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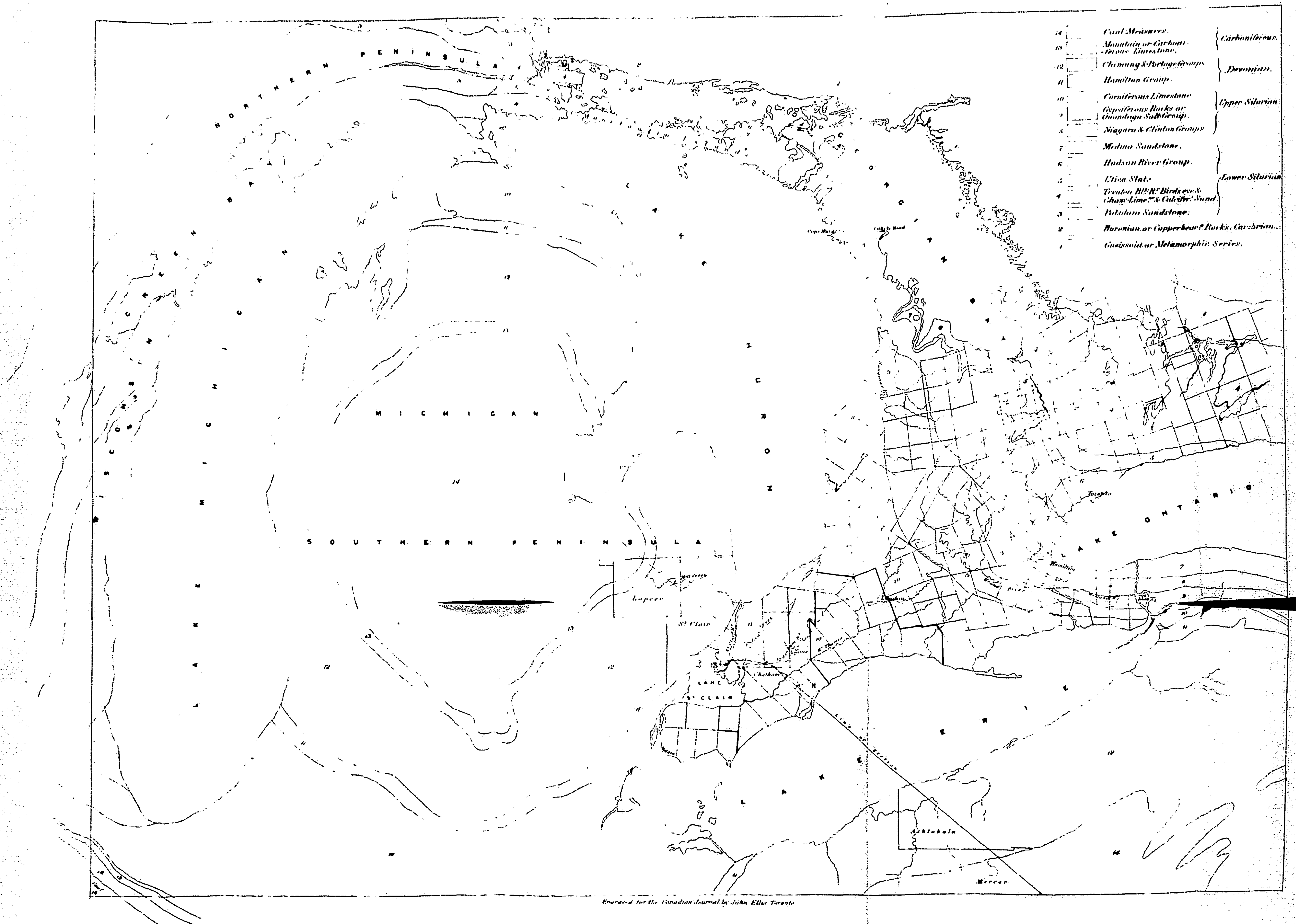

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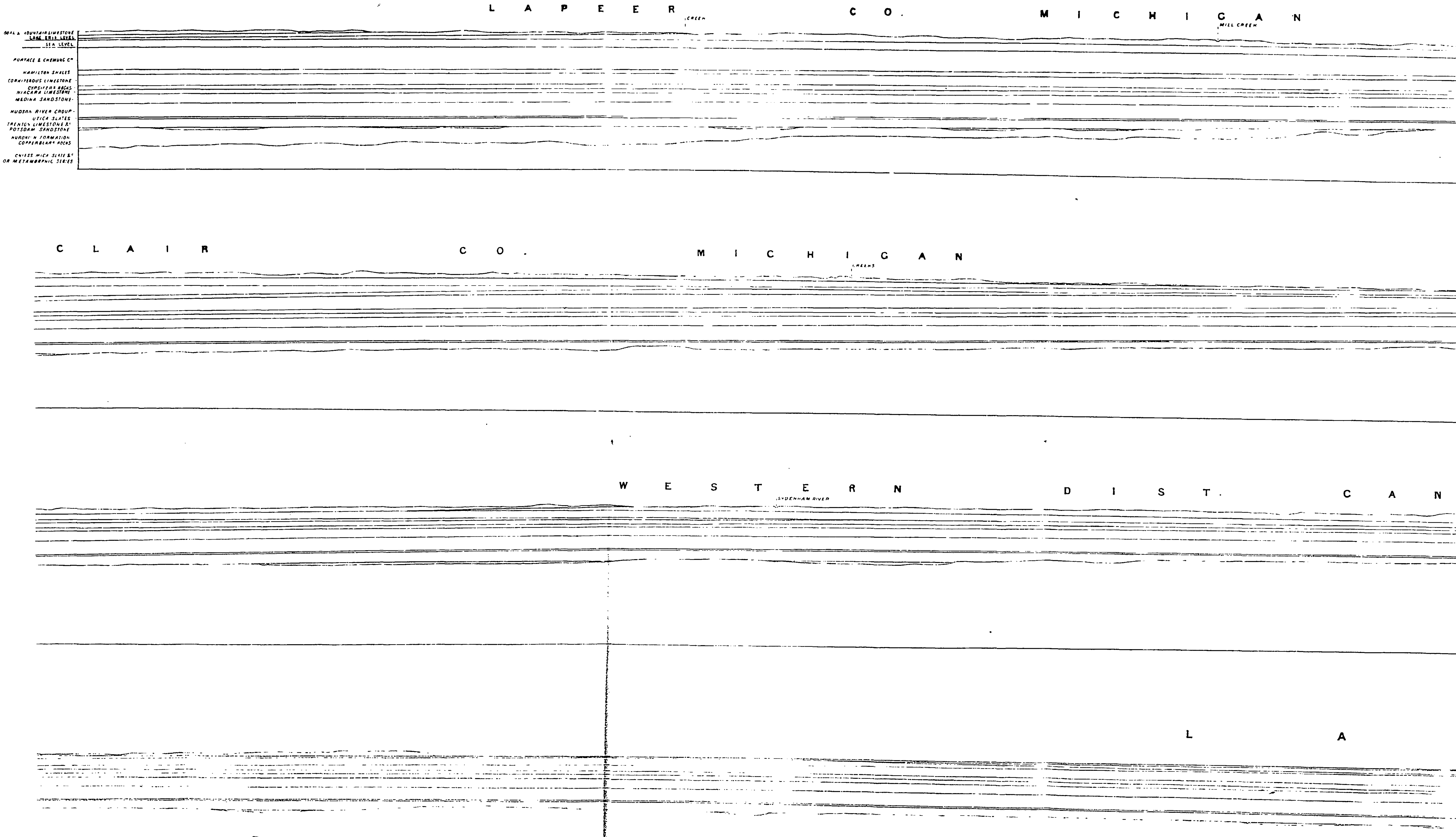

