	
Bethune, Prof. N., M.D., ...	Toronto,	“	Richmond St.
Billings, E.	Bytown,	“	
Bird, James...............................	Peterboro,'	“	
Blackie, John	Danville,	C.E.	
Black, James	Ayr,	C.W.	
Blake, E. D.	Toronto,	“	Bay Street.
Bleasdell, Rev. W.	Trenton,	“	
Bogert, J. J.	Toronto,	“	Trinity College.
Boomer, A. K.............................	“	“	Bay Street.
Boulton, W. S.	“	“	John Street.
Boulton, Hon. H. J.	“	“	Wellington St.
Bovell, Prof. James, M.D., ...	“	“	St. George's Sq.
Bristow, Arthur	Weston,	“	
Brondgeest, J. T.	Toronto,	“	Yorkville.

Names.	*Residence.*
Brown, Geo., (M.P.P.)	Toronto, C.W. Church Street.
Brown, James	“ “ Peter Street.
Brown, Philip	“ “ “
Browne, George	Montreal, C.E.
Brown, John	Thorold, C.W.
Browne, J. O.	Toronto, “ York Street.
Brunel, Alfred	“ “ Bond “
Brunskill, Thos.	“ “ Shuter “
Buchan, David	“ “ Yorkville.
Buckland, Prof. G.	“ “ Park Lane.
Burke, J. N.	Stanfold, C.E.
Burnet, Rev. R.	Hamilton, C.W.
Burwell, Lewis	Brantford, “
Cameron, Peter	Toronto, “
Cameron, J. M. A.	“ “ Canada Co. Office.
Cameron, Hon. Malcolm	Port Sarnia, “
Cameron, John	Toronto, “ Wellington Street.
Cameron, Hon. J. H.	“ “ The Meadows.
Cameron, Hector	“ “ Toronto Street.
Cameron, Col. K.	Beaverton, “
Campbell, Major T. E., C.B.	St. Hilaire, C.E.
Campbell, E. C.	Niagara, C.W.
Campbell, W.	Quebec, C.E.
Carruthers, F. F.	Toronto, C.W. Ann Street.
Cayley, F. M.	“ “
Chapman, Prof. E.	“ “ Yorkville.
Cherriman, Prof. J. B.	“ “ Observatory.
Chewitt, W. C., M.D.	“ “ York Street.
Clarke, Dr. E.	“ “ Gen. Hospital.
Clark, John	Port Dalhousie, C.W.
Connor, Skeffington, L.L.D.	Toronto, C.W., Bay Street.
Copp, W. W.	“ “ Richmond Street.
Cortlandt, H. N.	Simcoe, Norfolk, C.W.
Cotton, James	Toronto, C.W., Church Street.
Craigie, Doctor W.	Hamilton, “
Crawford, D.	Toronto, “ Jarvis Street.
Crease, Lieut., Royal Engineers	Quebec, C.E.
Croft, Prof. H.	Toronto, C.W., Yorkville.
Crombie, E. M.	“ “ George “
Crooks, Adam	Toronto, “ King “
Cull, E. L.	“ “
Cumberland, F. W.	“ “ Duke “
Dartnell, E. T.	Toronto, C.W., Peter Street.
Dartnell, G. H.	Toronto, C.W., Peter Street.
Davies, W. H. R.	Montreal, C.E.
Davies, H.	Toronto, C.W., Trinity College.
De Blaquiere, Hon. P. B.	Toronto, “ Yorkville.
Dennis, J. S.	“ “ King Street.
Denison, R. L.	Toronto, “ Dundas Street.
Deslandes, P. F. C.	New York, U.S.
Devine, Thomas	Quebec, C.E.
Dexter, Armory	Cobourg, C.W.
Dick, Captain T.	Toronto, “ Queen St. West.
Dickson, Andrew	Pakenham, C.W.
Donaldson, Capt. W.	St. Catherines, C.W.
Draper, Hon. Justice	Toronto, C.W., York Street.
Drummond, A.	“ “ Gerrard Street.
Duggan, Geo. Junr.	“ “ Adelaide Street.
Duggan, John	“ “ Bay Street.
Ellis, J. E.	“ “ King Street.
Ellis, Joseph	“ “ Queen Street.
Ellis, John	“ “ King Street.
Ermatinger, James	Stoney Creek, C.W.
Esten, J. H.	Toronto, C.W., St. George's Sq.
Ewart, John, Junr.	“ “ Yonge Street.
Farley, James	St. Thomas, “
Farmer, A. A.	Woodstock, “
Ferrie, Robert (M.P.P.)	Doon, “
Fitzgerald, W. W.	Toronto, “ Adelaide Street.
Fitzgerald, W. J.	“ “ Wellington St.
Fitzgibbon, C.	“ “ John Street.
Fleming, S.	“ “ Victoria Street.
Flesher, W. K.	Artimesia, “
Forneri, R.	Toronto, “
Forrest, J. W.	Hamilton, “
Fowler, Henry	Toronto, “ Wellington St.

Names.	*Residence.*
Freeland, Patrick	Toronto, C.W. Church Street.
French, D. O.	“ “ *Bay Street.*
Fripp, H. G. R.	“ “ Yonge Street.
Gibbard, William	Barrie, “
Gibb, Doctor G. D.	London, England.
Gibson, David	York Mills, C.W.
Good, James	Toronto, “ Yonge Street.
Grahame, W. R.	“ “ Richmond St.
Grant, John	Whitby, “
Grasett, Rev. H. J.	Toronto, “ Adelaide Street.
Gray, Rev. J.	Orillia, “
Gregory, T. C.	Windsor, “
Gzowski, C. S.	Toronto, “ Elm Street.
Hagarty, J. H.	“ “ William Street.
Hale, W. D.	Port Stanley, “
Hallan, S. W.	Toronto, “
Hall, Dr. A.	Montreal, C.E.
Hall, James	Peterboro, C.W.
Hallowell, Dr. W.	*Toronto,* “ Duke Street.
Hancock, E. C.	“ “ Jarvis Street.
Hanvey, Daniel	St. Thomas, “
Harman, S. B.	Toronto, C.W., St. George's Sqr.
Harrington, John	“ “ King Street.
Harrison, Hon. S. B.	“ “ Dundas Street.
Harington, T. P.	*Quebec, C.E.*
Harris, John F. J.	London, C.W.
Harris, T. D.	Toronto, C.W., Duke Street.
Hawkins, W.	“ “ King Street West.
Haycock, T. H.	Chippewa, “
Herrick, T. W.	London, “
Herrick, Doctor George	Toronto, “ Church Street.
Henning, Thomas	“ “ Queen Street.
Heward, W. B.	“ “ Yorkville.
Heyden, L.	“ “
Heyden, L., Junior	“ “
Hind, Prof. H. Y.	“ “ Spadina Avenue.
Hincks, Hon. Francis	Quebec, C.E.
Hincks, Rev. Prof. W.	Toronto, C.W. Yorkville.
Hirschfilder, J.	“ “ “
Hodder, Prof. E. M.	Toronto, “ Queen Street.
Hodgins, J. G.	“ “ Education Office.
Hodgins, Thos.	“ “ Education Office.
Holwell, W. A.	Quebec, C.E.
Holland, John	Toronto, C.W., King Street.
Holland, G. B.	“ “ “
Hood, Andrew	Dunnville, “
Houghton, E.	Port Stanley, C.W.
Howard, J. G.	Toronto, “ *King Street.*
Howard, J. S.	“ “ Gerrard Street.
Hutcheson, John	“ “ Church St.
Jacques, John	“ “ Front Street.
Jamieson, W. M.	“ “ King Street.
Jarvis, C. H.	Hamilton, “
Jones, W.	Port Stanley, C.W.
Jones, E. R.	Chatham, “
Irving, Rev. Prof. G. C.	Toronto, “ Trin. College.
Joseph, J. G.	“ “ King Street.
Keefer, Samuel	Montreal, C.E.
Keefer, Thomas	“ “
Kingston, Dr. Wm.	“ “
Lachlan, Major R.	“ “
Langton, John, (M.P.P.)	Peterboro, C.W.
Lawson, Walter	Guelph, “
Lawrason, L.	London, “
Leach, Rev. Dr. W. T.	*Montreal, C.E.*
Lefroy, Capt. J. H., R. Artillery	Woolwich, England
Lewis, Rice	Toronto, C.W., King Street.
Logan, W. E. (F.R.S.)	Montreal, C.E.
Lowe, F. C.	Toronto, C.W., Wellington Street.
Macaulay, J. J.	“ “ Carlton Street.
Macdonell, D.	“ “ *Yonge Street.*
Mack, Doctor T.	St. Catherines, C.W.
Mackenzie, H. M.	Guelph, C.W.
Macklem, Doctor Thomas C.	Chippewa.
Mackiem, S. S.	“
Maclear, Thomas	Toronto, C.W., King Street.

Names.	*Residence.*
Macmeekin, Rev. H.	
Major, John	Toronto, C.W., City Bank.
Masson, John	Hamilton, "
Mayer, S. D.	Toronto. " Adelaide Street.
Meredith, E. A.	Quebec, C.E.
Mitchell, John	Montreal, C.E.
Moberly, Walter	Toronto, C.W., Church Ttreet.
Moffatt, Lewis	" " Yonge Street.
Moore, John	" " East Market St.
Morrison, J. C., (M.P.P.)	" "
Mowat, O.	" " Church Street.
Murney, Edward H.	Belleville. "
Murray, H. W. M	Toronto, " John Street.
M'Callum, A.	" " Model School.
M'Callum, James, Jr.	Uxbridge, "
M'Caul, Rev. John, L.L.D.	Toronto, " Carlton Street.
M'Clary, William	London, "
M'Donald, Donald	Toronto, " Queen Street.
M'Donell, Alex.	Hamilton, "
M'Gill, Hon. Peter	Montreal, C.E.
M'Gregor, C. J.	Elora, C.W.
M'Kerras, Rev. J. H	Darlington, C.W.
M'Nab, John	Toronto, " Church Street.
M'Phillips, G.	Richmond Hill, C.W.
M'Queen, Thos.	Goderich, C.W.
Netting, George	Toronto, " King Street.
Newton, Doctor J. S.	Sault St. Mary, U.S.
Nicol, Doctor W. B.	Toronto, C.W., Adelaide Street.
Noble, Lieut. A., Rl. Artillery	Quebec, C.E.
Northcote, Henry	Toronto, C.W., King Street.
O'Brien, E. G.	" " Toronto Street.
O'Brien, W.	Barrie, "
O'Brien, L. R.	Toronto " Church Street.
Orchard, T. C.	" " Front Street.
Page, John	Quebec, C.E.
Palmer, E. J.	Toronto, C.W. King Street.
Pardey, W. H.	" " "
Parry, Rev. Prof. E., St. John	" " Trinity College.
Parkes, Vincent	Toronto, C.W., Adelaide Street.
Parr, Richard	Chatham, "
Passmore, F. F.	Toronto, " King Street.
Patrick, Alfred	" " John Street.
Pell, J. E.	" " King Street.
Perram, J.	Tecumseth "
Perkins, Frederick	Toronto, " Peter Street
Philbrick, Prof. C. J.	" " Yorkville.
Phillips, T. D.	" " Trinity College.
Piper, Hiram	" " Yonge Street.
Primrose, Doctor Francis	" " Wellington Street.
Prosser, T. C.	Bolton, Albion, C.W.
Pyper, W.	Toronto, C.W. Wellington Street.
Read, D. B.	" " Queen Street.
Reckie, James	Quebec, C.E.,
Reid, Rev. W.	Toronto, C.W., Front Street.
Rennie, Alex.	Montreal, C.E.,
Richardson, J. H., M.D.	Toronto, C.W., Bay Street.
Richards, Hon. Justice	" " Yonge Street.
Ridout, Thomas	" " Bay Street.
Ridout, G. P,.	" " King Street.
Ridout, Charles	" " Maria Street.
Ridout, Charles	Bank of Upper Canada, Quebec.
Robarts, T. P.	Toronto, C.W., William Street.
Roberts, D.	" "
Robertson, T. J.	" " Wellington Street.
Robins, S. P.	Brantford, "
Robinson, Hon. W. B. (M.P.P.)	Toronto, C.W., Duke Street.
Robinson, Hon. Sir J. B., Bart., Chief Justice,	" " Beverly House.
Robinson, W.	Norwich, "
Robinson, Christopher	Toronto, " Beverly House.
Robinson, J. Lukin	" " Peter Street.
Ross, James (M.P.P.)	Belleville "
Rothwell, Richard	Toronto, "
Rowsell, Henry	" " York Street.
Rubidge, F. P.	Quebec, C.E.,
Rutherford, E. H.	Toronto, C.W., Bay Street.