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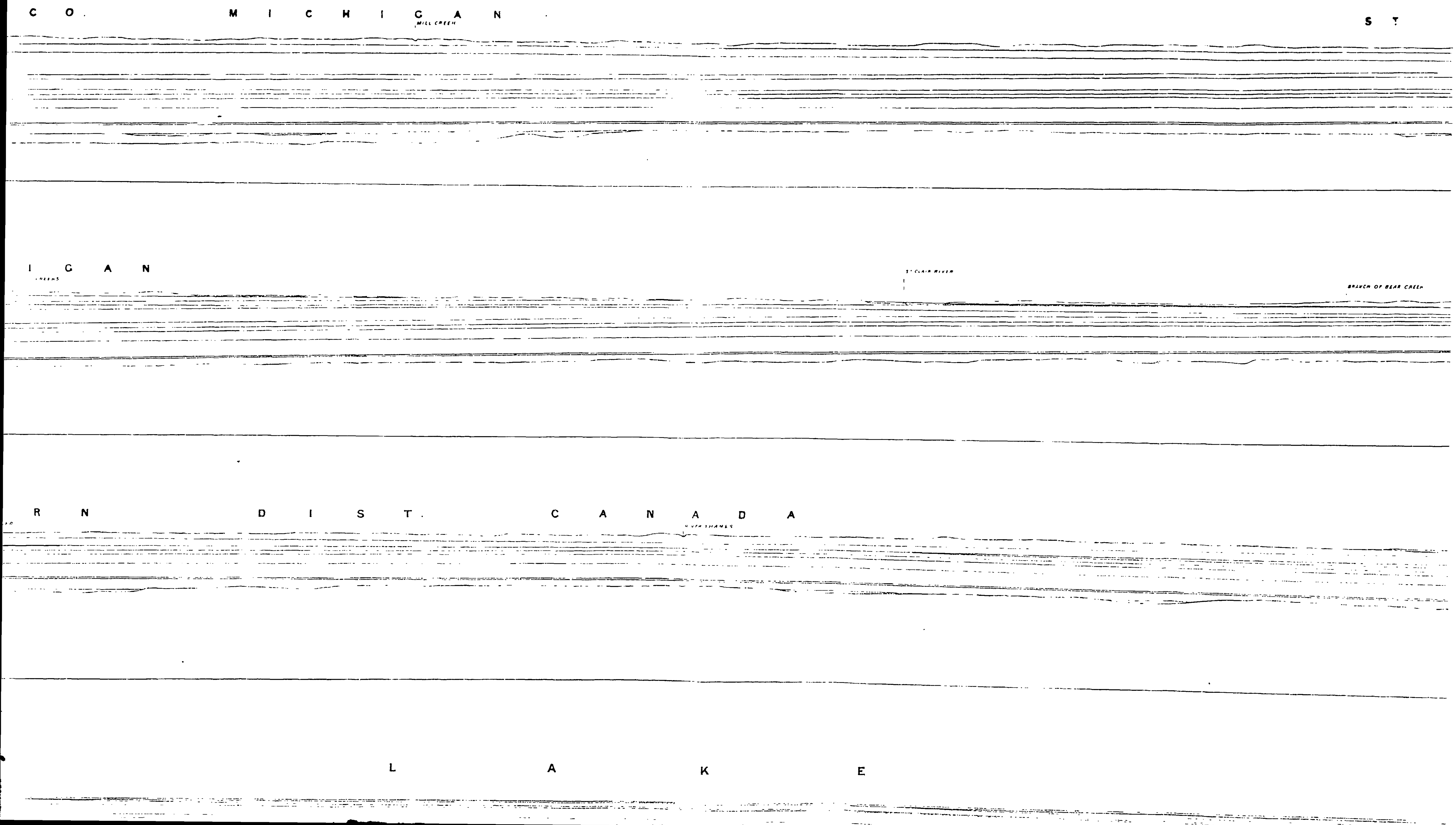