Names.	*Residence*
Ruttan, Henry	Cobourg, C.W.
Ryerson, Rev. Doctor E.	Toronto, " Victoria Street.
Rykert, G. Z.	St. Catherines, C.W.
Rykert, A. E.	Toronto, " Trinity College.
Sabine, Col. E, R. Artillery	Woolwich, England.
Salter, A. P.	Chatham, C.W.
St. George, H. Q.	Oakridges, "
Sangster, John H.	Hamilton, "
Savigny, H. P.	Barrie, "
Scadding, Rev. Doctor H.	Toronto, " U. C. College.
Schofield, M. C.	Berlin, Waterloo., C.W.
Scholefield, C. K.	Toronto, C. W., King Street.
Schreiber, Collingwood	" " Elmsley House.
Sears, S. B.	Chatham, "
Shanly, Walter	Toronto, " Wellington Street.
Shanly, Francis	" " Bay Street.
Shier, John	Whitby, "
Simons, T. M.	Hamilton, "
Simpson, A. W.	Cobourg, "
Sladden, W.	Toronto, " Church Street.
Small, Rev. J. W.	" " Queen Street.
Small, Jas. C.	" " Front Street.
Small, Dr. John	" " Duke Street.
Small, Jos. C.	Collingwood Harbour, C. W.
Smallwood, Doctor Charles	Isle Jesus, C. E.
Smith, William	Otterville, Oxford, C. W.
Smith, Rev. Prof. J. M.	Kingston, C. W. Queen's College.
Southeran, G. H	Toronto, " Yorkville.
Spragge, Hon. J. G. (Vice Chan'r.)	" " Portland Street.
Spratt, Robert	" " Jarvis Street.
Spreull, Samuel	" " Yonge Street.
Stark, David	Montreal, C. E.
Stephenson, Robert (M.P.)	England.
Stevenson, James	Toronto, C. W. Bank of Montreal.
Stewart, G. A.	Port Hope. "
Stewart, Chas.	Toronto, "
Storm, W. G.	" "
Strathy, G. W.	" " Bond Street.
Street, R. P.	Gore Bank, Hamilton, C. W.
Street, T. C.	Niagara Falls.
Toronto, The Rt. Rev. Lord Bishop of	Toronto, C. W., Front Street.
Thibodo, A. J. (M.B)	Trenton, "
Thomas, W.	Toronto, " Church Street.
Thomas, C. P.	" " " "
Thomas, G.	Chatham, "
Thomson, E. W.	York Township, C. W.
Thomson, C. E.	Toronto, C. W., Trinity College.
Thomson, John	" " King Street.
Torney, Hugh	" "
Turner, C. H.	England.
Turner, Loftus	Toronto, C. W.
Turner, H. (M.D.)	Galt, "
Unwin, Charles	Toronto, "
Ure, G. P.	" " Terauley Street.
Valentine, J. S.	Niagara, "
Vankoughnet, P. M.	Toronto, " Wellington Street.
Vidal, Alex.	Sarnia, "
Walsh, F. L.	Simcoe, "
Walsh, T. W.	" "
Walsh, Robt.	Lloydtown, C. W.
Walker, E. A.	Barrie, "
Weatherly, Capt.	Toronto, " Provincial In. Co.
Weir, Rev. Prof. G.	Kingston, " Queen's College.
Weller, W. H.	Cobourg, "
Wells, Robt.	Toronto, " Park Lane.
Wells, R. M.	" " King Street.
Whitney, F. A.	" " Toronto Street.
Whitney, J. W. G.	" " "
Whittemore, E. F.	" " Bay Street.
Whitwell, Rev R.	Philipsburg, C. E.
Widder, Fred'k.	Toronto, C. W. Lyndhurst.
Williamson, Rev. Prof. J.	Kingston, " Queen's College.
Wilkinson, J. A.	Sandwich, "
Wilkes, G. S.	Brantford, "
Wilson, Prof. D. LL.D.	Toronto " Yorkville.
Wilson, George	New York.

Woodruff, S. D.	St. Catharines, C. W.
Workman, Dr. B.	Montreal, C.E.
Workman, Doctor Jos.	Toronto, C.W.
Worthington, Thomas	Wellington, P. E. District, C. W.
Worthington, John	Toronto, C. W., Temperance St.
Worts, J. G.	" " Front Street.
Wright, James	" " City B'k. Church St.
Wyllie, G. B.	" " King Street.

HONORARY MEMBERS, 4.

Lefroy, Capt. J. H.; R.A., F.R.S.	Sabine, Col. E.; R.A., F.R.S, &c.
Logan, W. E.; F.R.S., and G.S.	*Stephenson, Robert (M.P.)*

LIFE MEMBERS, 9.

Cayley, F. M.	Hincks, Hon. F.
Cotton, James	Hutcheson, John
Duggan, George, Junr.	Parkes, Vincent
Duggan, John	Vankoughnet, P. M.
Herrick, Doctor G.	

JUNIOR MEMBERS.

Baldwin, Robert	Murney, E. H.
Baldwin, M. S.	Murray, H. W. M.
Battersby, Leslie	M'Gregor. C. J.
Beaven, T. F.	Northcote, Henry
Beaven, J. W.	'illips, T. D.
Bogert, J. J.	Ridout, Charles
Crombie, E. M.	Ridout, Charles
Dartnell, G. H.	Rothwell, Richard
Davies, H.	Rykert, A. E.
Esten, J. H.	Simpson, A. W.
Fitzgerald, W. W.	Thomas, C. P.
Forueri, R.	Torney, Hugh
Hallan, S. W.	Turner, Loftus
Heyden, L. Junr.	Wells, R. M.
Macklem, S. S.	Wright, James
Mayer, S. D.	

Honorary Members	4
Life Members	9
Members	306
Junior Members	31
Total	350

JAMES JOHNSTON,
Assistant Secretary,
Toronto, 31st December, 1854. *Canadian Institute.*

Extract from the Report of the Parliamentary Committee on the application of the Council of the Canadian Institute for encouragement in the publication of the Canadian Journal.

The joint Committee of the Legislative Council and the Legislative Assembly, for the management and direction of the Library of Parliament,

Beg leave to present a Third Report.

"The Council of the Canadian Institute have made application to the Committee for some pecuniary assistance in the publication of their Journal, which is a monthly periodical devoted to the diffusion of Scientific and Literary information, chiefly connected with the progress of Science and Art in this Province. It also serves as a medium for the publication of such papers of interest, on topics of Provincial concern, as may be read before the Institute, and is a record of the proceedings of that steadily improving and useful Society. By a recent arrangement, the proceedings of the Literary and Historical Society of Quebec, are also given in this Journal. Viewing it as a vehicle for the dissemination of accurate and practical knowledge on topics of great and increasing importance in this country, and as a means of collecting information regarding the mineral resources and manufacturing skill of Canada, which may tend to advance our interests abroad, the Committee have unanimously agreed to recommend that sixty copies of the Journal be subscribed for, from its commencement, and for the future, until further orders. These copies, they suggest, should be circulated, in the proportions of 36 in Upper Canada, and 24 in Lower Canada, among Mechanics' Institutes, Colleges and Schools, and they are now in correspondence with the Editor, in order to ascertain in what localities the circulation of the Journal could be increased so as best to forward the interests of the publication, and to meet the views of the Committee for the benefit of those to whom they would desire to have it sent. Having ascertained these particulars, and obtained the sanction of the House to their recommendation, they will direct the copies subscribed for to be dispatched direct from the office of the journal to their respective destinations"

Extract from the Third Report of the Joint Library Committee presented to the Legislative Assembly, and concurred in by that House, on Monday the 18th December, 1854, having been previously presented to the Legislative Council, and concurred in by that Honorable Body.

(Signed) ALPHEUS TODD,
Secretary Library Committee.

Scheme of distribution of the "Canadian Journal" by order of the Parliamentary Library Committee.

The Committee of the Library of Parliament being desirous that the distribution of sixty copies of the "Canadian Journal" placed at their disposal by the concurrence of the Legislature in the foregoing report, should not interfere with the present circulation of the Journal, and having ascertained from the Editor the names of those Institutions and Public Bodies who are either subscribers or receive the journal free, have decided upon the following scheme of distribution of thirty-six copies in Upper Canada, and twenty-four in Lower Canada.

Scheme of distribution of thirty-six copies of the "Canadian Journal" in Upper Canada:—

1	Mechanics' Institute	Kingston.
2	" "	Hamilton.
3	" "	Belleville.
4	" "	Brockville.
5	" "	Cobourg.
6	" "	Perth.
7	" "	Picton.
8	" "	Guelph.
9	" "	St. Thomas.
10	" "	Brantford.
11	" "	St. Catharines.
12	" "	Goderich.
13	" "	Whitby.
14	" "	Simcoe.
15	" "	County of Peel.
16	" "	Port Sarnia.
17	" "	Chatham.
18	" "	County of Halton.
19	" "	County of Ontario.
20	" "	Port Hope.
21	" "	Stratford.
12	" "	Peterborough.
23	" "	Renfrew.
24	" "	C. of Perth (Mitchell.)
25	" "	Berlin.
26	" "	Fonthill.
27	" "	Dundas.
28	" "	Oakville.
29	" "	Waterdown.
30	" "	Bytown.
31	" "	Huron (Lib'y. Asso'n.)
32	Saint Michael's College	Toronto.
33	Upper Canada College	Toronto.
34	Victoria College	Cobourg.
35	Queen's College	Kingston.
36	Regiopolis College	Kingston.

Scheme of Distribution of Twenty-four Copies of the "Canadian Journal" in Lower Canada:—

1.	Université Laval,	Quebec.
2.	MacGill College,	Montreal.
3.	Mechanics' Institute	Quebec.
4.	" "	Montreal.
5.	" "	Three Rivers.

6. Mechanics' Institute ....Berthier.
7. " " ....Iberville,
8. Nautical College..Quebec.
9. Canadian Institute..Quebec.
10. Canadian Institute..Montreal,
11. National Institute..Montreal.
12. Mechanics' Institute..St. Hyacinthe.
13. " " ....Sorel.
14. Bishop's Coll ge,..Lennoxville.
15. College at St. Hyacinthe.
16. Shefford Academy.
17. Stanstead Academy.
18. Sherbrook Academy.
19. St. Francis College.
20. College at Chambly.
21. Clarenceville Academy.
22. Huntingdon Academy.
23. Masson College at Terrebonne.
24. High School at Durham Village, County of Missisquoi.

Copies of the second volume of the *Canadian Journal*, together with the published numbers of the third volume, will be sent from the office of the Institute in conformity with the foregoing directions. We regret that in consequence of the edition of the first volume being exhausted, the very liberal and encouraging instructions of the Library Committee cannot be carried out *in extenso* at present. There are now upwards of one hundred applications for Volume I. in the office of the Institute.

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

Literary or Stated Meeting, Wednesday, 1st November.

Frederick Boxer was proposed as an Associate member.

A paper was read by Lieut. A. Noble, R.A., on the mean results of Meteorological Observations taken at Quebec during the winters of 1852 and 1853.

A paper was read by Lieut. Ashe, R.N., F.R.A.S., on the Construction of a raft for rescuing persons from sinking ships.

General Monthly Meeting, Wednesday, 8th November.

Frederick Boxer was elected an Associate Member of the Society.

Literary or Stated Meeting, Wednesday, 15th November.

Lieut. Ashe, R.N., F.R.A.S., exhibited a model of the species of raft which formed the subject of his communication to the Society on the 8th. instant.

The peculiarities of the proposed raft, are, 1st. Its simplicity, and consequent facility of construction. 2nd. Its component parts being intended to be used for other purposes on board ship, are always at hand when required.

Wm. Antrobus Holwell read a paper describing a new species of projectile invented by him.

A donation was announced of two specimens of paper money in use in the British North American Colonies of New York and Pennsylvania, dated 1758 and 1776 respectively, presented by Wm. Antrobus Holwell.

E. A. MEREDITH, Vice-President.

EMIGRATION OF 1854.—The annual report of the Commissioners of Emigration, recently published, shows that 313,749 persons landed in New York from foreign ports during the last year, being a considerable increase over the year 1853. Of the above number 166,723 came from Germany, 79,004 from Ireland, and 30,075 from England.

Professor Edward Forbes.

While the sympathies of Canadians, as members of the British empire, have been largely excited by the events in the East, which, amid her triumphs, involve the death of so many men whom England can ill afford to spare, we are startled by the loss of one no less distinguished among those who take the lead in the ranks of sci ntific enterprise. It would be unjust to the students of science in Canada to suppose that the name of Edward Forbes can be unfamiliar to them; though in this western province of the empire, his loss cannot be expected to excite that profound and mournful regret with which its announcement has been received by those whose daily intercourse with him enabled to appreciate, not only all he had already accomplished for science, but also all that was to be expected from him.

Edward Forbes was in his thirty-ninth year, to all appearance only on the threshold of maturity, and with his best years before him for the elaboration of his favourite pursuits; and yet he was already recognised as prominently distinguished among the naturalists of Europe, and one of the foremost in the ranks of British Palæontologists. The estimate of his contributions to geological science, consequent on the additions, his extensive knowledge, and fine powers of observation, in relation to extinct and recent zoology and botany, enabled him to make to the natural history of geology, was abundantly proved by his election, in 1852, to the Chair of the Geological Society of London. This honorary office, which, according to the wonted usage of scientific societies, pertained to some of the veteran savans who had grown grey in the service, was justly regarded as a peculiar and marked distinction, when conferred by such men as Lyell, De la Beche, Murchison, Sedgwick, and Owen, on one still little more than a youth, and who was never destined to attain his fortieth year.

Professor Forbes was the son of a banker at Douglas, in the Isle of Man, where his earlier years were spent, and his studies pursued, till he entered as a student of Edinburgh University in 1830. There it was his good fortune to form one of a little band of students, whose intellectual pastimes in those pleasant college days ripened, in later years, into substantial results. Among his contemporaries at College were Professor Goodsir, the distinguished physiologist, Professor J. Y. Simpson, well known on this continent as the discoverer of the anæsthetic properties of chloroform, Professor J. S. Blackie, the translator of Æschylus, Dr. George Wilson, the biographer of Cavendish, Dr. S. Brown, Dr. Lyon Playfair, Professor Day of St. Andrews, the Rev. John Cairns, Professor Bennet of Edinburgh, and others, whose subsequent contributions to science and literature have added a peculiar interest to the retrospect of those who can recall the associations of that period of student life at Edinburgh. The facilities which the Scottish capital affords to the student of science, not only by its educational institutions and peculiar social constitution—in some respects analogous to that of the English University towns—but also, still more, by its singular natural advantages, were promptly appreciated by Ed. Forbes; and he very early formed the desire of being able to take up his permanent residence there. In a notice of him, in one of the local journals, ascribed to his old friend and fellow-student, Professor Goodsir, it is remarked:—

"When beginning his studies in Edinburgh in 1830, Mr. Forbes had already made great advances in his favourite scientific pursuits, and to these attainments he added remarkable artistic powers, and literary acquirements of extraordinary extent in one so young. The earliest friend he made among his fellow students there, calling on him only a few days after his arrival, found his rooms occupied in every corner by geological, zoological, and botanical specimens already collected in the neighbourhood. From that time he entertained the opinion so strikingly expressed in his last introductory lecture, that no other city afforded so many advantages to the student of natural history as Edinburgh. From his various travels in Norway, Sweden,* Germany, and Algeria, all accomplished by him while a student, he ever returned to that city as to a home endeared to him by scientific as much as social considerations. On these returns, too, he was hailed with pleasure by a circle of scientific, literary, and artistic friends, in each of whose pursuits he took the thorough interest of a fellow student, while by all of them he was recognized as a centre of high intellect and benig-

* It may not, perhaps, be altogether superfluous to remind the readers of the *Canadian Journal* that the subject of the present memoir must not be confounded with another member of the Edinburgh scientific staff, Professor Jas. D. Forbes, whose recent work on the Glaciers of Norway has added to the reputation acquired by previous valuable works.

natal affections. While yet a student, he published his first work, 'Malacologia Monensis,' in this he described the mollusca of his native island—the Isle of Man. To the Edinburgh Student's Annual of 1840 he contributed a paper 'On the Association of Mollusca on the British Coasts, considered with reference to Pleistocene Geology.' And during his residence in Edinburgh in 1840-41, he wrote and published his work on 'British Starfishes.'"

The name of Edward Forbes is also associated with one of the popular institutions of Edinburgh, which has not been without its influence on modern literature. In the Philosophical Institution of that city—somewhat analogous to the Mechanics Institutes of Canada, though there markedly distinguished from the School of Arts, which more fitly performs the functions of a People's College—Edward Forbes gave the first publicity to many of those principles and ideas, which he subsequently elaborated in his most valued contributions to science. Among his colleagues, as lecturers to the Philosophical Institution of Edinburgh at that time, were his fellow-students Mr. Goodsir, Dr. Wilson, and Dr. Samuel Brown, and a greater publicity has been given to other courses of lectures, such as those of Dr. Moir (Delta), Hugh Miller, Aytoun, Kingsley and Ruskin, by their subsequent issue, in form or substance, from the press.

In the year 1838, Sir Charles Fellows, when travelling in Asia Minor, explored the ancient province of Lycia, and made many interesting discoveries in relation to that country, of which, till then, our knowledge was almost exclusively limited to the mythic legends of Homer and the historical records of Herodotus. The report furnished by Sir Charles Fellows of his discoveries in that ancient site of Greek colonization led to a Government expedition being despatched to the Levant, among the fruits of which were the beautiful Lycian and Xanthian marbles, now in the British Museum. Mr. Edward Forbes was selected as Naturalist to this expedition, and as such was attached to H.M. surveying ship Beacon, which sailed for its destination in the spring of 1841.

He had, in consequence of this, an opportunity of exploring some of the most interesting and least known parts of Asia Minor, in company with the Rev. E. T. Daniell and Lieutenant Spratt. Mr. Daniell died of sickness brought on by the climate, and a similar illness attacked Mr. Forbes, the effects of which, there is reason to believe, he never entirely recovered from. Soon after his return, he published, jointly with Mr. Spratt, an account of the expedition. This work, "Spratt's and Forbes's Lycia, besides its contributions to natural history, detailed the discovery of many ancient Lycian and Greek cities. Mr. Forbes's appointment to the Chair of Botany in King's College, London, took place, unexpectedly by him, during his absence in the East, and not long after, he was appointed secretary and curator to the Geological Society of London. In this position his extended knowledge of recent vegetable and animal species, and his remarkable acquaintance with the laws of their distribution (particularly as regards invertebrate animals), became available for general palæontological research. Here, too, he was enabled to apply to geology that peculiar knowledge of the conditions of existence of species, which his continual operations with the dredge had disclosed to him. It is to him, indeed, that we owe the methodical use of the dredge as an instrument of research in natural history; to use his own words, "the dredge is an instrument as valuable to a naturalist as a thermometer to a natural philosopher." At his instance, the British Association appointed for several years a dredging committee, charged with the duty of completing our knowledge of marine animals, with a view to geological inquiry.

The British association for the advancement of science was a favourite field of labour. There he resumed his coöperation with some of the most distinguished among his old fellow-students, and entered into honorable rivalry with the veterans in his favourite pursuits. In the natural history and geological sections, it will be difficult indeed to find any to supply his place. "He was transferred from the curatorship of the geological society to the staff of Sir Henry de la Bêche for the geological survey of Great Britain and Ireland, in which the palæontological department was specially committed to him. He co-operated with his colleagues in arranging the Museum of Economic Geology established by the government in London, and at the same time held the lectureship of natural history in the relation to geology in that institution. During his connection with the geological survey, besides necessary field operations, he made descriptions and superintended the drawing and engraving of numerous fossil species, and contributed many valuable memoirs on geological subjects. About the same time he also wrote, in conjunction with Mr. Hanley, the comprehensive and beautifully illustrated history of "British Mollusca," which, like his earlier but not less remarkable history of "British Starfishes," forms part of the valuable series of natural history works published by Van Voorst." The death of the veteran Professor Jamieson, who had filled the chair of natural history in the University of Edinburgh for upwards of half a century, left vacant the post which had been long looked forward to by the friends of Edward Forbes as peculiarily suited for him, and accordingly, by the unanimous voice of the patrons, he succeeded to a chair which seemed to promise the fulfilment of all the most cherished wishes of his life. It also transferred him to congenial duties precisely similar to those he had already so admirably fulfilled in connection with the English Geological Survey, the preliminary steps having just before been take for establishing the Scotish museum of economic geology at Edinburgh. At the same time he looked upon his removal from London as an escape from many harassing duties and claims that seriously encroached on his time, and he spoke to his intimate friends, as though he had for the first time succeeded to such congenial duties as promised to permit his reaping the fruits of all his earlier labours and studies. On his appointment to the Edinburgh chair of natural history he at once commenced its more immediate duties, and delivered a course of lectures to a crowded class-room during the summer term of the past year. Up to the time of his last illness he was dilligently engaged in organising plans for the extension of the University Museum of which he was keeper; while the last labours of his pen were employed in revising the elaborate paper, prepared to accompany the geological and palæontological maps for the new edition of Johnston's "Physical Atlas."

A recent number of the Athenæum, published on Saturday, November 18th, the very day of his death, reviewed the four parts of the Physical Atlas, specially noticing the map prepared by Professor Forbes to illustrate the distribution of marine life. This brief notice, thus issuing from the press at the very time when he to whom it referred was closing his eye on all earthly things, and the hand that had executed this, its last task, so well, was "forgetting its cunning," does justice to the work. The reviewer remarks:—"the map by Prof. E. Forbes is new to this edition, and contains an epitome of his researches on the distribution of marine animals on the surface of the earth. The illustrations are selected from the fishes, *Mollusca* and *Radiata*. The careful manner in which Prof. Forbes has worked out this subject, and the important results at which he has arrived, render it desirable that all other families of animals and plants should, if possible be illustrated in the same way."

Professor Edward Forbes was a man of remarkable energy and perseverance, as well as of singular and varied talent, and in private one of the most delightful companions. He drew with great ease and spirit, and also with considerable humour, as is shown in the comic tail pieces, appended to his "British Starfishes," all the illustrations of which are from his own pencil. His comic vein also found vent not unfrequently in verse, and it was a special treat when intimate friends were gathered together, not only to recall the humorous records in verse of "The Great Snowball Riot" of old college days, when the military had to be called out to quell the insubordination of the exuberant students, but to coax from him some later effusion dedicated to the "wars of science," the strifes of the modern Caractacus in the "*Silurian Fields*," or the great battle of the "Dodo," once waged so fiercely in association sections.

These, however, were but the playful pastimes of genius, wherewith in genial intellectual scintillations, he showed the healthful vigour of his mind. Edward Forbes,—as his old friends alone can designate him—was pre-eminently a naturalist. His attention had never been exclusively directed to any one of the Natural Sciences. He was equally a botanist, a zoologist, and a geologist, from first to last.—With a remarkable eye and tact for the discrimination of species and the allocation of natural groups, he combined the utmost delicacy in the perception of Organic and Cosmical relations. He possessed that rare quality, so remarkable in the great masters of Natural History, Linnæus and Cuvier, the power of availing himself of the labours of his brethren—not, as is too often the case, by appropriating their acquisitions, but by associating them voluntarily in the common labour. Entirely destitute of jealousy in scientific matters, he rather erred in overrating than in underrating the services of his friends.—He was consequently as much beloved and confided in by his seniors in science as by the youngest naturalists of his acquaintance. We find him, accordingly, in the earlier period of his career, taking an active part in geological and zoological discussion and publication with his veteran predecessor in the Edinburgh Chair of Natural History and his other fellow-members of the Wernerian Society, at the same time that, along with his early teacher, Dr. Graham, the late Professor of Botany at Edinburgh, his friends Drs. Neill and Greville, and a group of younger men of his own standing, he assisted, along with Dr. Balfour, the present Professor of Botany, in founding the Edinburgh Botanical Society.

With his varied tastes and acquirements, it may readily be believed that Edward Forbes possessed the most comprehensive intellectual sympathies. Hence the peculiar value of his labours in the wide field which Geology embraces; and hence, no less so, the keen sense of irreparable loss felt by those who have enjoyed his personal friendship, or have shared in the privileges of intellectual coöperation and rivalry. His private conversation was peculiarly varied and attractive, and as has been already hinted, when he unbent himself among his more intimate friends, he was the delight of the social circle. As a public speaker, he was graceful, lucid, and when the subject required, and admitted of it, eloquent, and rich in playful fancy.

Dr. Forbes' last illness manifested its earliest symptoms by a nervousness, altogether unusual in him, when he began his course of lectures for the present winter. When it assumed more formidable symptoms, he ascribed it to a return of the ague, which he had caught during his expedition to Lycia, and subsequent examination after his death confirmed the belief that the seeds of the disease which terminated his life were sown during that period, when he underwent much fatigue and exposure, in his ardent pursuit of the objects for which he had been despatched to that long-unknown region. His friend, Professor Goodsir, remarks, in reference to his death, when apparently on the threshold of a new course of more concentrated labours, and of correspondingly higher triumphs:—"His sudden death, while causing deepest sorrow to his many friends, will be deplored by all who can appreciate the additions already made to Natural History by his genius and acquirements,and the promise of what he might have accomplished had his life been prolonged. His friends, indeed, know well how irreparable is their loss; but it is more difficult to estimate the loss to science caused by the removal of one who, following like his predecessors, Walker and Jameson, in the footsteps of Linnæus, gave promise of raising the Science of Natural History to a height nowhere yet attained. The hope that his labours would issue in such an important result was entertained on solid grounds by those who knew him intimately from the commencement of his career, and were thoroughly acquainted, as well with his past labours, as with his plan of future work." This is but one expression of what all feel. Another fellow-student and attached friend thus speaks of him, in announcing his death to the writer of this brief notice:—"Edward Forbes was a man of genius, and united to it so much good sense, prudence, discretion, kindliness, gentleness, and geniality, that it is no wonder he was so very largely and widely honoured and loved. To myself his loss is in many respects irreparable. Short-sighted mortals that we are, he and I had been arranging extensive conjoint labours, and this is the end of it! With nearly every one there is the feeling that he is taken away, not from the evil to come, but from the good that was anticipated from his work."

His funeral, which took place on Thursday, Nov. 23rd., was attended by the magistrates of the city, the Professors and students of the University, and a large body of the citizens. He is laid at rest in the Dean Cemetery, a beautiful wooded retreat on the banks of the waters of Leith, in the neighbourhood of Edinburgh, where Lord Jeffrey, Lord Coburn, Professor Wilson, David Scott the painter, and others of greater and lesser note are interred.

Twenty-fourth Meeting of the British Association for the Advancement of Science.*

LIVERPOOL, SEPTEMBER, 1854.

On Some of the more recent Changes in the Area of the Irish Sea: by REV. J. G. CUMMING.

All the recent changes in the relative level of land and sea, indicated in the Isle of Man, appear to have extended to the surrounding coasts of Britain and Ireland. The period of the boulder clay was marked by a cold climate and the subsidence of the island and surrounding coasts to the extent of at least 1,600 feet;—and, during the re-elevation of the country, there was an interval, when the land was stationary at about fifteen feet above its present level. The sea-bed of the great drift gravel was then left dry, forming an extensive treeless plain, connecting the Isle of Man with the surrounding countries, England being at that time united to the Continent. This was the second elephantine period, in which the great Irish stag (*Cervus megaceros*) became an inhabitant of the Isle of Man, along with other animals whose remains are found in the fresh-water marls occupying basin-shaped depressions in the gravel plain. The marl basins and the plains themselves were afterwards covered with vegetation, and are still often occupied with beds of peat, containing forest trees; but, during the same period, the sea was quietly eating back its way into the terrace of drift gravel, until the Isle of Man became insulated and the further immigration of animals and plants was arrested. Cliffs of drift gravel occur on all the coasts of the island, sometimes capping the hard rocks, at others retiring a little distance inland. The form of the channel, and the greater waste of the pleistocene deposits in the south of the Isle of Man, show that the action of the sea was chiefly from the south; and its higher level is proved by the numerous water-worn caves, above the highest modern tides, along the whole southern and western shores. A still later change is indicated by the submerged forests, on many parts of the coast, which appear to have grown after the formation of the gravel terrace, during a temporary elevation, by which the bed of the Irish sea was once more laid dry. Whether the last subsidence took place during the historic period is a question yet to be determined.

On the Great Terrace of Erosion, in Scotland, and its Relative Date and Connexion with Glacial Phenomena: by MR. R. CHAMBERS.

This terrace is very conspicuous, at twenty to thirty feet above the sea, along the Frith of Clyde, the Islands of Bute and Arran and coast of Argyle, but is less remarkable on the east coast of Scotland. The shells found on it are all of recent species. On the west coast the hills generally slope smoothly to the present beach, broken only by the well-defined rectangular cut of the great terrace, which forms a level platform, seldom less than 100 feet wide, at the base of a vertical cliff, often forty feet high. The cliff is perforated by many caves, and sometimes rough with overhanging stones, whilst fantastic masses of harder rock occasionally rise up from the platform. This terrace is considered to indicate the sea's action during a much longer time than the present beach has existed, and to have been formed at a period of some comparative geological antiquity. On the north-west coast of Arran the ancient sea cliff is 50 to 100 feet high; and the opening of Glen Jorsa is filled to a considerable height with terraces of detritus. The lower part of the detritus is composed of blue clay and small half-worn boulders; over it is a bed of coarse gravel and then fine sand. Some of this detritus rests on the face of the cliff itself, showing its origin to have been posterior to the incising action of the sea, by which the terrace was formed. The surface of the drift is not less than 140 feet above the sea level, and it is considered to be the product of a glacier once filling Glen Jorsa. The coarse sand and gravel indicate periods at which the land occupied different levels and the sea penetrated more and more into the valley: a succession of events requiring a great length of time.

Further Observations on Glacial Phenomena in Scotland and the North of England: by MR. R. CHAMBERS.