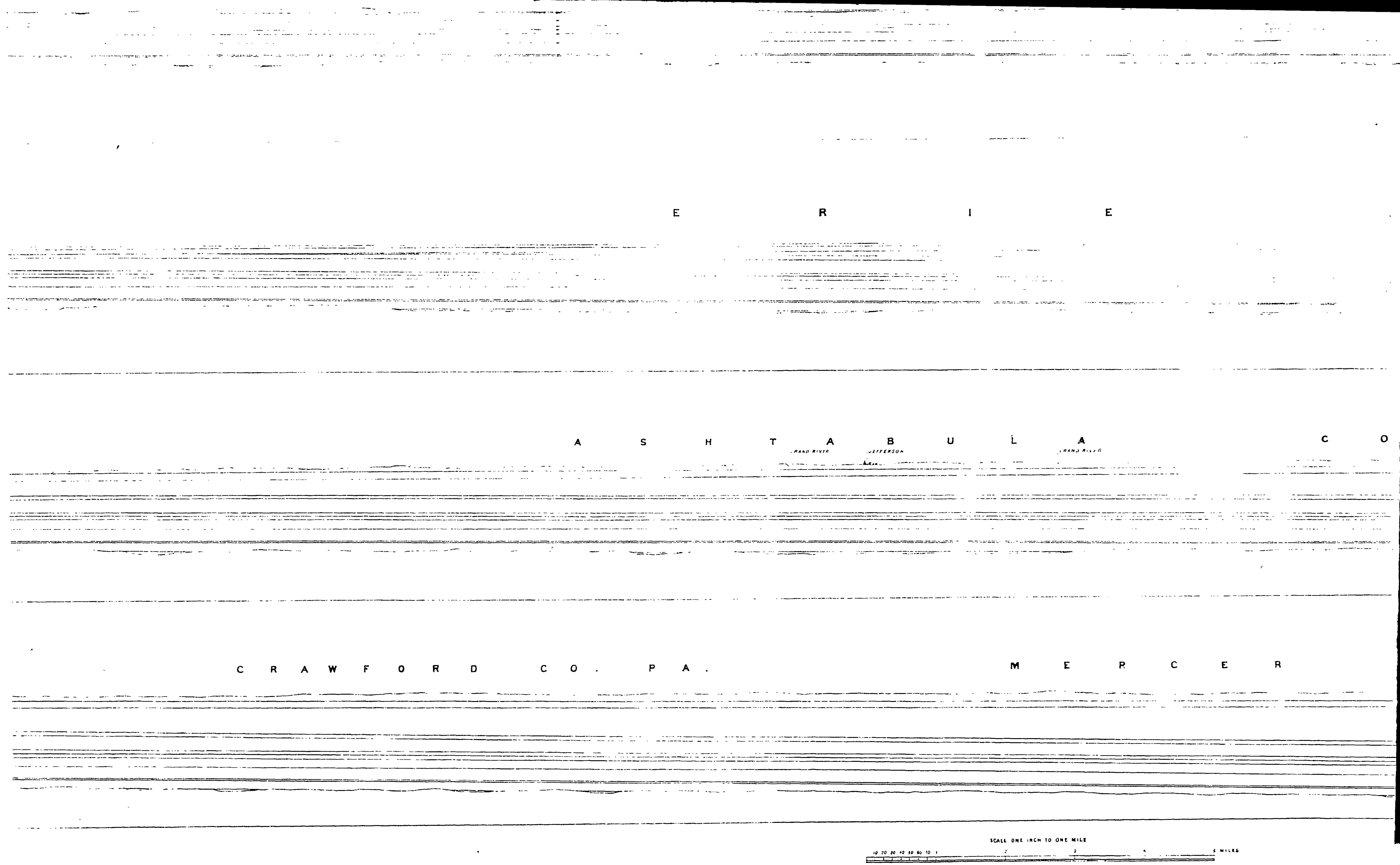

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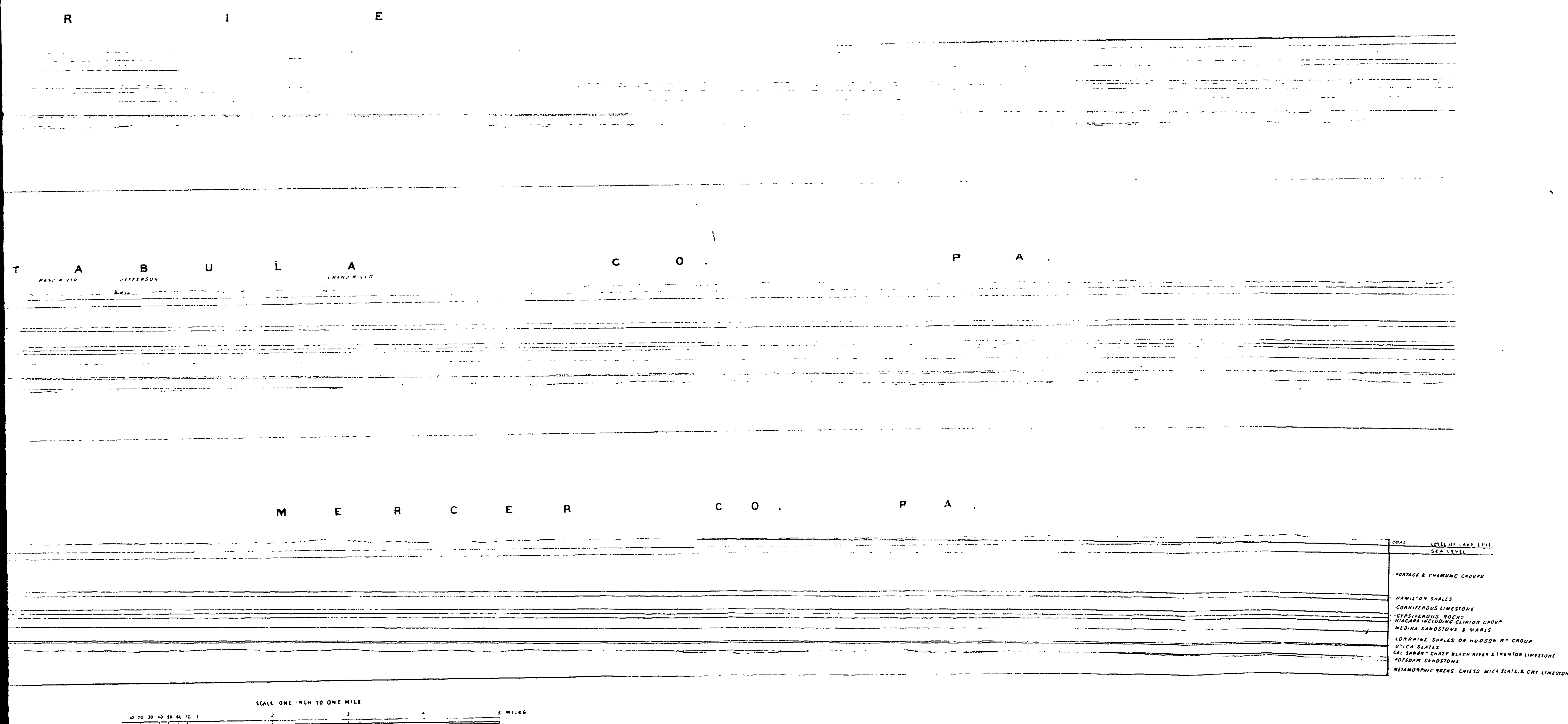

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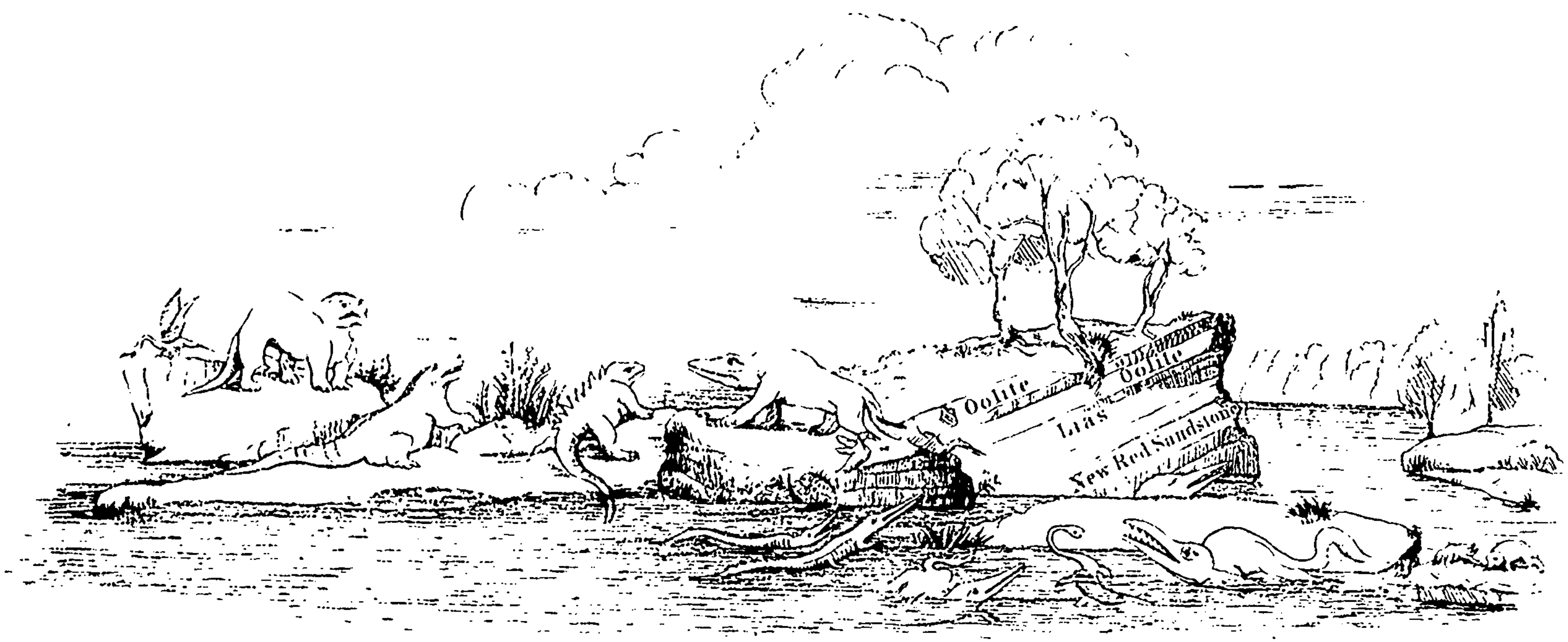
DIAGRAM OF THE GEOLOGICAL RESTORATIONS AT THE CHRYSTAL PALACE.



Chalk	*Wealden*		*Oolite (Stonesfield Slate)*	*Lias*		*Lias*	*New Red Sandstone*
Pterodactyle	Iguanodons	Hylæosaurus	Megalosaurus	Taleosaurus	Plesiosaurus	Icthyosaurus	Labyrinthodon

THE

CANADIAN JOURNAL:

A REPERTORY OF

INDUSTRY, SCIENCE, AND ART;

AND A RECORD OF THE

PROCEEDINGS OF THE CANADIAN INSTITUTE.

EDITED BY

HENRY YOULE HIND, M.A.,

PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF TRINITY COLLEGE;

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INDEX.

The Canadian Journal.

TORONTO, AUGUST, 1854.

On the Physical Structure of the Western District of Upper Canada.

By W. E. LOGAN, *F.R.S., F.G.S., and Director of the Geological Survey of Canada.*

The Western District of Upper Canada has, at a short distance on the north-west side of it, the coal-field of Michigan, and at a somewhat greater on the south-east, what has been called the coal-field of Appalachia. The former, as has been ascertained by the investigations of the geologists of the United States, occupies the chief part of the interior of the southern peninsula of Michigan, and has a superficies of about 12,000 square miles, while the latter, extending in length from the north-eastern corner of Pennsylvania to Tennessee, and in breadth from the vicinity of Lake Erie to the sources of the Potomac, presents the greatest known carboniferous area on the face of the globe, its surface being equal to about 60,000 square miles. The rocks of the Michigan coal-field, where they approach nearest to Lake St. Clair, and those of the Appalachian, where they do the same in regard to Lake Erie, exhibit an attitude so near to horizontality, that, without accurate admeasurements, it would not be easy to detect their dip. Those between the coal-fields and the two Lakes equally do so, and those again between the Lakes themselves are, as a whole, flatter still. The Western District, thus flanked on both sides by coal measures, and showing no easily observed reason in the dip why they should not be carried across it, might induce those who had made no careful examination of the matter to entertain a hope that some outlying patch of such measures might yet be found in that part of Canada. The ascertained structure of the District, however, shows that such a hope would be ill founded; and I propose to place before the Institute an explanation of what that structure is, illustrated by a map and section, that part of the map representing a portion of the United States being copied from the works of American geologists.