The author referred to his former attempt to establish a distinction between an early general operation of ice over the surface of Scotland, by which the boulder clay was formed, and a more recent presence of valley glaciers in the chief mountain-systems, bearing as its monument a looser and coaser detritus, like the moraines of the Alps. The latter is supposed to have taken place without the presence of the sea; the former with the sea or with ice covering so large a surface as not to allow of drainage,—just as on the west coast of Northern Greenland, Dr. Rink has shown that continental ice of vast thickness is continually advancing from the interior to the coast, and thus breaking off in icebergs. Additional examples of true moraines, or sub-aerial glacial deposits, have been observed in two of the valleys of Ben Macdin, Aberdeenshire, where conspicuous terminal moraines occur at various stages; in Glen Dearg four of these occur, a mile or two apart,—the height of one of them is 130 feet, the bottom of the valley being about 1,700 feet above the sea. In the valley of the Dee, the lateral vale of Muick has also a remarkable series of moraines at a much lower level. In the Tay valley below Aberfeldy, not more than 300 feet above the sea, there is moraine matter; and near Garth Castle are some more recent terminal moraines of the same glacier. These and other examples show that glaciers have been wherever the mountains approach 3,000 feet. Another class of Scottish moraines is connected with shallow recesses of the more elevated mountains, being placed in front of them, as if masses of snow had gathered till an outward movement took place, carrying coarse detritus for a few hundred yards. One of these exists in Benmore Coigach, near Ullapool, and the moraines which confine Lochs Whorral and Brandy are of the same

*From the London Athenæum.

class. Loch Skeen, Dumfriesshire, is formed by another such moraine, the hills being 2,600 feet high, and the lake probably 1,200 feet. In front of a similar recess to the westward are other lines and humps of detritus, but there is no lake, the water having escaped by a passage still as clearly defined as a gate in a wall. A similar recess-moraine occurs in the valley of Loch Ranza, Arran, 50 feet above the sea, a furlong in length, with an opening in the centre, the recess is occupied by a morass. In the Lake district of England the author had obtained additional evidence of glacial action in the Thirlmere valley, where it enters the cross valley below the pass of Dunmailraise, which connects it with the Grasmere valley. There is a remarkable double ridge descending the hill side, about 30 feet high, its surface bristled with blocks, like the train of detritus of a glacier 300 or 400 feet deep, coming down the Thirlmere valley, further down are other heaps of detritus along with rounded and scratched rocks. The author's last observations on the two sets of glacial phenomena were made at the Scotch mountain Schiehallion, which rises from a base 1,100 feet above the sea to the height of 3,600 feet, and is composed of quartz rock. It is abrupt to the westward, and tails away to the east, the top of the ridge is thickly strewn with loose slabs. About half-way up, and above the level of Ferragon, the highest mountain to the eastward, there are examples of striated surfaces, and others within a few hundred feet of the summit, the direction in both instances being W. 30 N., or the same as that of the mountain ridge. About 800 feet below the summit a block of granite was found, and other foreign blocks were noticed in several places. These appearances, and the humps of brown moraine detritus in the valley of the Tay, indicate sub-aerial glacial action, but at the pass called White Bridge, the summit level east of Schiehallion, there is a deep bed of true boulder-clay with many worn and striated blocks, it lies out of the way of valley glaciers, and has escaped removal by their agency.

On Associations of Colour and Relations of Colour and Form in Plants: by Dr. G. Dickie.

The Professor remarked that relations in the form, structure, number and position of organs are familiar to every botanist: *a priori* it might have been inferred, that order prevails also in the distribution of colours. This is not only the fact, there are, besides, obvious indications of a relation between the colour and form of certain organs. My attention was first directed to the subject in April, 1853, and the facts here recorded were demonstrated to scientific friends at that date. A brief account of the subject was communicated to the Belfast Natural History Society in October following. Certain associations of colour have, however, been known to artists who have cultivated the special department of flower painting: any relation between form and colour seems to have escaped notice, and even erroneous views have been promulgated,—for instance, by Ruskin in his 'Lamps of Architecture.' The subject appears to have been very much—perhaps altogether—overlooked by the botanist. The presence of all the colours, red, yellow, blue, which form compound or white light, is a physical want of the organ of vision. Among the lower tribes of plants, the Algæ may be mentioned as remarkable examples of constantly associated colours. Such, in fact, is the foundation of Prof. Harvey's classification, who divides them into red, green, and olive. Among the red there are many which have a red-purple hue, and among the olive not a few which are yellow-green stand in the same relation. Among mosses we find the red or red-purple peristome associated with the green or yellow-green capsule, and the same is true of their stems and leaves. In flowering plants the associations of certain colours are so numerous, that it is unnecessary in the summary to do more than mention a few examples. In the leaves of *Caladium pictum*, *Coleus Blumei*, and *Victoria Regia* we find red or red-purple associated with green or yellow-green. The same is true of the pitcher-like organs of Sarraceniæ, Nepenthes, and Dischidia. In the flower similar associations of various kinds are common. We need not expect to find in a corolla or any other organ the primaries red and yellow, or blue and red, associated and in contact. The red has green, the yellow has purple, and the blue has orange associated. Of the primaries, blue is rarest,—many cases so denominated being, in fact, red-purples. In the flower yellow predominates, hence the very general diffusion of purple of various degrees of intensity. Purple being of such general occurrence in the flower, we can now understand why yellow is the most common colour of pollen: some exceptional cases seem to confirm this; in the turn-cap lily, for example, the red pollen is associated with the green filaments. The colour of the flower may have its complement in that of other parts, as stem, leaf, &c. Sometimes the associated colours are not visible at the same time. The inside of a ripe fig is red-purple, the outside yellow-green. Sometimes a yellow corolla is succeeded by a purple fruit. Direct exposure to light, although usually and in general correctly admitted to have a direct relation to intensity of colour in organisms, appears not to be necessary in every instance. The plant, however, must receive the light at some part or other, in order to produce that intensity of colour observed in the coats of seeds, in the interior of fruits, and in the tissues of subterranean organs. In conclusion—1. The primaries, red, yellow and blue, are generally to be seen in some part of the plant. 2. When a primary occurs in any part of the plant, its complement will usually be found in some other part, or at some period or other of the development of the plant. I have found, in not a few instances, in the animal kingdom similar associations of colour, birds, mollusca and radiata present many obvious examples. We may next examine the relation between colour and form, and the remarks are, for the present, confined to the flower. Law 1. In regular polypetalous and gamopetalous corolla the colour is uniformly distributed. That is to say, the pieces of the corolla, being all uniform in size and shape, have each an equal proportion of colour. Examples of this occur in Primulaceæ, Boragineæ, Ericaceæ, Gentianeæ, Papaveraceæ, Cruciferæ, Rosaceæ, Cact_ eæ, &c.—Law 2. Irregularity of corolla is associated with irregular distribution of colour. The odd lobe of the corolla in such is most varied in form, size and colour. When there is only colour, it is usually more intense in the odd lobe. When there are two, one of them is very generally confined to the odd lobe. Sometimes, when only one colour is present, and of uniform intensity in all the pieces, the odd lobe has spots, or streaks, of white. The odd lobe, therefore, in irregular flowers, is distinguished from the others not merely by size, form, and position, but also by its colour. Papilionaceæ, Labiatæ, Scrophularineæ, &c., are examples. In some cases, as Gloxinia, Achimenes, Rhododendron, &c., in which irregularity of flower is less marked, the two pieces on each side of the odd lobe frequently partake of its character as regards colour. In some thalamiflorous Exogens (as Pelargonium, Tropæolum, Æsculus), &c., with irregularity of flower, owing chiefly to difference in the size of the pieces, the largest are most highly coloured.—Law 3. Different forms of corolla in the same inflorescence often present differences of colour, but all of the same form have the same colour. The Compositæ are examples,—when there are two colours, the flowers of the centre have one colour and uniform in its intensity; those of the circumference also agree in this respect, but have the other colour. The first two laws prevail in monocotyledons as well as in dicotyledons. In the former the calyx and corolla generally resemble each other in structure, shape, and in colour also. The law of the contrasts is, therefore, simpler in monocotyledons than in dicotyledons. The former may be symbolized by the triangle, three and six being the typical numbers in the flower; the latter by the square or pentagon, four and eight, five or ten, being the prevalent numbers. Simplicity of figure corresponds with simple contrast of colour in the one, while greater complexity of colour and of structure are in direct relation in the other. According to the investigations of Brongniart, there has been progressive increase of angiospermous dicotyledons up to man's epoch. Among them we find the floral organs with greater prominence in size, form and colour, and such prominence of the "nuptial dress" of the plant is peculiarly a feature of species belonging to natural families which have found their maximum in man's epoch and are characteristic, of it.

Mr. Warrington gave an account of some experiments he had made on the influence of coloured glass on the growth of plants in sea-water. He found the red sea-plants grew best in glass-cases coloured green, and that green Confervæ were thus destroyed.—Mr. Huxley made some remarks on the general theory of harmony and adaptation in nature. He thought naturalists were too much disposed to take it for granted that beauty was an end in creation. He believed, on the contrary, that grotesqueness was frequently an object, and that inharmonious and inapposite colours and forms were purposely brought together, and thus excited the feeling of the ridiculous.—Dr. Carpenter called attention to the fact, that different chemical conditions of the plant produced chemical colours; and the point to be ascertained was whether these were subservient to the laws of harmony sought to be established.

On the Progress of Naval Architecture and Steam Navigation, including a Notice of the Large Ship of the Eastern Steam Navigation Company, by the President, Mr. Scott Russell.

Mr. Russell explained the principles which guide the construction of ships, and condemned the legislative restrictions which, till within the last twenty years, prevented the application of those principles. The old "sea chests," which were constructed with a view to avoid the taxa tion imposed on ships that were not built of certain shapes, possessed neither the requisite properties of stability nor winwardness, and were very slow; they were built solely with a view to hold the greatest amount of cargo within a given superficies, without regard to the other qualities of a ship. In smuggling and piratical vessels the true principle of ship building, for acquiring speed, had however been long introduced before the subject was taken up by the British Association, and the wave principle of construction had thus been established by extended experiments on a large scale. A fine concave entrance, instead of a bluff round bow, is now generally admitted to be the best; and, in addition to the shape of the water line, it had been found that length of the body of a ship facilitates its passage through the water, by allowing a longer time for the particles of the fluid to separate. A ship with a fine concave bow, a long body, and a comparatively round stern, Mr. Russell said, cleaves its passage through the water without raising a wave in front to obstruct its course. No steam ship that is not 180 feet long can be propelled at a speed of sixteen miles an hour without a great expenditure of power; and 400 feet is the shortest length for a ship that is intended to be propelled at so high a speed at twenty-four miles an hour. As an illustration of this rule, it was mentioned that the Himalaya, which is 365 feet long, attains the greatest speed for the power employed of any merchant ship. In the construction of large ships, however, the builders were met with the difficulty of not being able to find wood of sufficient size for the requisite strength, since no means have yet been invented of joining pieces of wood together so as to give them the same strength as the whole timber This want of material of sufficient size was supplied by using iron, for the joints can be made as strongly as the whole plate, or plates of metal of any required size can be rolled for the purpose. This facility of increasing the size of the material is the principle advantage derived from the use of iron, which affords facilities for constructing ships of any size; and it is of that material that the great ship, now building in London for the Eastern Steam Navigation Company, is to be constructed. Mr. Russell complimented Mr. Brunel for the engineering skill and ingenuity he had displayed in leading the way in the construction of large iron ships; and he alluded to the forebodings of disaster on former occasions, when the Great Western and the Great Britain were built, which forebodings events had shown to be groundless, and he felt confident that the similar forebodings which some people had expressed of the still larger ship now being built would be equally fallacious. Mr. Russell said he wished it, however, to be understood that he did not recommend the general adoption of such large ships. The size of the ships ought to be suited to the traffic and the distance; but the point he contended for was, that it is only by employing very large ships that steam navigation to distant parts of the globe can be profitably carried on. A steam-ship to Australia, if it were not large enough to carry sufficient coal for the voyage, had to take in a supply over and over again, and at each station the cost of the coal was increased by conveying it to the different stations. Under such disadvantages no freight could pay the cost of conveyance; and in order to remove them, it was necessary to build a ship of sufficient size to carry a supply of fuel for the voyage out and back again, or equal to circumnavigating the globe. An extremely fine entrance was another of the characters which the large ship now building would possess, so as to enable it to move through the water with the greatest attainable velocity with a moderate amount of steam power. With these advantages it was expected that the ship would accomplish the voyage to Austraila in thirty or thirty-three days. It would easily carry six thousand tons, besides its requisite quantity of coal, and would have excellent accommodation for 500 first-class passengers, 600 second-class, and 1,000 third-class passengers. It would be 675 feet long, 83 feet in breadth of beam, and 60 feet deep, and though so large that St. George's Hall is small in comparison, it is the smallest size that could do the work required with speed and economy.

Mr. Fairbairn said Mr. Brunel had shown him the plans; and though he had at one time thought a ship of that size would be too large for strength, he had, after examination of the plans, arrived at the opposite opinion. He had now no doubt that the ship would be perfectly strong, and be able to bear a gale of wind without bending. It was built on the same principle as the Britannia Tubular Bridge; and when it was perceived that that mode of structure is able to sustain a bridge without any support in the middle, there could be no doubt that supported as the ship would be by the water, it would under all circumstances be able to bear the strains to which it might be subjected.

Mr Nasmyth explained a plan for destroying ships by means of a marine mortar fixed at the bow of a strongly built vessel to be propelled by steam power; He proposed to place in the bow of the vessel, and projecting about two feet beyond it, a case large enough to contain about six hundred weight of gunpowder. A percussion ball was to be inserted at the back of the reservior of gunpowder to explode at the instant that it struck against the ship to be destroyed. The mortar vessel was to be built of blocks of timber, so strongly as to be able itself to resists the effects of the explosion, which would completely destroy the enemy's ship. Such a marine mortar, it was stated, could be amply manned by "three brave fellows," who would be secured from danger by the strength of the ship and its recoil, and by them occupying a position least exposed to injury, even should the explosion do damage to the parts nearest to it.

Mr. Nasmyth described a Lightning Conductor for Chimneys, which he conceived affords more perfect insulation, and is therefore safer then those in common use. The present practice is to fix the conducter outside the chimney by metal holdfasts, by which means during severe thunder-storms chimneys are often damaged by the lightning entering at the points of attachment and displacing the bricks. In the method of fixing the conducter recommended by Mr. Nasmyth the metal rod is suspended in the middle of the chimney by branching supports fixed on the top. A conducter of this kind had proved efficient in storms which had severely injured other chimneys in the neighbourhood that were protected in the usual manner. An experience of eighteen years had tested the superiority of the plan.

Prof. Faraday, on being called on for his opinion, said that he recommended that lightning conducters should be placed inside instead of outside of all buildings. He had been consulted on that point when the lightning conducter was fixed to the Duke of York's Pillar, and he advised the placing it inside, but his advice was not taken, and the rod was fixed outside, to the great disfigurement of the column. All attachments of metal to or near the conducter are bad, unless there be a continuous line of conduction to the ground. He mentioned the instance of damage done to a lighthouse in consequence of part of the discharge lightning having passed from the conducter to the lead fastening of the stones. The practical question for consideration by the Mechanical Section was, how far they could safely run lead between the stone of such a structure, for if it were done partially, leaving a discontinuous series of such metallic fastenings, there would be great danger of the stones being displaced by the electric discharge. When such fastenings are used, care should be taken that they are connected together and with the earth by a continuous metallic conducter. Some persons conceived that it is desirable to insulate the conducter from the wall of a building by glass, but all such contrivances are absurd, since the distance to which the metal could be removed from the wall by the interposed insulator was altogether insignificant compared with the distance through which the lightning must pass in a discharge from the clouds to the earth. On being asked whether a flat strip of copper was not better than a copper rod, Prof. Faraday said the shape of the conducter is immaterial, provided the substance and quality of the metal are the same.