The rocks comprehended in the section in descending order are—

1. Gneissoid, or Metamorphic series.
2. Huronian, or Copper-bearing rocks, perhaps equivalent to the Cambrian of England.
3. Potsdam Sandstone.
4. Calciferous Sand-rock, Chazy, Birdseye, Black River, and Trenton Limestones. } Lower Silurian.
5. Utica Slates. } Lower Silurian.
6. Hudson River group. } Lower Silurian.
7. Medina Sandstone. } Lower Silurian.
8. Clinton and Niagara groups. } Upper Silurian.
9. Gypsiferous Rocks, or Onondaga Salt group. } Upper Silurian.
10. Corniferous Limestone.* } Upper Silurian.
11. Hamilton group. } Devonian.
12. Chemung and Portage groups. } Devonian.
13. Mountain or Carboniferous Limestone. } Carboniferous.
14. Coal measures. } Carboniferous.

It is not my intention to give any detailed description of these rocks, but for their mineral and fossil contents, as well as their respective thicknesses, refer to the various official reports presented to the government on the progress of the geological survey of the Province, and those of the geologists of the United States; nor shall I allude to their geographical distribution in detail farther than as occasion may require, the map being sufficient to explain it.

Taking these rocks in their general groupings, it will be perceived by the map that the Lower Silurian series, by a change in the strike from west to north-west, sweeps round from Lake Ontario to Georgian Bay, and proceeds thence by the north side of the Manitoulin Islands, and the north shore of Lake Huron, to the northern peninsula of Michigan, gradually curving to Green Bay, in Lake Michigan. The Upper Silurian follows them. The Niagara Limestone at the base aids in forming the neck of land separating and holding up Lake Erie from Lake Ontario, and continues in a ridge along the Blue Mountains, and the promontory terminating at Cabot's Head and Cape Hurd, of which promontory the chain of the Manitoulin Islands is only an interrupted prolongation. The Gypsiferous rocks succeed conformably, running from Grand Island, by the Welland and Grand Rivers, to the River Sauguine, while the superimposed Corniferous Limestone, from Lake Erie on the one side and Lake Huron on the other, is projected forward into the Western District as far as the Township of Zone. The same formation, with a projected form in an opposite direction, comes up from Ohio by the upper end of Lake Erie, and is carried north-easterly as far as the eastward side of Chatham. Between Zone and Chatham, the Hamilton group, composed of black bituminous shales, constitutes a narrow band, which runs north-westward towards Lakes Huron and St. Clair, and south-eastward to Lake Erie, gradually widening in both directions in the surface it occupies, and finally merging into two rings, or irregular circular belts, one of which is rudely concentric with the coal measures of Michigan, and the other with those of the Appalachian field—of which last, however, the map shows but a small portion. Within these two rings, thus united by the band across the Western District, and between them and the carboniferous centres, the Chemung and Portage groups occupy their place, in two broad and entirely separate zones, one of them showing itself north-west of Lake St. Clair, and the other south- east of Lake Erie.

To any one accustomed to consider the forms derived from the intersection of surfaces, who will carry in his mind that the various formations which have been given are nothing more than a set of thick, close-fitting, conformable sheets, which are intersected by the general surface of the country, it will be at once apparent that the ascertained geographical distribution of the formations results from the fact that between the Michigan and Appalachian coal-fields there is a flat anticlinal arch, the axis of which runs, with a gentle curve, from the upper extremity of Lake Ontario by London, Zone, and Malden, to the Maumé River, at the upper end of Lake Erie, and that between Chatham and Zone there is in it a slight transverse depression. This anticlinal arch is represented in the section, the line of which runs in a north-west and south-east direction from the one coal-field to the other, a little south-west of the Hamilton shales in Chatham. The section is given on a scale of one

* What is called the Corniferous limestone, under No. 10, is intended to represent whatever there may be in Canada of those deposits which, in the New York series of rocks, compose the Helderberg series, with the exclusion of the Onondaga Salt group; and, it may be here remarked, that the line of division between the Upper Silurian and Devonian rocks is given as merely approximative. The true position of this line seems as yet not quite certain, but it is supposed to be some where about the middle of that portion of the Helderberg series, which lies above the Onondaga Salt group.

mile to an inch, both horizontally and vertically; for it is only by using the same scale for both measurements that a true idea can be at once conceived of the very small slope in a set of strata that is required to produce important effects in geographical distribution.

It will be seen by the section that between the highest formation in the Western District (the Hamilton group) and the Carboniferous series, the rocks that are wanting (the Chemung and Portage groups) have a thickness of about 2500 feet, and without a very extensive area of these, there can be no reasonable expectation of coal.

The position of the great Lakes of the St. Lawrence, and the distribution of the rocks in connection with them, is one of the grandest and most beautiful instances to be met with of the dependence of the geographical features of a country upon geological structure. Lake Ontario, Georgian Bay, with its continuance behind the Manitoulin Islands, and Green Bay, in Wisconsin, are excavations in the same formation of the Lower Silurian series. Lake Erie, Lake St. Clair, Lake Huron, and Lake Michigan are excavations in equivalent constituents of the Upper Silurian, while there runs a ridge separating these two sets of excavations from one another, which derives its main characteristic from the Niagara Limestone. The Chemung and Portage groups, which are composed chiefly of sandstones, have been strong enough to resist the denuding forces which have produced the excavations, and we find them forming equivalent limits to the Upper Silurian or perhaps more correctly, Devonian Lakes. It is thus the distribution of these various rocks, which is again dependent in a great measure upon the anticlinal arch running between the two great coal-fields, that gives to a very large part of Upper Canada its present geographical form.

Let us suppose that there was the smallest possible patch of the Carboniferous series in the Western District. What would be the result? It would be surrounded, of course, by the Chemung and Portage groups. These would give around the carboniferous centre a broad ring of sandstone, which would reach as far as Malden to the south-westward, and London to the north-eastward, and the Western and London Districts, instead of being underlaid chiefly by calcareous, would be so by silicious rocks. The structure in connection with the coal-patch being sinclinal instead of anticlinal, the projected forms of the Corniferous limestone would be turned in the opposite directions to those they now have, and in Canada all the formations below would in succession be carried farther to the eastward. With the distribution of the rocks, the forms of the Lakes, dependent on this distribution, would be altered. The sandstones surrounding the coal-patch would extend, with the exception of the coal-patch, across from the Michigan to the Appalachian coal-field; and if like causes are to be supposed productive of like effects, one-half of Lake Erie and a part of Lake Huron would be obliterated, and the remaining portion modified in form. In short, the supposition of an acre of the true Carboniferous rocks existing in the Western District, requires as a consequence the supposition of a very extensive change in Upper Canadian geography.

If it be supposed that the coal-patch might be present through the influence of a dislocation, one of the conditions of such a dislocation must necessarily be that it must produce a downthrow on one side or the other of at least 2500 feet; and it would still be required that on the downthrow side the wide zone of sandstone, and all the circumstances consequent on it, should follow the coal until interrupted by the fault. But if disturbances had occurred in this part of America of sufficient force to produce a dislocation of this order, it is probable that it would not be a solitary one. The strata of the District would have been tilted up to various high angles, and instead of its flat surface, dependent on the flatness of its rocks, the country would have presented a mountainous one.

Unless, therefore, workable coal seams are to be found in older rocks than those of the true carboniferous age, which no ascertained facts either in the United States or in Canada, or any other part of America, authorize us to expect, it appears to be a necessary consequence of the structure of the Western District that none will be met with there. But though there are no true coal measures in the District, there are rocks which may readily be mistaken for such by observers, who unaware, when actual workable coal seams are not before the eye, how extensive an examination it may be expedient to make, and how many circumstances connected with geological structure it may be necessary to bring into harmony, before it is definitely pronounced whether a particular set of strata are likely to be associated with coal seams, are disposed to come to a hasty conclusion, founded upon mere mineral resemblances. These rocks are the black bituminous shales of the Hamilton group. They are no doubt nearly identical in mineral character with similar shales frequently found interstratified with true coal measures. Like them, they in several places hold so much bituminous matter as to give a partially inflammable character to the rock, and to yield petroleum or mineral oil. Not only do they resemble them in mineral character, but also in some degree in respect to a portion of their fossil contents. Coal measures are strongly marked by their fossil plants, and in the Hamilton shales are found *Calamites*, a genus abundant in the Carboniferous rocks, though the species may perhaps be different. These *Calamites* in the Hamilton shales, having lost their interior by decay, are found compressed into flat stripes and converted into crystalline coal, as they generally are under similar conditions in true coal measures. The circumstances of the case, therefore, might occasionally deceive even practical observers, had they not other guides in the Crustacea and Mollusca of the formation, and a traced out and ascertained place for it in the order of superposition, in which by prior extended examinations its constituent strata had become known. It has been well ascertained by the geologists of the United States, that the place of these shales in Northern New York and Pennsylvania is about 2500 feet beneath the Carboniferous rocks; and before the institution of the State geological surveys, the formation had been very extensively and very expensively examined by boring, excavation, and surface explorations in search of coal seams, but of course without success; and it is with a view to aid in preventing a repetition of such useless expenditure in Canada that the present paper and its illustrations are submitted to the Canadian Institute.