A communication from Mr. Sewell, *on Boiler Explosions*, gave rise to a discussion on the causes of such explosions, and on the effect of percussion in weakening the strength of iron, in which Mr. Fairbairn, Mr. Roberts, Mr. Hopkinson, Mr. Oldham, and other members took part. Mr. Fairbairn said, that, so far as his experience went, the explosions of boilers generally occur at the moment the engines start, in consequence of the sudden generation of steam by the increased motion given to the water. With respect to the weakening of railway axles by use, he conceived that effect to be produced rather by the continuous bindings of the metal, however small they may be, which give a set to the fibres and increase the liability to break. Boiler-plates are also frequently injured by the operation of punching for melting. Mr. Roberts attributed boiler explosions in most instances to the defective construction. He was of opinion that in rivetting boiler plates the rivets are seldom made large enough, large rivets being much stronger than small ones.—Mr. Clay said the crystalline structure of wrought iron acquired by long continued percussion might be restored to the fibrous state by reheating. Mr. Oldham considered it would be of advantage to reheat the axeltrees of locomotive engines after they had run for some time, so that the fibrous structure, from whatever cause it was rendered crystalline, might be restored.—Mr. Roberts was not disposed to admit that any change is produced in the quality of iron by wear. If the iron were of good quality and perfect at first it would remain so till it was worn out. He observed that bars of iron are frequently different at their opposite ends, for whilst one is tough the other may sometimes be broken with a slight stroke of the hammer.

Mr. W. Clay explained the construction and mode of fixing the large fly-wheel of the Warsey forge, which is the largest fly-wheel in the world. It is 35 feet in diameter, and 60 tons weight, and its axle is mounted on friction rollers.—Mr. Clay also produced and explained the model of a machine used for rolling taper iron, by which an iron bar may be rolled of any length and tapered to any required degree. The principle of the action of the machine consists in keeping one of the rollers fixed in its bearings by hydraulic pressure. A valve, regulated by a fine screw, permits the water to escape, and thus as the operation proceeds the rollers become more and more separated, and the iron bar less flattened. By regulating the valve, so as to allow of greater or less escape of the water, the degree of tapering can be very accurately adjusted.

Meteorological Observations, &c., on Lake Nipissing,

During the Months of October and November, 1854, by ALEXANDER MURRAY, *Assistant Provincial Geologist.*

We are indebted to Alexander Murray, Esq., for the following abstracts from his Journal during a recent visit to Lake Nipissing. Although the observations do not extend over a period of more than twenty-seven days, yet they furnish some interesting glimpses of the nature of the autumnal climate of that remote and unfrequented lake. Lake Nipissing is 69 feet above Lake Huron, or 647 feet above the sea; Lake Superior being 597 feet, Lake Simcoe 706, and Balsam Lake—the highest in Western Canada—about 820 feet above the sea level. The influence of a northerly wind is well shown on the 4th of November, when the thermometer fell to 18 degrees at 7.30 p. m., and descended as low as 15 degrees at 8 p. m., the temperature at Toronto being at the same time 17.5°

1854.	Time.	An. Bar	Ther Att.	Ther Det.	Temp. of water	Remarks, Weather, &c.
			°	°	°	
Oct. 16	6.35 a. m.	28.750	42	44	—	Fresh gale from West.
"	1.00 p. m.	28.800	47	47	—	Do.
"	8.00 p. m.	28.850	43	45	—	
Oct. 17	7.00 a. m,	28.950	39	41	46	
"	6.00 p. m.	29.000	50.5	53	54	
"	6.30 p. m.	29.000	49	49	—	[blowing hard.
Oct. 18	7.00 a. m.	29.075	41	39	—	Snow with NE wind
"	2,00 p. m.	29.155	41	39	—	Do.
"	6.00 p. m.	29.225	41	38	—	Do.
Oct. 19	7.00 a. m.	29.375	44	37	—	Ice along the shores.
"	8.00 a. m.	29.400	38	40	—	[Ther. Att. affected
"	1.00 p. m.	29.500	40	43	44	[by local heat.
"	9.25 p. m.	29.325	41	43	—	
Oct. 20	8.00 a. m.	29.350	44	45	47	
"	0.30 p. m	29.375	48	50	—	
"	5.30 p. m.	29.475	51	52	—	
Oct. 21	7.00 a. m.	29.550	47	48	—	Cloudy and Calm.
"	9.00 a. m.	29.525	48	49	—	Do.
"	Noon.	29.500	56	55	51	Do.
"	5.30 p. m.	29.500	55	55	—	Do.
Oct. 22	8.00 a. m.	29.525	48	49	—	Cloudy, with a light
"	4.35 p. m.	29.455	54	55	—	Do. [breeze from SE.
"	7.00 p. m.	29.475	56	56	—	Do.
Oct. 23	7.00 a. m.	29.450	46	48	—	Cloudy, blowing fresh
"	6.00 p. m.	29.400	51	52	—	Do. [from SE.
Oct. 24	9.00 a. m.	29.450	52	51	—	
"	0.30 p. m.	29.500	56	55	54	
"	6.20 p. m.	29.525	56	56	—	
Oct. 25	8.30 a. m.	29.625	52	53	—	Calm and cloudy,
"	Noon.	29.650	59	62	53	Do.
"	9.00 p. m.	29.575	62	61	—	Light wind from WSW.
Oct. 26	7.30 a. m.	29.550	53	53	—	Light wind and cloudy.
"	6.00 p. m.	29.500	56	57	—	Fine—little wind.
"	9.00 p. m.	29.575	60	61	—	
Oct. 27	7.00 a. m.	29.455	47	49	—	Calm and clear.
"	1.00 p. m.	29.500	65	64	55	Very fine—calm.
"	6.30 p. m.	29.400	56		—	Light wind & very fine.
Oct. 28	6.40 a. m.	29.325	36	37	—	Calm & hazy—red sky.
"	11.30 a. m.	29.400	65	63	54	Calm and hazy—Halo
"	6.00 p. m.	29.400	58	60	—	Do. weather[round sun.
Oct. 29	7.40 a. m.	29.300	52	53	—	Calm and cloudy.
"	0.45 p. m.	29.250	[illegible]	62	—	Light wind E with rain.
"	8.30 p. m.	29.200	55	56	—	Light wind—star light.
Oct. 30	7.20 a. m.	29.225	53	55	—	Calm and cloudy.
"	1.00 p. m.	29.210	63	63	55.5	Light wind SE—driz. r.
"	6.00 p. m.	29.125	61	62	—	Light S wind & cloudy.
Oct. 31	7.00 a. m.	28.900	58	61	—	Calm and cloudy.
"	Noon.	28.775	60	62	—	Cloudy with showers.
"	7.00 p. m.	28.625	56	58	—	SW wind with rain.
Nov. 1	7.15 a. m.	28.800	42	44	—	W wind and cloudy.
"	1.00 p. m.	28.825	48	51	54	Cloudy—dist. thunder.
"	8.00 p. m.	28.875	41	43	—	W winds—passing sh.
Nov. 2	7.20 a. m.	28 925	34	36	—	Bright and calm.
"	Noon.					Fresh breeze & cloudy.
"	4.30 p. m.	28.725	42	46	—	Heavy rain and squals
"	9.00 p. m.	28.825				[from SW.
Nov. 3	7.00 a. m.	29.150	24	28	—	Snow showers.
"	2.00 p. m.	29.300	34	34	47	Fresh breeze N. of West.
"	8.00 p. m.	29.225	27	30	—	Snow sh.—clear interv.
Nov. 4	7.30 a. m.	29.450	18	19	—	Strong wind from N.
"	Noon.	29.575	31	29	48	Wind NW by W.
"	6.00 p. m.	29.500	19	20	—	
"	8.00 p. m.	29.500	15	18	—	Calm and clear.
Nov. 5	7.00 a. m.	29.425	15	18	—	Calm and cloudy.
"	7.30 a. m.	29.425	22	26	—	Snow.
"	Noon.	29.400	34	36	52	Below Chaudiere Falls.
"	9.00 p. m.	29.150	34	36	—	[25 feet fall from Lake
Nov. 6	8.00 a. m.	28.775	34	36	—	[Nipissing.
"	Noon.	28.550	40	40	—	Rain from SW.
"	2.00 p. m.	28.550	40		—	Heavy rain.
Nov. 7	7.30 a. m.	28.575	34		—	Cloudy with snow sh.
"	Noon.	28.775	44	46	52	Wind NW descending
"	7.00 p. m.	28.850	34	37	—	[French River.
Nov. 8	8.00 a. m.	29.000	28	31	—	Clear—West wind.
"	Noon.	29,100	41	37	51	Clear.
"	6.00 p. m.	29.500	31	34	—	[Huron.
Nov. 9	8.00 a. m.	29.275	23	23	—	Cloudy—North wind L.
"	Noon.	29.325	31	33	40	E wind and cloudy.
"	9.00 p. m.	29.200	26	31	—	
Nov. 10	6.00 a. m.	29.200	36	39	—	NE wind
"	Noon.	28.925	47	47	46	Fresh breeze with rain.
"	8.00 p. m.	28.775	48	50	—	Fresh SE wind with r.
Nov. 11	7.00 a. m.	28.850	43	45	—	Strong Westerly wind.

Climate of the Crimea.

The following tables show the temperature of the seasons at Sebastopol, London, Paris, Dijon, Toronto, Hamilton, and Kingston. They will serve to convey an idea of the climate of Sebastopol, now a subject of universal interest.

	Latitude.	Longitude.	Temperature of Winter, Fahrenheit.	Temperature of Spring, Fahrenheit.	Temperature of Summer, Fahrenheit.	Temperature of Autumn, Fahrenheit.	Temperature of Year, Fahrenheit.	Number of Years Observations.	Height above the Sea in Feet.
	° ′	° ′							
Sebastopol*	44 36	33 32	35.945	1.62	70.57	53.76	52.97	10	—
London . . .	51 30	0 5	39.504	9.06	62.93	51,83	50.83	50	—
Paris . . .	48 50	2 20	37.855	0.62	64.58	52.20	51.31	39	114
Dijon . . .	47 19	5 2	35.385	3.30	69.58	53.30	52.89	7	700
Toronto . .	43 39	79 21	25. 04	0. 9	64. 6	46. 5	44.23	12	440
Kingston . .	44 8	76 32	18. 74	1. 7	67. 7	48. 7	44. 7		400 nearly.
Hamilton . .	——	——	23. 94	2. 8	64. 6	45. 9	44.25	8	400 nearly.

* Dove's Meteorological Tables.

The mean winter temperature at Toronto is 10°94 lower than at Sebastopol. The lowest mean temperature of any month in the winter at Sebastopol is 34°27, in January; at Toronto it is 24°2 for the mean of fourteen years, and 17° for the coldest month recorded, in 1840. At Dijon the lowest mean monthly temperature is 33°58, Paris 35°44. London, 37°35. From these facts there does not appear to be any cause for apprehension that our gallant troops in the Crimea will suffer from extreme cold.

Mineral Wealth of the Ottawa Region.

During the past week were shipped from Bytown a number of large specimens of ores, marbles, building stones, and other natural productions, destined to take a part in the great Exhibition of Industry of all Nations at Paris in May next. There was a huge mass of the magnetic iron ore contributed by J. Forsyth, Esq., from the mine in the township of Hull, weighing over two thousand pounds: another six feet long, and of about the same weight of specular iron, from the township of MacNab, from A. Dickson, Esq.; and a piece of silicate of iron, weighing about two hundred and sixty pounds. This latter is a rare mineral, and the specimen in question is perhaps the largest yet seen. Besides these, there were two strongly hooped casks, weighing over eighteen hundred pounds of other specimens of ore, and a number of boxes and uncovered blocks of limestone and marble. The object in procuring such large masses is to enable the Parisians to form some conception of the extent of the supply by the magnitude of the specimens. The extra expense is but trifling, compared with the importance of creating an impression. A country whose mineral wealth is only represented by a few insignificant fragments will not be much known, unless the visitors receive verbal or written information that the collection only partially represents its riches.—Large specimens, however, are the heralds of their own and their country's greatness. They make an impression of natural wealth on the mind which cannot be effaced. The name of Canada will be associated with the idea of one of the richest spots on the earth. And what is still better, the idea in this instance, will be in no way an exaggeration. The bed of ore from which the first of the above mentioned specimens was procured is situated about six miles from Bytown, in the township of Hull. It is about 400 feet thick, and of such an excellent quality that it will yield about 75 per cent. of pure iron. It rises into a dome-shaped mound about 70 or 80 feet above the level of the surrounding land, and it is computed that there are three millions of tons of it above the surface. The only mining operations, therefore, that will be required for a long time will be to break it up, and several thousand tons of it have been already quarried and are now being transported. It was lately purchased by J. Forsyth, Esq., of Pittsburgh, in the State of Pennsylvania, who intends to convey it to that place and smelt it along with other ores. It requires an amount of scientific knowledge, and a thorough acquaintance with the resources of other countries, such as is possessed by but one man in Canada, to take charge of a matter of this kind; and no person can witness Mr. Logan's operations without being at once convinced that this Province will be creditably represented at Paris in 1855, as it was in London in 1851.—*Bytown Citizen.*

Railways in Canada.

Schedule of the several Companies incorporated for the construction of Railways in Canada, from the date of the first Charter (25th of February, 1832) to the close of the session of 1852.

Name of Company Incorporated.	Amount of Capital.	No. of Miles under contract, and No. of Miles completed.	
	$		
1. Champlain & St. Lawrence - - -	200,000	—	16
Branch Lines of do. - - - -	200,000	—	52
2. Cobourg - - - - - - - -	1,600,000	Charter expired.	
3. Great Western and Branches -	10,000,000	55	240
4. Hamilton and Port Dover - - -	2,000,000	40	—
5. Erie and Ontario - - - - -	600,000	—	17½
6. Toronto and Lake Huron - - -	2,000,000	Not commenced.	
7. Niagara and Detroit - - - -	2,000,000	Charter expired.	
8. Huron and Ontario - - - -	1,400,000	Charter expired.	
9. Quebec and Provinces Line - - -	————	Charter expired.	
10. London and Davenport - - -	200,000	Charter expired.	
11. Canada Union - - - - - -	400,000	Not commenced.	
12. Upper and Lower Ottawa - -	120,000	Charter expired.	
13. Eastern townships - - - - -	600,000	Charter expired.	
14. St. Lawrence and Atlantic - -	2,000,000	—	130
Branch Lines of ditto. - - -	————	115	—
15. Montreal and New York - - - -	3,460,000	—	—
Branch of 120 Miles - - - -		Not commenced.	
16. Montreal and Kingston - - -	4,000,000	Not commenced.	
17. Wolfe Island, Kingston and Toronto	4,000,000	Charter expired.	
18. Peterboro' and Port Hope - - -	1,000,000	100	—
19. Hamilton and Toronto - - - -	1,800,000	45	—
Branch - - - - - - - - -	————	35	—
20. St. Lawrence and Industry - - -	48,000	—	13
21. Woodstock and Lake Erie - - -	2,000,000	75	—
22. Bytown and Britannia - - - -	40,000	Charter expired.	
23. Carrillon and Grenville - - - -	240,000	—	12
24. Canada, New Brunswick, and Nova Scotia - - - - - - - - -	8,000,000	Not commenced.	
25. Montreal and Province Line Junction - - - - - - - - -	300,000	Not commenced.	
26. Toronto and Goderich - - - -	3,000,000	Charter repealed.	
27. Montreal and Vermont Junction -	400,000	68	—
28. Ontario, Simcoe, and Huron - -	2,000,000	4½	92½
Branch - - - - - - - - -	1,000,000	60	—
29. St. Lawrence and Ottawa - - -	————	Not commenced.	
30. Industry and Rawdon - - - -	36,000	—	10
31. Quebec and Richmond - - - -	————	See Grand Trunk.	
32. Quebec and St. Andrews - - -	3,000,000	Not commenced.	
33. Bytown and Prescott . - - - -	6,000,000	—	63
34. Kingston and Toronto - - - -	3,000,000	Not commenced.	
35. Toronto and Guelph - - - - }	————	Included in Gr'd	
Extension of do. - - - - - - }		Trunk.	
36. Wolf Island - - - - - - - -	200,000	Not commenced.	
37. Grand Trunk of Canada - - - -	16,000,000	—	—
Icreased by amalgamation of Companies to - - - - - - - -	38,000,000	720	382
38. Grand Trunk of Canada East, (included in Grand Trunk) - -	————		
39. Cobourg and Peterboro' - - - -	————	—	25
40. Galt and Guelph - - - - - -	560,000	16	25
41. Grand Junction, (included in Grand Trunk) - - - - - - - -	————		
42. Buffalo, Brantford, and Goderich -	4,000,000	78	80
43. North Shore Railway - - - - -	2,490,000	145	—
44. London and Port Sarnia - - - -	2,000,000	60	—
45. Montreal and Bytown - - - -	2,000,000	120	—
46. Megantic Junction - - - - -	400,000	Not commenced.	
47. Port Whitby and Lake Huron - -	————	Not commenced.	
48. Brockville and Ottawa - - - -	2,000,000	130	—
49. Stanstead, Shefford, and Chambly -	3,000,000	95	—
50. London and Port Stanley - - -	600,000	25	—
51. Vandreuil - - - - - - - -	1,000,000	34	—
52. Cataraqui and Peterboro - - - -	1,500,000	Not commenced.	
53. Port Dalhousie and Thorold - -	300,000	5	4
54. Bytown and Pembroke - - - -	1,600,000	Not commenced.	
55. Perth and Kemptville - - - -	600,000	Not commenced.	
56. Prince Edward - - - - - -	1,400,000	Not commenced.	

From these statistics the following summary appears:—Total number of Charters granted to Railroad Companies, 56; number of Companies whose charters have expired from *non user*, 10; number of Companies which have not as yet commenced laying down their roads, 14; number of roads now in the course of construction in the Province 32. Belonging to the latter class, 1,193 miles have been completed, and 2,022 are more or less advanced, besides a vast number of miles of road which have not yet been commenced.

Railway Influence.—The forests at the head of the Androscoggin and Connecticut rivers, have been quadrupled in value in the last four years, and a similar result is found along the streams of Canada, in the neighbourhood of the line. It will be seen by reference to the returns of the Grand Trunk Railway for the week ending June 3, that over a half million feet of lumber was moved on that road, and from the new operations going forward along the line, we may predict that another year it will average one million feet a week.—*State of Maine*

Etching Liquid for Lithographers.—Chevallier and Langlume propose for the purpose six parts of fused *chloride of calcium*, dissolved in nineteen parts of rain-water and filtered. In this solution, four parts of gum-arabic are to be dissolved, and one part of pure muriatic acid added to it. This solution serves at the same time to etch, to gum, and, by its penetrating the stone, to keep it moist during the printing—a matter of great consequence.

Elements of Food

The following tables, by Dr. Angus, of Manchester, show the quantity of the elements of plants contained in the food annually consumed by a hundred adult persons, as ascertained by actual observation. The 44,400 lbs. of farinaceous food are taken as about equal to 93 quarters of wheat, which would grow on about 20 acres of good land:

Quantities of the Elements of Food contained in the Provisions consumed by 100 Adult Persons.

	44,400 lbs. farinaceous food.	26,000 lbs. of potatoes and vegetables, 4 lbs. per week each.	36,500 pints of beer, at 15 gals to the bush., 300 bushels of malt, 1 pint ⅌ day each.	13,000 lbs. of meat, or 11,143 lbs. deducting 1-7th for fat 2½ lbs. per week each.	4,333 lbs. of bone.	4,600 lbs. of cheese, 2 oz ⅌ day each.	Total quantities.
	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potass and Soda -	368	193	103	70	13	80	827
Lime and magnesia	177	20	58	10	2·889	4	3·158
Phosphoric acid -	486	13	85	60	1·039	30	1·713
Silica - - - - - -	21	3	142	....	....	....	166
Metallic oxides -	5	fract'n	....	fract'n	....	....	6
Nitrogen - - - -	1·021	94	242	580	75	300	2 312
Sulphur and chl'ne	....	23	4	4	2	54	87

Quantities of the Elements of Food removed from 100 Acres of Soil by the usual four-course system; and the Quantities which would be supplied by the Excretion of 100 Adult Persons.

	25 acres of wheat, five quarters per acre.	25 acres of barley, five quarters per acre.	From the land in flesh of animals.	40 lambs, at 80 lbs. each.	Four calves.	Four young cows.	Two young horses.	Carried away from 50 acres of barley and wheat, and 50 acres of green crops.	Excretions of 100 adults contain.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potass and Soda -	470	395	10	8	2	4	2	780	827
Lime and magnesia	350	225	144	250	27	45	22	948	3·168
Phosphoric acid -	680	430	145	210	21	42	21	1 549	1·713
Silica - - - - - -	30	420	....	....	....	....	....	450	166
Metallic oxide - -	4	4	....	....	....	....	....	8	6
Sulphur & chlorine	...	....	5	12	1	2	1	21	87
Nitrogen- - - - -	1·360	1·030	113	128	15	23	12	2·681	2·312

Distances between leading Cities in the United States.

The following table will show the distance between some of the leading points of the United States by the nearest mail routes. That a better judgment may be formed of the extent of the country, they are compared with nearly equi-distant foreign cities.—

American Cities.	Distance in miles.
Pittsburg to Boston	616
New York to Mobile	1,476
Philadelphia to Pensacola	1,443
Boston to Nashville	1,590
Albany to Richmond	506
New York to Charleston	790
New York to Cleveland (Ohio)	671
Boston to Galveston (Texas)	2,256
New York to Astoria (land route)	3,523
New York to Astoria (via Cape Horn)	17,500
New York to Astoria (via Panama)	6,200
New York to San Diego, California (land route)	3,732
Charleston to Hartford	900
New York to New Orleans	1,640
Falls of St. Anthony to mouths of Mississippi River	2,200
Sources of Mississippi to mouths of Mississippi	2,986
Pittsburg to New Orleans, via river	2,175
Nearly equi-distant American and Foreign Cities.	
Paris to Vienna	625
Paris to St. Petersburg	1,510
St. Petersburg to Constantinople, land route	1,490
Paris to Berlin	510
London to Vienna	760
Paris to Rome	700
Stockholm (Sweden) to Madrid	2,150
London to Ispahan, Persia	3,589
Liverpool to Canton, via Cape of Good Hope	18,000
London to Delhi, Hindostan	5,337
New York to Bremen, across Atlantic	3,800
London to Rome	910
London to Constantinople, by land	1,490
Stockholm (Sweden) to Tunis (Africa)	2,200
St. Petersburg to Thebes, Egypt	2,800
St. Petersburgh to Madrid	2,100

The citizen of the United States arriving at New Orleans from New York has passed over a distance more than equal to that separating London from Constantinople, or Paris from St. Petersburg. If he has taken the land route to Astoria, his travel will be nearly as great as from New York to Bremen; if the water route, he will have made a voyage nearly equal to one from London to Canton.

Consumption of Smoke.

The London Athenæum says, "In the pages of a Contemporary of Saturday last, we read a paragraph anouncing a new invention that has been put into successful operation at Messrs. Cubitt's, the builders of Gray's Inn Road. This invention is described as effecting the "complete suppression of smoke," and as causing an enormous economy of fuel, the saving being declared to be at the rate of 7 out of every 11 bushels of coal:—a rather startling statement. It is not our purpose, however, just now, to question the truth of that statement; but to remark on the waste of the inventive faculty occasioned by the want of a good system of public record, by which inventors could ascertain whether what they are doing has not previously been effected by some one else. The plan referred to above is that of washing the ponderable matter out of the smoke by means of a jet of water playing in the chimney, or in a passage through which the smoke is made to pass. Not many months since, a patent was applied for in London, and Provisional protection granted for an American invention precisely similar to that referred to above: and the patent was abandoned *because it was ascertained that the same thing had been invented and* patented years ago in this country. The original inventor, in this country, so far as we know, was Mr. Muntz, of Birmingham, the Member of Parliament, who was examined as a witness before the Select Committee of the House of Commons on Smoke Prevention, which sat in 1843. It seems that a model had been exhibited to the Committee, by some other person, "with ascending and descending flues, and a shower of water," and Mr. Muntz being asked if he had seen it, replied "I took out a patent for that in 1816 myself." So far as the evidence is before us, it seems that in 1816 Mr. Muntz hit upon a certain plan of washing his smoke,—in 1843 some one else expounds a like plan, and seems to have patented it, in 1853 the same thing is again invented in the United States, and a patent is again applied for in England, and provisionally obtained, and lastly, Messrs. Cubitt adopt an apparently identical plan which is ushered to the world with the honours of originallity.—Much has certainly been done of late towards systematizing our information on these subjects; but here is evidence how much more has to be effected before the faculties of invention will be freed from the chances of waste."

Copper Smoke and Copper Men.—The vocation of the copper man is distinguished from that of almost every other craftsman in this particular—that working in the face of an intense fire, high temperature, and its consequences, are superadded to hard labour. Exposed for 12 hours to a heat alternating between 130° and 55°, the furnace-man, working before an intense fire, or sitting in a cold draught, will constantly within that period consume a quantity varying from two to three gallons of water. This raises a curious question, applicable to many of our operatives, whether a man who loses gallons of fluid by perspiration every day throughout the year is liable to waste? Statistics, if rigorously compiled on this subject, would occupy years; but general observation, and the assurances of the men themselves, will suffice to set all doubt at rest. In all the works of the district it is quite common to find men hale, florid, and even corpulent, in personal appearance; and those who have passed 20, 30, and even 40 years before the furnace livingly solve the problem. Emaciated and lean are not more commonly met with amongst those veteran furnace-men who have perspired 600 gallons within the year, than amongst labourers in general; 50 such men lately assured our author that they were precisely the same weight as they were twelve months ago, although, as a counterpoise to such perspiration they had consumed within that period 800 or 1000 gallons of water. The conclusion arrived at is, that the sweating of the workman labouring before the fire does not affect the frame, when that frame is saturated with water; that the nutrition of the body proceeds, even though deluged with the fluid.—The fusing point of copper is 1500°, and often, in the midst of a heat radiating from such a temperature, the furnace-man works bravely for two consecutive hours, and then retires to cool himself and to drink.—While direct experience supports what is physiologically reasonable, that it is by alternately drinking and sweating that the man is enabled to sustain the heat of an intensely powerful furnace, and the fatigue of very exhausting labour, indigestion is found to prevail amongst them. This Thomas Williams, M.D. of Swansea, attributes to drinking large quantities of cold water too soon after meals; but he assures us that organic diseases of the stomach are not more common amongst them than amongst other men who support themselves by their labour.—*Mining Journal.*

Railway Suspension Bridge at the Falls.—This noble structure is expected to be completed by the first of January, and the first train will probably pass over it on that day. The Rochester *American* gives the following dimensions of the Bridge, as furnished by the Architect, Mr. J. A. Roebling:

Length or distance from the centre of the towers - - -	feet	822
Height of the towers above the rocks on the New York side	feet	98
Height on the Canada side - - - - - - - - - - -	feet	37
Height to the railroad track - - - - - - - - - -	feet	60
Height of the track above the water - - - - - - - -	feet	260
Number of wire cables - - - - - - - - - - - - - - -		4
Diameter of cables - - - - - - - - - - - - - -	inches	10
Number of strands of No. 9 wire in cable - - - - - - - -		3,659
Total power of the cables - - - - - - - - - - -	tons	12,400
Weight of the entire bridge - - - - - - - - - - -	tons	750
Weight of the bridge and of the heaviest load that can be put upon it - - - - - - - - - - - - - - - - -	tons	1,250
Greatest weight which the cables and supports can bear -	tons	7,300

The Railways of Maine.—The *State of Maine* says, that upon the completion of the Somerset and Kennebec and the Penobscot and Kennebec roads, which may be looked for at an early day in January, the Railway system for Maine, including its Canadian connections, will embrace the following aggregate of Railway lines, continuing at or radiating from Portland.