On a method for preserving the sensitiveness of Collodion Plates for a considerable time.

By John Spiller and William Crookes.*

The extreme sensitiveness of Collodion as compared with paper and other photographic surfaces, renders this material invaluable in all cases where rapidity of action is desirable, but

*From the *Philosophical Magazine*.

up to the present time its use has been greatly restricted by the necessity for preparing the plate and completing the whole of the manipulatory details within a comparatively short space of time, thus rendering this beautiful process practically inapplicable in all cases where the conveniences of a photographic laboratory are not at hand.

For some time past we have been investigating the causes which operate to prevent the excited plate retaining its efficiency for more than a few hours. It seemed highly probable that the permanent sensitiveness of the film was principally dependent on the retention of a moist surface; and if by any artificial means this end could be secured, the original sensitiveness of the film would be, for at least a reasonable time, preserved unimpaired.

The only attempts up to the present time to effect this object are, we believe, that of M. Girod*, who proposes to enclose the sensitive collodion film between two plates of glass, with only so much of the exciting silver solution as might be retained by capillary attraction; and thus by retarding the evaporation of the water, to keep the surface moist, and consequently sensitive for a longer period; and secondly that of M. Gaudin†, who suggests the use of perfectly air-tight dark frames or boxes, in which a number of the wet plates could be arranged in a horizontal position, and there kept until required. Besides these two methods, it is well known that the plate will remain excited for a considerable time if kept immersed in a solution of nitrate of silver; in fact, a glass bath in the camera has been often used in cases where the length of exposure was likely to be too prolonged to admit of the plate being placed in the ordinary slide.

Instead, however of having recourse to a mechanical means for preventing the evaporation from the surface, we have endeavoured to avail ourselves of a chemical process, by the employment in the bath of substances having a powerful affinity for water; in the choice of these, however, we are necessarily limited to such as are neutral in constitution, and do not form insoluble compounds with silver. The nitrates and acetates, especially the former, seemed most convenient for our purpose on account of their general deliquescent nature, and for our first experiments we selected the nitrates of lime, magnesia, and zinc, as most promising of success. These agents were at first tried in the above-mentioned order; but from a few preliminary trials we were inclined to give the preference to the zinc salt, and having obtained such satisfactory results with its use, are induced to communicate them at once rather than withhold them until our investigation of the other compounds shall have been completed. At first we endeavoured to add the nitrate of zinc direct to the exciting bath, but the quantity required to prevent so large an amount of nitrate of silver from crystalizing out on the plate rendered the solution too dense to work with.

The following process can be recommended as having proved perfectly successful in our hands; we do not doubt that with more general use it may be considerably modified and improved, but at present we have rather contented ourselves with establishing the broad principle with such details only as will suffice to ensure good results, and to leave to a future period the consideration of those minor points which only a long experience can develope.

The plate coated with collodion (that which we employ contains iodide, bromide, and chloride of ammonium, in about equal proportions,) is made sensitive by immersion in the ordinary solution of nitrate of silver (30 grains to the ounce), and after remaining there for the usual time is transferred to a second solution of the following composition:—

Nitrate of zinc (fused) . . .	2 ounces.
Nitrate of silver.	35 grains.
Water	6 ounces.

The plate must be left in this bath until the zinc solution has thoroughly penetrated the film (we have found five minutes amply sufficient for this purpose, although a much longer time is of no consequence); it should then be taken out, allowed to drain upright on blotting-paper until all the surface moisture has been absorbed (about half an hour), and then put by until required. The nitrate of zinc, which is still retained on the plate is sufficient to keep it moist for any length of time, and we see no theoretical or practical reason why its sensitiveness should not be retained as long; experiments on this point are in progress; at present, however, we have only subjected them to the trial of about a week; although at the end of that period they were hardly deteriorated in any appreciable degree. It is not necessary that the exposure in the camera should be immediately followed by the development, as this latter process can be deferred to any convenient opportunity provided it be within the week. Previous to development, the plate should be allowed to remain for a few seconds in the original 30 grain silver-bath, then removed and developed with either pyrogallic acid or a protosalt of iron, and afterwards fixed, &c. in the usual manner.

The advantages of this process can scarcely be overrated.—Besides the facility it affords of working in the open air without any cumbrous apparatus, photography may now be applied in cases where it would have been hitherto impracticable, owing to the feebleness of the light *e. g.* badly illuminated interiors, natural caverns, &c.; if necessary, the exposure could be protracted for a week, or possibly much longer, and the deficiency of daylight compensated for by the employment of the electric or other artificial light. It will also be found useful where the plate must be kept ready excited, but the exact moment of exposure may depend upon possible contingencies rather than on the will of the operator, or in cases where it would be impracticable to prepare the plate just before exposure; for these reasons it might prove a valuable adjunct on the eve of a naval or military engagement, for accurately recording the positions of the forces.

A small proportion of nitrate of zinc added to the ordinary nitrate of silver bath in no way interferes with its action, and might obviate the inconvenience sometimes felt during hot weather in photographic rooms, of the film becoming partially dry before exposure. If added in a still sm[illegible] proportion to the silver solution used for exciting the ordinary Talbotype paper (without the employment of gallic acid), it is very probable that its sensitiveness may be preserved during a much longer period than is generally possible. As far as our experiments have gone, they tend to confirm this supposition; but at present we can hardly speak more confidently on this point, as it is still under investigation.

There are, no doubt, many other substances which might equally well answer the purpose of nitrate of zinc; besides those already mentioned, the nitrates of cadmium, manganese, and perhaps also those of copper, nickel, and cobalt might be found serviceable. Glycerine at first seemed to promise very good results, but the principal difficulty was the necessary impurity of the commercial product, in consequence of its being obtained from the exhausted leys of the soap boilers.

*Journal Phil. Soc. No. 9. †Ibid. No. 10.

Observations on a Telegraph Line between Europe and America.

By L. Turnbull, M.D.*

The magnificent idea of connecting Great Britain and the United States by telegraph, which has long been a favourite one with me, has been again revived in this country, and received much strength and encouragement from the investigations of the depths and condition of the bottom of the ocean, along the route of the merchantmen between Europe and the United States. According to a recent letter of Lieut. Maury's to the Secretary of the Navy, dated February 22, 1854, Lieut. Berryman availed himself of this opportunity to carry a line of deep sea soundings from the shores of Newfoundland to those of the Irish coast.

The result is highly interesting, as it bears directly, in so far as the bottom of the sea is concerned, upon the question of a submarine telegraph across the Atlantic, and I therefore beg leave to make it the subject of a special report.

This line of deep-sea soundings seems to be decisive of the question as to the practicability of a submarine telegraph between the two continents, in so far as the bottom of the sea is concerned.

From Newfoundland to Ireland, the distance between the nearest point is about 1600 miles;† and the bottom of the sea between the two places is a plateau, which seems to have been placed there especially for the purpose of holding the wires of a submarine telegraph, and of keeping them out of harm's way. It is neither too deep nor too shallow; yet it is so deep that the wires, but once laid, will remain for ever beyond the reach of vessels' anchors, icebergs, and drifts of any kind; and so shallow, that the wires may be readily lodged upon the bottom.

The depth of this plateau is quite regular, gradually increasing from the shores of Newfoundland to the depth of from 1500 to 2000 fathoms, as you approach the other side.

The distance between Ireland and Cape St. Charles, or Cape St. Lewis, in Labrador, is somewhat less than the distance from any point of Ireland to the nearest point of Newfoundland.