	Length, miles.		Cost.
Portland, Saco and Portsmouth - - - -	51		$1,459,384
Portland and Montreal - - - - - - - -	292		11,419,000
Quebec Branch - - - - - - - - - - -	100		3,152,000
Androscoggin and Kennebec - - - - - - -	55		2,200,000
Kennebec and Portland - - - - - - -	72		2,605,365
Androscoggin Railroad - - - - - - -	20	about	350,000
Somerset and Kennebec - - - - - - - -	21	about	400,000
Penobscot and Kennebec - - - - - - - -	55		1,100,000
Buckfield Branch - - - - - - - - -	13		250,000
York and Cumberland - - - - - - - -	18		800,000
Bangor and Piscataquis - - - - - - -	12		138,000
Totals - - - - - - - - - -	709		24,064,749

Expansive Force of Steam.—Taking the "Lord of the Isles" locomotive, which attracted so much attention at the Exhibition of 1851, and the steam at 120 lbs. per square inch above the atmosphere, it gives an aggregate force of 17,438 tons, as calculated from the surface it acts against within the boiler.

Thus, the pressure on the cylindrical shell round the tubes —	1259·57	tons.
On the smoke-box tube plate - - - - - - - - - - - —	99·53	"
On the fire-box and plate - - - - - - - - - - - - —	376·51	"
On the two outer sides of fire-box - - - - - - - - —	502·07	"
On the outer top plate of fire-box - - - - - - - - —	392·46	"
On the tube plate of fire-box - - - - - - - - - - —	95·10	"
Total pressure on outer shell - - - - - - - - - - -	2716·27	tons.
Pressure on the 303 tubes, each 2 inches in diameter - —	13,569·87	"
Pressure on the inner copper fire-box - - - - - - - —	1152·41	"
Total pressure as divided over the boiler - - - - - - —	17,438·55	tons.

confined in about 205 cubic feet of space, of which about 42 cubic feet are filled with steam, and 163 cubic feet with water. This is the quiescent force under ordinary conditions, as it is confined in a space of about 205 cubic feet, but which on release seeks instantaneously to occupy a space of about 277,436 cubic feet, equal to atmospheric pressure, which gives some idea of the gunpowder-like expansion of steam and water in explosions. The steam expands with an elastic force equal to that of eight atmospheres, or say to 336 cubic feet, and the water to about 1700 times its own volume, or about 277,100 cubic feet, making a total volume of 277,436 cubic feet, into which they would expand at the moment of explosion. The steam produces only about 1-825th part of the expansive force, so that the explosive force of the water is by far the most formidable element in all boiler explosions.

Coal versus Sinews.—It has been proved, says Prof. Henry president of the Mechanic's Institute at Washington, that, on an average, four ounces of coal are sufficient to draw on a railroad, one ton a mile. It has also been found on experiment, that a man working on a treadmill continually for eight hours, will elevate 1,500,000 lbs. one foot high. Now, Cornish engines will perform the same work by the expenditure of 1¼lbs. of coal. It follows from these data that about 5 tons of coal would evolve as much power during its combustion as would be equal to the continued labour of an able bodied man for 20 years, at the rate of 8 hours per day; or, in other words to the average power of a man during the active period of life.

Large Water-wheel.—We see by the local press that a large water-wheel has been recently started at a mine in the Isle of Man. The wheel is 72 feet 6 inches in diameter, and 6 feet wide; the shaft is of wrought iron, forged at the Mersey Forge, Liverpool: it is about 21 inches diameter, and 17 feet long, weighing 10 tons. The arms are of wood, and the rim of cast iron. It is a breast-wheel, and the water is conveyed from a reservoir by a cast-iron stand-pipe of 2 feet diameter, around which is built a tower of masonry, which gives a peculiar and picturesque appearance to the wheel. A crank on the shaft has 10 feet stroke, and the motion is communicated by means of flat rods to the mouth of the pit, where, by means of a bob, a stroke of 8 feet is given to the pumps. We presume that a crank and rods are placed at each end of the shaft. We do not see any utility in employing a wrought-iron shaft for such a purpose. A hollow cast-iron shaft would have been much cheaper and lighter, and less liable to vibration.—*Artizan.*

Manufacture of Sugar in France.—The quantity of sugar made from beet-root to the end of the fourth month of the season, February, was 73,987,419 kilogrammes, being very nearly equal to the entire season of September, 1852, to September, 1853. No branch of commerce in France has been so successful as the fabrication of sugar from beet-root. The original discovery of the process was due to M. Thiery, a common clerk in the office of the Prefect of Lille, and who shortly after became director of the first beet-root sugar factory erected in France, at Passy, and who, as a reward for his valuable invention, received from the Minister of the Interior, in the year 1810, the sum of 300 francs.—*Brussels Herald.*

Solvent Action of Common Salt at High Temperatures.—Forchhammer, after a long series of experiments, has come to the conclusion that common salt at high temperatures, such as prevailed at earlier periods of the earth's history, acted as a general solvent, similarly to water at common temperatures. The amount of common salt in the earth would suffice to cover its whole surface with a crust ten feet in thickness.

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

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

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	29·376	29·401	29.448	29·428	47.0°	51·2°	38·6°	45·8°	+ 5·35°	0 263	0·224	0.206	0·227	·82	.61	·89	76	W b N	W b S	W	0·08	0·095	...
2	·657	·535	·402	·535	35.5	51·9	54·2	47·3	+ 7·07	·180	·239	.223	·217	87	63	54	69	W S W	S W b W	S W b W	13·20	·005	...
3	·671	·879	·930	·844	28.4	38·5	38·2	37·7	— 2·33	·144	·130	.200	·156	62	56	87	69	N N W	N W b W	S W	9·4	...	...
4	30·039	30·174	30.196	30·143	29·1	29 7	17·5	24 3	—15·43	·098	·098	.078	·089	66	58	77	66	N	N b W	N	8·97	...	Inap
5	30.149	30·049	—	—	18·0	34 0	—	—	—	·084	·152	—	—	82	78	—	—	N b E	S E b S	—	8·14	Inap.	...
6	29·444	29·170	29·095	29·230	42·4	48 0	43 5	44·5	+ 5 32	·182	·232	.247	·223	68	70	89	77	S b W	S W b S	W b S	10·08	·140	...
7	·125	·153	·385	·243	33·4	47·1	34·6	37·8	— 1·18	·138	·192	.172	·175	72	60	86	77	W b S	N W	N N W	6·55	·020	..
8	·481	·579	·722	·605	33·4	43·4	28·2	34·1	— 4·58	·151	·165	.121	·233	78	60	77	73	W b S	N W b W	Calm	6·96	...	...
9	·856	·858	.773	·825	32·7	34·7	35·9	34·1	— 4·32	·164	·156	.149	·155	89	78	70	80	W N W	E	N E b E	5·59	...	...
10	·656	·504	·366	·501	36·8	48 2	48·3	44·5	+ 6·12	·183	·244	.318	·255	84	73	95	86	N E b E	E	Calm	3·93	·150	...
11	.338	·510	·652	·518	48·5	47·1	35·2	42·8	+ 5·03	.302	·223	.171	·224	90	70	84	81	Calm	W b N	Calm	4·07	...	...
12	·725	·537	—	—	31·6	48·3	—	—	—	·160	·226	—	—	96	67	—	—	N	E N E	—	9·37	·315	...
13	·330	·416	·513	·435	42·0	39·5	32·5	37·0	— 0·18	·188	·175	·160	·179	77	73	87	83	S W b W	W S W	W S W	10·74	Inap.	...
14	·526	·467	·237	·396	34·5	34·3	37·3	35·3	— 1·57	·172	·160	·201	·178	86	80	91	86	W S W	W S W	S W b S	9·11	·040	0·2
15	.119	·121	·283	·186	35·5	41·7	40·6	38·8	+ 2 33	·191	·234	·205	·207	95	89	82	89	Calm	Calm	N N E	1·95	·045	...
16	·402	·389	·317	·370	35·9	36·5	30·8	34·4	— 1·82	·180	·156	·149	·160	86	73	86	81	N N W	N N W	Calm	7·87	·040	...
17	28·937	28·820	28 980	·917	38·2	39·8	38·4	37·9	+ 2·12	·191	·190	·182	·184	85	78	79	81	S W b S	W S W	W S W	6·40	·035	...
18	29.017	29 128	29 249	·151	30·2	40·2	31 6	34·1	— 1·43	.136	·192	·152	·161	81	78	86	82	Calm	W	Calm	3·53	Inap.	Inap.
19	·437	·519	—	—	31·6	35·8	—	—	—	·149	·124	—	—	85	59	—	—	N W	N N W	—	5·79	...	0·1
20	·522	·499	·595	·543	30·2	35 0	30 5	31·3	— 3.47	·158	·152	·161	·153	94	74	95	87	Calm	N W b N	Calm	1.99	...	0·2
21	·692	·661	·506	·616	23·7	34·0	35·5	30·7	— 3·63	·113	·157	·180	·149	86	79	87	85	Calm	E b S	E S E	4·33	...	0·8
22	·434	·515	·553	·504	31·6	35 7	35·8	34·1	+ 0·02	·162	·176	·188	·172	92	82	90	88	N N E	Calm	S W b W	0·60	...	...
23	·471	·335	·229	·331	38·4	48 5	42·0	42·7	+ 9·05	·208	·258	·231	·233	96	77	87	86	Calm	S E b S	E S E	1·35	·090	...
24	·004	28·735	28·708	28·800	46·7	50·0	47·8	48·1	+14·78	·294	·314	·284	·297	93	89	88	90	E	E b S	S E b S	5·70	·135	...
25	28·685	28·809	28.937	28·825	39 8	39 9	36·8	39·0	+ 6.02	·188	·191	·179	·188	78	78	82	80	S S W	S W b W	S W	10·21	·005	...
26	28 987	29·079	—	—	35·5	36·6	—	—	—	·180	·148	—	—	87	69	—	—	S W	S W b W	—	13·98	...	...
27	29·406	29·580	29.627	29·562	27·8	39·6	34·2	33·4	+ 1·18	·131	·176	·157	·154	85	73	78	80	N W b W	N N W	S W b W	10·70	...	...
28	·676	·640	·646	·657	30·2	35·6	33·0	32·4	+ 0·48	·150	·145	·155	·147	89	70	82	80	W S W	S W	S W	10·99	...	...
29	·557	·475	·525	·523	34·8	39·5	30·7	34·9	+ 3·48	·169	·174	·139	·162	84	73	80	78	S W	S W	W N W	12·60	...	Inap.
30	·675	·725	·788	·733	24·4	24·9	16·2	20·7	—10·32	·100	·087	·079	·085	74	66	82	73	N W	N W b N	W N W	13·16	...	Inap.
M	29·427	29.426	29·449	29·439	35·43	40 56	35 69	36 8	— 0.69	0·175	0·186	0·180	0·180	83	71	83	80	7·66	9·46	5 80	7·58	1·115	1·3

Highest Barometer...... 30 196, at 10 p m. on 4th } Monthly range:
Lowest Barometer....... 28 685, at 6 a.m. on 25th } 1·511 inches.
Highest registered temperature 55°·4, at p.m. on 2nd } Monthly range:
Lowest registered temperature 13° 8, at midnt. on 30th } 41° 6.
Mean Maximum Thermometer............. 42° 08 } Mean daily range:
Mean Minimum Thermometer...... ...... 28°·13 } 13°·91.
Greatest daily range.........29°·1, from a.m. of 5th to a.m. of 6th.
Warmest day....... 24th. Mean temperature ..... 48°·05 } Difference,
Coldest day......... 30th. Mean temperature...... 20°·77 } 27°·28.
Greatest intensity of Solar Radiation, 64°·0 on p.m. of 2nd } Range,
Lowest point of Terrestrial Radiation, 8°·6 on a.m. of 21st } 55°·4.
Aurora observed on 3 nights: viz. 8th, 11th, and 20th.
Possible to see Aurora on 13 nights.
Impossible to see Aurora on 17 nights.
Raining on 13 days. Raining 34·1 hours: depth, 1·115 inches.
Snowing on 4 days. Snowing 16·5 hours: depth 1·3 inches.
Sheet Lightning occurred on the 1st, 2nd and 17th.
No Thunder Storms recorded this month.

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

North.	West.	South.	East.
1610·75	3368·02	1681·60	685·26

Mean direction of the Wind, W 1° S.
Mean velocity of the Wind, 7·58 miles per hour.
Maximum velocity, 28·1 miles per hour, from 7 to 8 a. m. on 30th.
Most windy day, the 26th; mean velocity, 13·98 miles per hour.
Least windy day, the 22nd; mean velocity, 0·60 " "

The Barometric depression on the 24th and 25th was extreme, being 0·823 and 0·798 below the corresponding means for these days in November. This depression has only been exceeded on two instances during the last 15 years.

The mean velocity of the wind for this month has been 2 09 miles per hour above the average, being the most windy November recorded since 1847.

November 1854 was an extremely dry month, although a measurable quantity of rain fell on 13 days, yet the total quantity was only 1·115 inches on the surface, which is 1·799 inch less than the average.

Comparative Table for November.

Year.	Temperature. Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind. Mean Velocity	
1840	35·9°	—0·7°	54·4°	20·5°	33·9°	5	1·220	8	...	...	
1841	35·0	—1·6	63·2	7·6	55·6	8	2·450	5	...	0·91	lb.
1842	33·3	—3·3	50·6	7·6	43 0	9	5·310	10	...	1·22	lb.
1843	33·5	—3·1	51·2	14·4	36·8	10	4·765	7	1·2	0·59	lb.
1844	34·9	—1·7	49·8	12·0	37·8	8	Impf	4	8·0	0·48	lb.
1845	36·8	+0·2	58·8	7·6	51·2	7	1·105	4	5·0	0·53	lb.
1846	41.3	+4·7	55·5	18·2	37·3	12	5·805	2	0·4	0·64	lb.
1847	38·6	+2·0	58·2	7·8	50·4	14	3·155	3	Inap.	4·77	Miles.
1848	34·5	—2·1	49·3	16·5	32·8	9	2·020	3	1·4	4·81	Miles.
1849	42·6	+6·0	56·7	28·4	28 3	10	2·815	2	1·0	4·78	Miles.
1850	38·8	+2·2	62·3	18·1	44·2	7	2·955	1	Inap.	5·27	Miles.
1851	32·9	—3·7	50·1	16·5	33·6	5	3·885	6	6·7	4·70	Miles.
1852	36·0	—0·6	50·4	18·7	31·7	7	1·775	3	2·0	6·50	Miles.
1853	38·7	+2·1	54·1	14 4	39·7	15	2·425	6	2·7	5·52	Miles.
1854	36·8	+0 2	54·9	15·1	39 8	13	1·115	4	1 3	7·58	Miles.
										0·73	lbs.
M'n.	36·34		54·63	14·89	39·74	9·3	2·914	4·5	2·5	5·49	Miles.