But whether it would be better to lead the wires from Newfoundland or Labrador, is not now the question; nor do I pretend to consider the question as to the possibility of finding a time calm enough, the sea smooth enough, a wire long enough, a ship big enough, to lay a coil of wire 1600 miles in length; though I have no fear but that the enterprise and ingenuity of the age, whenever called on with these problems, will be ready with satisfactory and practical solutions of them.

I simply address myself at this time to the question in so far as the bottom of the sea is concerned, and as far as that, the greatest practical difficulties will, I apprehend, be found after reaching soundings at either end of the line, and not in the deep sea.

I submit herewith, a chart showing the depth of the Atlantic, according to the deep-sea soundings, made from time to time, on board of vessels of the navy, by authority of the Department, and according to instructions issued by the Chief of the Bureau of Ordnance and Hydrography. This chart is plate XIV. of the sixth edition of Maury's Sailing Directions.

By an examination of it, it will be perceived that we have acquired, by these simple means, a pretty good idea as to the depression below the sea-level of that portion of the solid crust of our planet which underlies the Atlantic Ocean, and constitutes the basin that holds its waters.

A wire laid across from either of the above-named places on this side, will pass to the north of the Grand Banks, and rest on that beautiful plateau to which I have alluded, and where the waters of the sea appear to be as quiet and as completely at rest as it is at the bottom of a mill-pond.

It is proper that the reasons should be stated for the inference that there are no perceptible currents, and no abrading agents at work at the bottom of the sea upon this telegraphic plateau.

I derive this inference from a study of physical fact, which I little deemed, when I sought it, had any such bearings.

It is unnecessary to speak on this occasion of the germs which physical facts, even apparently the most trifling, are often found to contain.

Lieut. Berryman brought up with Brook's deep-sea sounding apparatus specimens of the bottom from this plateau.

I sent them to Professor Baily, of West Point, for examination under his microscope. This he kindly gave, and that eminent microscopist was quite as much surprised to find, as I was to learn, that all these specimens of deep-sea soundings are filled with microscopic shells; to use his own words, "not a particle of sand or gravel exists in them!"

These little shells, therefore, suggest the fact that there are no currents at the bottom of the sea whence they came—that Brook's lead found them where they were deposited in their burial place after they had lived and died on the surface, and by gradually sinking were lodged on the bottom.

Had there been currents at the bottom, these would have swept and abraded and mingled with these microscopic remains, the debris of the bottom of the sea, such as oaze, sand, gravel, and other matter; but not a particle of sand or gravel was found among them. Hence the inference that these depths of the sea are not disturbed either by waves or currents.

Consequently, a telegraphic wire once laid there, there it would remain as completely beyond the reach of accident, as it would be if buried in air-tight cases. Therefore, so far as the bottom of the deep sea between Newfoundland or the North Cape, at the mouth of the St. Lawrence, and Ireland is concerned, the practicability of a submarine telegraph across the Atlantic is proved.

The present state of Europe invests the subject of a line of telegraph wires across the Atlantic with a high degree of interest to the government and people of the United States. A general European war seems now almost inevitable; the attitude which this government will assume with regard to all the belligerent powers that may be involved in that war, is that of strict impartial neutrality.

The better to enable this government to maintain this position, and the people of the United States to avail themselves of all the advantages of such a position, a line of daily telegraph communication with Europe would be of incalculable service.

In this view of the subject, and for the purpose of hastening the completion of such a line, I take the liberty of suggesting for your consideration the propriety of an offer, from the proper source, of a prize to the company through whose telegraphic wire the first message shall be passed across the Atlantic.

From the above interesting and instructive letter, the following points are to be decided by the telegraphic engineer:—

1st. "To find a time calm enough, and a sea smooth enough to lay down a telegraphic cable." In my own mind, this first difficulty can be overcome as easily as the observations of Lieut. Berryman were made, if times of calm are found for such careful observations as he has made, by means of a twine string so as to let down a cannon ball of sixty-four pounds, and then raise a tube filled with the shells and earth of the depths of the ocean, we are almost certain a time calm enough and a smooth sea can be found to stretch a wire cable from land to land.

The second difficulty is, "a wire long enough." On this point we have accurate data to follow. The cable from Calais to Dover is 24 miles long, and consists of four copper wires, through which the electric currents pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun yarn, forming a core or centre, around which are laid ten iron galvanized wires of 5-16ths of an inch in diameter, each welded into one length of 24½ miles, and weighing about 15 tons per mile. The rope weighs altogether about 180 tons. It formed a coil of 30 feet diameter outside, 15 feet inside, and 5 feet high, and was made in the short space of 20 days, by a machine invented by Mr. George Fenwick, an engineer of the Leaham Harbour Iron Works in Durham.

* See Journal of the Franklin Institute.

† From Cape Freels, Newfoundland, to Erris Head, Ireland, the distance is 1611 miles; from Cape Charles, or Cape St. Lewis, Labrador, to ditto, the distance is 1601 miles.

The transatlantic cable, if the machinery is multiplied, and sixteen machines are employed, could, we have little doubt, complete the cable in six or seven months.

The third difficulty is, "a ship big enough." This can be no difficulty, for if one would not do, surely twenty would. What is the objection to sending it by trips or in pieces? Could it not be attached, as it was laid down, to a buoy? A vessel of 1000 tons could surely carry 400 tons of coil, for our cable would not exceed 12,000 tons.

Another important matter to be determined is, to what extent a galvanic current can be sent on an insulated wire. This has also been determined, for in favourable states of the atmosphere, lines in this country have been so insulated as to work in one circuit from 800 to 1000 miles.

In my work on the Telegraph, p. 152, I there state that the greatest distance that any of the lines had worked in one circuit, was from Boston to Montreal, *via* New York, Buffalo, and Toronto, a distance of about 1500 miles. This was done when the earth was frozen, and the lines insulated by frost.

The entire length of the telegraph line from New York to New Orleans, *via* Charleston, Savannah, and Mobile, is 1966 miles, and even this distance has been worked as one circuit by the aid of an instrument termed a connector, the effect of which is to cause one circuit to work the other through the entire series, thus producing a result similar to working through the entire line in one circuit.

As late as December 3, 1853, despatches were written direct through from New Orleans to Philadelphia and New York, on the National Telegraph line, the weather being cold and the earth frozen. In doing so, the only connector or repeater used was an insulated screw on the back of the register, invented by a distinguished telegraphic engineer, W. C. McRea, of this city, which is now the simplest mode employed; but this distance would require at least 30 Grove's cups, of a pint each, for every 100 miles, making about 480 cups, or 240 each side. I think this number of the battery of Mr. C. T. Chester would be amply sufficient. If a copper and zinc battery were employed, the number would have to be increased to about 30 to 40 cups every 100 miles, but even with this large battery, the expenses would be less than with the Grove's battery. In preparing the batteries, it is even possible to determine mathematically beforehand the amount of resistance and the force necessary to overcome it; and thus to proportion the number and size of the plates to the distance to which the wires extend. Large wires are better conductors than small ones. Copper is a much better conductor than iron; and as a thinner wire answers the purpose of conduction, it may be much more easily insulated.

The several conditions may all be calculated from the beautiful formula of Ohm.

In some recent experiments of Professor Faraday, that distinguished philosopher, by some of the results he obtained, has thrown much light upon the action of voltaic electricity in the submerged wire of the electric telegraph.

He first determines by actual experiment, that when copper wire is perfectly covered with gutta percha, so high is the insulation that in 100 miles of such wire, when fully charged by an intensity battery of 350 pairs of plates and submerged in water, the deflexion of a delicate galvanometer was not more than 5 degrees. The great perfection in the covering of the wire may be judged of by this fact alone. The 100 miles of wire was 1-16th of an inch in diameter; the covered wire was 4-16ths; the gutta percha on the metal was 0·1 of an inch in thickness. There could not be a better proof than this, that gutta percha is one of the best insulating agents we have, which fact I have before stated in my work on the Telegraph. He experimented with the subterraneous wires which exist between London and Manchester, and when they were all connected together so as to make one series, they made almost the distance as determined by Lieutenants Berryman and Maury between the Irish coast and Newfoundland, being 1500 miles, and having introduced galvanometers at intervals of about 400 miles, he found that when the whole 1500 miles were included, it required *two seconds* for the electric stream to reach the last instrument, which was placed at the end. In this instance the insulation was not as perfect, still the result shows that it will require a little over two seconds to cross the Atlantic by telegraph, which is about the rate of 750 miles in a second, which result is far below those obtained by the London and Brussels telegraph, which is stated at only 2700 miles in a second, even with a copper wire, while it will be remembered that Wheatstone, in 1834, with copper wire, made the velocity of the electric current 288,000 miles per second—a considerable difference.

The whole of this difference, according to Professor Faraday, depends upon the lateral induction of the wire carrying the current. "The production of a polarized state of the particles of neighbouring matters by a excited body, constitutes *induction*, and this arises from its action upon the particles in immediate contact with it, which again act upon those contiguous to them, and thus the forces are transferred to a distance. If the induction remain undiminished, then perfect insulation is the consequence; and the higher the polarized condition which the particles can acquire or maintain, the higher is the intensity which may be given to the acting forces. In a word, insulators may be said to be bodies whose particles can retain the the polarized state; whilst conductors are those whose particles cannot be permanently polarized." And in regard to long circuits, such as those described, their conducting power cannot be understood, whilst no reference is made to their lateral static induction or to the conditions of intensity and quantity which then comes into play.

The conducting power of the air and water wires are alike for a constant current. This, according to Faraday, is in perfect accordance with the principles and with the definite character of the electric force, whether in the static, or current, or transition state. When a voltaic current of a certain intensity is sent into a long water wire, connected at the further extremity with the earth, part of the force is in the first instance occupied in raising a lateral induction round the wire, ultimately equal in intensity at the near end to the intensity of the battery stream, and decreasing gradually to the earth end.

In the report of Professor Faraday, which is given in the *London Philosophical Magazine* for March, he there, in conclusion, refers to the terms *intensity* and *quantity*. These terms, he remarks, or equivalents for them, cannot be dispensed with by those who study both the static and dynamic relations of electricity. Every current where there is resistance, has the static element and induction involved in it, whilst every case of insulation has more or less of the dynamic element and conduction; and we have seen that the same voltaic source, the same current in the same length of the same wire gives a different result, as the intensity is made to vary with variations of the induction around the wire. The idea of intensity, or the power of overcoming resistance, is as necessary to that of electricity, either static or current, as the idea of pressure is to steam in a boiler, or to air passing through apertures or tubes; and we must have language competent to express these conditions and these ideas.

In conclusion, I trust that a cable may be laid across the briny deep, and I am happy to find the matter taken hold of by intelligent and scientific telegraphic engineers, and its completion will be one of the wonders of the age. I have been recently informed that a company has been organized, styled the New York, Newfoundland, and London Telegraph Company, whose object is the establishment of a submarine telegraph, to connect Newfoundland with Ireland. Peter Cooper, Esq., a telegraph wire merchant of New York, is the President, and Professor S. F. B. Morse is the Vice-President, with a number of Directors. One of the most active is Tal. P. Shaffner, Esq., a gentleman who has had considerable experience in submarine telegraph lines during the past five years, and who employed the following language in regard to the enterprise in the first number of a Journal of which he is editor:—"Tides may ebb and flow; the billows may surge with mighty power; the icebergs may tower their white mantled forms high in the skies, and sink deep in the briny sea; the heavens may let loose the loud rolling thunder, and the earth heave up its fiery lava; but just as sure as these elements of nature exist, and worlds revolve, America and Europe will be connected by an electric cord."

On a New Smoke-Consuming and Fuel-Saving Fire-Place,

With Accessories Ensuring the Healthful Warming and Ventilation of Houses.

BY NEIL ARNOTT, M.D., F.R.S.

The great evils connected with the common coal fires are:—

1. Production of Smoke.
2. Waste of Fuel.
3. Defective Warming and Ventilation of Rooms.

We shall consider these in order:—

I. OF SMOKE IN THE INTERIOR OF HOUSES AND IN THE EXTERNAL ATMOSPHERE.

The proverb which declares a smoky chimney to be one of the greatest troubles of life, may suffice in relation to the interiors; in regard to the exterior, many particulars have to be noted. Examination of the question has ascertained that in London alone, on account of its smoke-loaded atmosphere, the cost of washing the clothes of the inhabitants is greater by two millions and a half sterling a year (that is, twenty-five times one hundred thousand pounds,) than for the same number of families residing in the country; and this is seen to be but a small part of the expense when we consider the rapid destruction of all furniture in houses, as of carpets and curtains, of articles of female apparel, of books and paintings, of the internal decorations, and even of the external surface of the stones of which edifices are built. For personal cleanliness it is necessary to be almost constantly washing the hands and face. Flowering shrubs and many trees cannot live in the London atmosphere, so that the charm of a garden, even at considerable distances from town, has almost ceased with the extension of the buildings and increase of smoke. A growing flower, if exposed to the atmosphere, is always covered with blacks or sooty dust, and defiles the hand which plucks or touches it. Sheep from the country, placed for a few days to graze in any of the parks, have soon a dingy fleece, strikingly apparent when others newly arrived are mixed with them. And this atmosphere, so damaging to inanimate things and to vegetable life, is inimical also to the health of man, as proved by numerous facts recorded in the bills of mortality. Many persons, with certain kinds of chest weakness, cannot live here. Many children brought from the country are seen soon not to be thriving. The coal-smoke then, may be called the great nuisance and opprobrium of the English capital.

II. OF WASTE OF FUEL.

Count Rumford, a writer of great authority in such matters, after making many elaborate experiments, declared that five-sixths of the whole heat produced in an ordinary English fire goes up the chimney with the smoke, to waste. This estimate is borne out by the facts observed in countries where fuel is scarce and dear, as in parts of Continental Europe, where it is burned in close stoves, that prevents the waste. With these a fourth part of what would be consumed in an open fire, suffices to maintain the desired temperature. I have myself made experiments here in London with like results. To save a third part of the coal burned in London alone, would save more than a million sterling a-year; and when coal is very dear, as during last winter, the saving would be much greater.

Then it is to be considered that coal is a part of our national wealth, of which, whatever is once used can never, like corn or any produce of industry, be renewed or replaced. The coal mines of Britain may truly be regarded as among the most precious possessions of the inhabitants, and without which they could never have attained to the importance in the world which the extraordinary developement of their mental and bodily faculties has now given them. It is enough to say that without coal they would not have had or used the steam-engine. To consume coal wastefully or unnecessarily, then, is not merely improvidence, but is a serious crime committed against future generations.

III. OF DEFECTIVE HEATING AND VENTILATING IN DWELLINGS.

Calling a thousand a week the average rate of mortality in London alone, it was found in the middle of last winter, that nearly 700 additional deaths occurred owing to the intense cold which then prevailed, and against which, evidently, the existing arrangements for warming and ventilating were insufficient. Not a little of the premature mortality at all times, and of the spread of epidemics, and of the low condition of health among the people, is, doubtless, owing to the same cause.

We shall now inquire whether it be or be not possible in a great measure to avoid the three great evils above described, and at the same time to secure other advantages.

I. SMOKE.

Is it possible to avoid or to consume smoke—in other words, to produce a smokeless coal fire?

Common coal is known to consist of carbon and bitumen or pitch, of which pitch again the elements are still chiefly carbon and hydrogen, a substance which, when separate, exists as an air or gas.

When the coal is heated to about 600 degrees Fahrenheit, the bitumen or pitch evaporates as a thick, visible smoke, which, when it afterwards cools, assumes the form of a black dust or flakes, called blacks, or smut, or soot. If that pitch, however, or pitchy vapour, be heated still more, as it is in the red hot iron retorts of a gas work, or in rising through a certain thickness of ignited coal in an ordinary fire, it is in great part resolved into invisible carburetted hydrogen gas, such as we burn in street lamps.

Now, when fresh coal is thrown upon the top of a common fire, part of it is soon heated to 600 degrees, and the bitumen of it evaporates as the visible smoke, which immediately rises. Of such matter the great cloud over London consists. If the pitchy vapour, however, be heated to ignition by the contact of a flame or of ignited coal near the surface, it suddenly becomes in a great part gas, and itself burns as flame. This is the phenomenon seen in the flickering and burning which takes place on the top of a common fire.