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

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	29·522	29·519	29·632	54·2	56·1	46·6	·349	·237	·262	·81	·62	·80	W	W S W	W b N	16·56	8·76	6·38	...	...	Str. 8.	Cum. Str. 5.	Cum. Str. 9.
2	·810	·827	·705	36·7	50·0	44·6	210	220	223	91	59	73	W N W	W S W	S b W	5·76	9·30	9·06	0·260	...	Clear.	Clear.	Str. 10.
3	·844	30·034	30·230	37·8	38·1	26·6	182	158	146	76	64	88	W N W	W b N	N W	21·62	13·50	11·13	...	...	Cum. Str. 2.	Cum. 2.	Clear.
4	30·220	30·486	30·500	27·1	24·6	17·0	156	112	074	94	71	61	W N W	N W	N W b N	2·16	12·96	5·58	...	Inap.	Sl't Snow 5 am	Clear.	Do.
5	30·513	30·465	30·300	10·7	32·2	20·0	071	160	089	82	82	68	N W b W	S	S b E	1·30	0·50	Calm	...	...	Clear.	Do.	Do.
6	30·302	30·312	30·346	26·0	33·4	33·0	135	178	187	83	86	90	S S E	S	S	9·15	12·14	6·13	...	...	Do.	Str. 10.	Light. Cir.
7	29·432	29·384	29·482	36·7	41·0	34·0	200	242	195	89	88	91	S	S W b S	W N W	35·17	4·30	3·71	0·539	...	Rain at 6 a.m.	Rain.	Cir. Str. 8.
8	·554	·660	·866	30·6	31·4	26·0	160	171	141	86	89	88	W b N	W N W	W N W	12·67	12·17	17·62	...	...	Cum. Str. 8.	Cir. Str. 6.	Do. 9.
9	·871	30·110	30·189	14·4	24·0	25·0	091	127	141	87	85	90	W N W	W N W	W N W	18·43	13·86	5·78	...	...	Clear.	Clear.	Str. 2.
10	30·110	30·035	29·941	21·6	31·0	27·0	111	158	156	83	81	96	E N E	N E	N E b E	0·37	7·05	7·29	...	...	Str. 4.	Str. 10.	Str. 10.
11	29·779	29·750	·765	44·0	44·3	42·6	292	292	293	96	94	1·00	E S E	E S E	W	6·92	1·92	1·33	0·790	...	Rain.	Cir. Str. 9.	Cir. Str. 2.
12	·929	·919	·998	37·0	42·8	33·2	220	280	207	94	98	1·00	W b S	N E b E	N E b E	1·26	2·31	12·00	Inap.	...	Cum. Str. 9.	Str. 10.	Fog.
13	·605	·612	·710	41·0	50·0	39·2	269	349	196	98	93	76	N E b E	W b S	W b S	15·01	8·80	3·25	0·542	...	Rain.	Cir. Str. 8.	Cir. Str. 2.
14	·730	·698	·651	35·0	40·1	36·0	196	227	210	89	85	91	W S W	W S W	W S W	5·42	3·52	7·77	...	...	Clear.	Do. 2.	Do. 2.
15	·890	·571	·580	32·6	39·0	33·5	206	235	207	98	91	1·00	N	N E b E	N E b N	3·30	3·20	2·96	...	...	Sleet.	Cir. Str. 8.	Sleet & Rain.
16	·605	·600	·544	33·0	41·0	33·0	197	253	178	95	92	86	N E b N	N E b N	N	7·86	7·01	Calm	0·273	...	Cir. Str. 9.	Do. 4.	Cir. Str. 10.
17	·512	·270	·227	30·8	34·4	32·0	178	214	192	93	98	96	W S W	S S E	S b E	6·21	1·16	6·25	...	1·10	Str. 2.	Sleet & Snow	Snow.
18	·357	·472	·520	34·0	40·2	33·1	216	245	207	99	92	98	S S W	N W	N E b E	2·85	Calm	Calm	0·700	...	Rain.	Cir. Str. 4.	Clear.
19	·620	·684	·744	31·8	37·8	29·0	178	226	157	92	91	76	N E	W b N	W b N	Calm	1·85	9·20	...	...	Cir. Str. 10.	Do. 4.	Do.
20	·782	·785	·847	22·4	29·2	23·0	108	152	112	87	85	77	W b N	W b N	N W b W	12·50	10·37	5·17	...	...	Clear.	Clear.	Do.
21	·938	·990	30·002	18·1	28·5	21·3	106	153	112	87	86	80	N W	N W	N W	3·21	Calm	0·25	...	...	Do.	Do.	Do.
22	·862	·822	29·849	22·6	26·1	24·8	108	141	135	80	88	86	N E b E	N E b E	N E b N	9·17	6·25	9·12	...	...	Snow.	Snow.	Str. 10.
23	·932	·831	·733	26·3	31·8	27·9	147	184	153	90	89	89	W	S E	N E b E	1·03	0·38	1·58	...	...	Str. 10.	Str. 10.	Do. 10.
24	·672	·409	·320	28·0	38·0	36·7	163	209	218	94	85	91	N E	E N E	N E b E	0·62	2·62	2·00	0·866	...	Do. 10.	Cir. Str. 10.	Rain.
25	·001	28·989	·241	42·0	45·1	38·6	291	272	226	98	90	91	N E b E	S W	S W b S	3·09	6·31	6·42	0·628	...	Rain.	Thun. at 12·35	Str. 4.
26	·240	29·291	·440	37·9	38·7	35·9	236	244	192	99	98	84	S W b W	W b S	S W b W	0·62	2·93	11·25	0·532	...	Do.	Cir. Str. 4.	Str. 4.
27	·588	720	·838	30·6	29·2	24·0	178	161	127	92	89	85	W b S	W b N	W S W	15·00	5·16	5·26	...	Inap.	Snow.	Do. 4.	Clear.
28	·996	·930	·982	33·0	39·0	35·0	197	234	198	95	91	84	S W b W	W S W	S b W	2·00	2·02	3·62	...	...	Clear.	Do. 2.	C. Str. 4.
29	·900	·870	·770	30·9	37·0	30·1	171	184	168	90	77	90	N b W	W b N	W b N	1·00	0·18	Calm	...	...	Do.	Do. 4.	Light Cirs. 2.
30	·591	·672	·814	30·0	25·0	17·0	168	112	106	90	71	89	W b N	W S W	W	2·51	12·20	18·51	...	...	Str. 8.	Do. 9.	Cir. Str. 8.

Barometer ....
- Highest, the 5th day .... 30·513
- Lowest, the 25th day .... 28·989
- Monthly Mean .... 29·761
- " Range .... 1·524

Thermometer.
- Highest, the 1st day .... 60°·6
- Lowest, the 5th day .... 10°·0
- Monthly Mean .... 32°·99
- " Range .... 50°·6
- Mean Humidity .... ·878

Greatest Intensity of the Sun's Rays .... 117°·8

Rain fell on 10 days, amounting to 5·130 inches. Raining 29 hours, 40 minutes.
Snow fell on 3 days, amounting to 1·10 inches. Snowing 7 hours 45 minutes.
Most prevalent Wind, W.N.W. Least prevalent Wind, N.
Most Windy Day, the 3rd day; mean miles per hour, 15·41.
Least Windy Day, the 18th day; mean miles per hour, 0.95
Aurora Borealis invisible this month. Might have been seen on 9 nights.
Electrical State of the Atmosphere has been marked by rather high tension of a negative character.
Ozone was present in the atmosphere in large quantities during the month.

Monthly Meteorological Register, Quebec, Canada East, November, 1854.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. 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. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·163	29·251	29.369	29·263	56·5	55·7	43·0	51·7	0·387	0·339	0·218	0·315	86	77	79	81	S W	S W	S W	13·9	10·1	7·2	0·04	...	
2	·502	·602	·534	·546	36·2	44·2	42·6	41·0	·165	·170	·168	·168	78	60	62	67	S W	S W	S W	5·2	12·9	7·2	·05	...	2d. At 8, p.m., Lunar Halo.
3	·408	·734	·983	·708	44·8	36·7	26·4	36·0	·253	·097	·108	·153	86	45	74	68	S W	W N W	W N W	11·3	11·3	11·3	...	...	3d. Observed snow on the Mountains.
4	30·037	30·088	30·228	30·118	25·0	22·1	13·6	20·2	·092	·116	·074	·094	66	94	85	82	Calm.	N	N	0·0	5·2	6·2	...	2·2	
5	30·249	30·243	30·177	30·223	10·4	21·1	15·6	15·7	·069	·091	·080	·080	94	78	86	86	W b S	W	Calm.	7·2	5·2	0·0	...	...	
6	30·000	29·713	29·566	29·760	16·3	32·0	32·7	27·0	·076	·109	·142	·109	78	60	75	71	S b E	S b E	S b E	2·0	3·8	3·8	...	·9	
7	29·348	·263	·261	·291	38·1	36·3	36·0	35·1	·181	·213	·206	·199	96	100	98	98	N E	N E	N E	10·2	6·2	6 2	·93	0·3	
8	.227	·277	·458	·321	32·9	34·7	26·3	31·3	·174	·176	·133	·161	94	89	92	92	N E	W	W	7·2	11·3	12·4	·09	...	8th. Snow, which melted as it fell.
9	·650	·792	·930	·791	12·1	22·5	18·0	17·5	·065	·092	·070	·076	80	74	70	75	W N W	W	W	22·7	11·3	10·0	...	...	
10	·982	·951	·851	·928	16·4	27·6	27·8	23·9	·085	·091	·125	·100	88	59	81	76	W	S W	E N E	8·0	3·8	8·0	...	...	
11	·813	·646	·638	·699	32·0	36·8	37·7	35·3	·152	·213	·208	·191	84	100	93	92	E N E	E N E	E N E	8·8	12·9	6·2	1·34	...	
12	·820	·843	·840	·834	36·7	36·9	33·0	35·5	·204	·206	·188	·199	95	95	100	97	Calm.	Calm.	W S W	0·0	0·0	2·0	·04	...	
13	·659	·433	·527	·540	37·9	36·7	38·0	37·5	·210	·210	·213	·211	93	97	94	95	N E	N E	Calm.	21·3	11·5	0·0	·46	...	
14	·494	·444	·430	·456	38·0	40·0	36·4	38·1	·197	·166	·156	·173	87	68	73	76	Calm.	S W	S W	0·0	7·2	5·2	...	...	
15	·449	·406	·406	·420	34·6	38·1	35·2	36·0	·175	·151	·163	·163	89	66	80	78	S	N	N E	3·8	8·0	10·0	...	·5	
16	·403	·328	·288	·340	33·0	36·4	33·6	34·3	·175	·162	·168	·168	94	76	88	86	Calm.	N N E	Calm.	0·0	7·2	0·0	...	1·2	
17	·196	·154	·129	·160	31·1	34·5	31·1	32·2	·140	·156	·174	·157	80	78	100	86	W N W	Calm.	Calm.	3·8	0·0	0·0	...	2·8	
18	·218	·306	·395	·303	34·7	37·0	35·6	35·8	·175	·190	·200	·188	88	87	96	90	Calm.	N E	Calm.	0·0	2·0	0·0	·18	...	
19	·416	·439	·371	·409	33·8	36·1	34·5	34·8	·182	·193	·145	·173	95	91	73	86	Calm.	Calm.	W	0·0	0·0	5·2	...	...	19th. Auroral Light visible at 10 p.m.
20	·382	·454	·552	·463	29·5	29·1	25·7	28·1	·130	·117	·099	·115	79	72	70	74	W	W	W	2·0	5·2	8·0	...	...	
21	·676	·765	·864	·768	18·2	21·4	17·8	19·1	·080	·079	·082	·080	78	67	80	75	W	W	W	6·2	6·2	6·2	...	...	
22	·863	·761	·710	·778	19·9	22·7	26·3	23·0	·096	·121	·132	·116	85	97	91	81	W	N E	N E	8·0	13·9	17 9	...	1·5	
23	·703	·607	·567	·626	25·9	29·5	28·9	28·1	·129	·133	·138	·133	89	81	87	86	N N E	S E	Calm.	11·3	8·0	0·0	...	...	
24	·477	·374	·300	·384	30·5	34·3	34·5	33·1	·153	·165	·193	·170	90	83	97	90	Calm.	E	E	0·0	5·2	19·0	·70	...	
25	·163	28·958	·106	·076	38·6	45·3	43·0	42·3	·224	·268	·239	·244	96	90	88	91	E N E	E N E	E N E	22·7	21·3	6·2	·20	...	
26	·113	29·037	·192	·114	38·5	38·4	33·1	36·7	·216	·210	·180	·202	93	92	100	95	Calm.	Calm.	W N W	0·0	0·0	13 9	·22	1·0	26th. This amount of snow is estimated as it melted as it fell.
27	·296	·449	·630	·458	34.0	31·9	28·0	31·3	·163	·146	·131	·147	83	81	86	83	W N W	W N W	W N W	17·9	8·0	6·2	...	1·5	
28	·704	·698	·798	·733	25·6	31·0	34·0	30·2	·126	·160	·164	·150	89	93	83	88	W N W	Calm.	Calm.	3·8	0·5	0·0	...	1·8	
29	·778	·677	·524	·660	33·2	36·8	32·4	34·1	·162	·151	·177	·163	86	70	96	84	W S W	N	Calm.	6·2	5·2	0·0	...	2·5	
30	·288	·235	·413	·312	32·6	34·1	22·5	29·7	176	·160	·101	·146	95	80	82	86	Calm.	W	W	0·0	10·9	9·3	...	0·6	
	29·5492	29·5309	29·5679	29·5494	30·73	33·98	30·78	31·83	0·160	0·162	0·152	0·158	85	80	87	84				6·78	7·13	6·25	4·25	16.53	

Maximum Barometer, 6 a.m. on the 5th	30·249
Minimum Barometer. 2 p.m. on the 25th.,	28·958
Monthly Range	1·291
Monthly Mean	29·5494
Maximum Thermometer on the 1st	59°.8
Minimum Thermometer on the 5th.	10°·0
Monthly Range	49·8
Mean Maximum Thermometer	35·95
Mean Minimum Thermometer	25·95
Mean Daily Range	10·00
Mean Monthly Temperature	31·83

Greatest Daily Range of Thermometer on 3rd	24°·6
Least Daily Range of Thermomter on 29th	3°·9
Warmest Day, 1th. Mean Temperature	51·7
Coldest Day, 5th. Mean Temperature	15·7
Climatic Difference	36·0

Possible to see Aurora on 6 Nights.
Aurora visible on 4 Nights.
Total quantity of Rain, 4·25 inches.
Total quantity of Snow, 16·53 inches.
Rain fell on 10 days.
Snow fell on 12 days.