But if fresh coal, instead of being placed on the top of a fire, where it unavoidably must emit visible pitchy vapour or smoke, be introduced beneath the burning, red-hot coal, so that its pitch, in rising as vapour, must pass among the parts of the burning mass, it will be partly resolved into the inflammable coal gas, and will itself burn and inflame whatever else it touches. Persons often amuse themselves by pushing a piece of fresh coal into the centre of the fire in this way, and then observing the blaze of the newly-formed gas.

Various attempts, beginning, perhaps, with Dr. Franklin's, have been made to feed fires always from below, and so to get rid altogether of smoke. Another more recent one was made about thirty years ago, by an ingenious manufacturer in London, Mr. Cutler. He placed a box filled with coal under the fire, with its open mouth occupying the place of the removed bottom bars of the grate, and in the box was a moveable bottom, supporting the coal, by raising which the coal was lifted gradually into the grate to be consumed. The apparatus for lifting, however, was complicated, and liable to get out of order, which, with other reasons, caused the stove to be little used. The moveable bottom rested on a cross-bar of iron, which in moving was guided by slits in the side of the coal-box, and was lifted by chains at each end, drawn up by a windlass, and this windlass was turned by bevel wheels, of which one had to be moved by a winch in the hands of an attendant. Mr. Cutler was not aware that others had been engaged in the same pursuit, and took out a patent for his apparatus. A trial at law, however, afterwards decided that he had no patent right.

In the new fire-grate which I am now to describe, I have sought in every part the greatest possible simplicity which could give complete efficiency. The combination is represented in the wood-cut.—(in next number.—Ed.) The charge of coal for the day is placed in a box immediately beneath the grate, as shown in the diagram at the letters *e f g h*, and is borne upwards, as wanted, by a piston in the box, raised simply by the poker used as a lever, and as readily as the wick of an argand lamp is raised by its screw; the fire is thus under command, as to its intensity, almost as completely as the flame of a lamp. There are notches in the piston-rod for the point of the poker, and a ratchet catch to support the piston when the lever is withdrawn.

The coal-box of an ordinary fire may have a depth of seven or eight inches, which will receive from twenty to thirty pounds of coal, according to the area. In winter an inch or two more depth of coal may be placed over the mouth of the box before the fire is lighted, and in warmer weather the box will not require to be quite filled, that is to say, the piston at the time of charging needs not to be lowered quite to the bottom. If it become desirable on any account, as will happen with kitchen fires, to replenish the coal-box in the course of the day, it may be done almost as easily as to put coal on a common fire; thus, when the piston has been fully raised, so as to have its flat surface flush with the bottom bar of the grate, *e f*, a broad flat shovel or spade, of the shape of the bottom of the grate, is pushed in upon the piston, and it becomes at once a temporary bottom to the grate and a lid to the coal-box. The piston being then allowed to sink down to the bottom of the coal-box, the spade or lid is raised in front by its handle, and opens the box, so that a new charge of coal can be shot in. The spade being then withdrawn, the combustion goes on again just as in the morning. That the opening of this lid may be wider, the second bar of the grate is hinged, and yields to the upward pressure of the spade.

This fire is lighted with singular ease and speed. The wood is laid on the upper surface of the fresh coal filling the coal-box, and a thickness of three or four inches of cinder or coked coal left from the fire of the preceding day is placed over it. The wood being then lighted, instantly ignites the cinder above, and at the same time the pitchy vapour from the fresh coal below rises through the wood-flame and cinders, and becomes heated sufficiently to inflame itself, and so to augment the blaze. When the cinder is once fairly ignited, all the bitumen rising through it afterwards becomes gas, and the fire remains quite smokeless ever afterwards. A fire-place supplied with coal from below was used by a distinguished engineer in town for ten years, and the fact that his chimney had not to be swept in the whole of that time, proved that no soot was formed.

In the new grate, because no air is allowed to enter at the bottom of the coal-box,—for the piston-rod fits its opening pretty accurately—there is no combustion below, but only between the bars of the grate, where the fuel is completely exposed to the air, and near the mouth or top of the coal-box. The unsatisfactory result of some other attempts to make such a fire have been owing, in part, to the combustion extending downwards in the coal-box, because of air having been admitted below, and then consequent melting and coking of the mass of coal, so as to make it swell and stick, impede the rising of the piston.

A remarkable and most valuable quality of this fire is, its tenacity of life, or its little tendency to go out or be extinguished. Even after nearly all the coal in the grate, surrounded by the fire bars, has been consumed, the air will dive into the coal-box and keep the fire there gently alight, like a torch burning from the top downwards, until nearly the whole contents of the box are consumed, and thus the fire will remain burning for a whole day or night, without stirring or attendance, and yet at any moment it is ready to burn up actively when the piston is raised.

In certain cases, as during long nights, it may be desirable to ensure the maintenance of combustion with rather more activity, and for this purpose there is a slide in a small door at the front bottom of the coal-box, by which a graduated admission of air may be allowed. That door itself is open before lighting the fire, to allow of the removal of any coal-dust or ash which has fallen down past the edge of the piston.

Before lighting the fire in the morning, the little ash which remains with this form of combustion is removed from off the piston.

The fire is extinguished at night by allowing it to exhaust itself, or by lifting out the few lumps of coke or caked coal which remain. The morning charge should be such that enough cinder or coke may be left for the smokeless lighting of the next day.

By the means now described, then, the first-named evil of the *production of smoke* is effectually combatted.

II. WASTE OF FUEL.

We now come to consider whether the *waste of fuel* which occurs in common open fires can be prevented.

Count Rumford, as the result of his own experiments already referred to, declared that 5-6ths of all the heat produced in a common open fire passed up the chimney with the smoke, and therefore to waste; and he appealed in corroboration to the experience of the Continent of Europe, where close stoves are used, which do not thus waste heat up the chimney, and where a much smaller allowance of fuel than is here needed in open fires suffices. I have, in my own house, a striking illustration of the matter in a peculiar enclosed fire, which, for fourteen years past, in a large dining-room, has maintained, day and night, from October to May, a temperature of 60 degrees or more, accompanied with good ventilation, by an expenditure of only 12lbs. of coal for 24 hours, or about a fourth of what would be used in an open fire burning for 15 or 16 hours. This fire is lighted about the beginning of October, and is not extinguished at all until the following May. The aperture by which the fresh air enters the stove to maintain the combustion sufficient to warm that room, is about three-quarters of an inch in diameter. If this be compared with the aperture of a common chimney-pot, which has a diameter of ten inches, and an area or size 150 times greater than my stove, and one thinks of the rapidity with which a column of dense smoke filling that pot escapes from it when the fire is burning briskly; and reflects further that such column consists entirely of the warmest air from the room, blackened by a little pitchy vapour from the fire, there is proof of prodigious waste, and room for reasonable hope that a saving is possible. To see how a saving may be effected, the exact nature of the waste in such cases has now to be explained:—A single mouthful of tobacco smoke, on issuing immediately diffuses itself so as to form a cloud larger than the smoker's head, and soon would contaminate the whole air of a room, as would also the smoke and smell of wood, paper, or or combustible burned in a room. Now, the true smoke of a common fire is not the whole of what is seen issuing from the chimney top, but only little driblets or jets which shoot up or issue from the cracks in the upper surface of coal which forms the fire. These jets, however, quickly diffuse themselves, like the tobacco smoke, in the air around them, that is to say, in the large volume which fills the space left over a common fire, and over the hobs, if there be such, at the side of the grate. The whole of the air so contaminated, and which may be in volume 30, 50, or 100 times greater than that of the true smoke, is then all called smoke, and must all be allowed to ascend away from the room. It is evident, then, that if a cover or hood be placed over a fire, such as is represented by the letters *y a b* in the diagram, so as to prevent the diffusion of the true smoke or the entrance of pure air from around to mix with it, except just what is necessary to burn the inflammable gases which rise with the true smoke, there would be a great economy. This has been done in the new fire-place, with a saving of from one-third to one-half of the fuel required to maintain a desired temperature. In a room the three dimensions of which are 15 feet, 13½ feet, and 12 feet, with two large windows, the coal burned to maintain a temperature of 55 degrees in the coldest winter days, has been 18 lbs. for 19 hours, or less than a pound per hour.

And it is to be remarked that not nearly the whole possible saving has been effected in the case referred to; for the grate was an old one imperfectly altered, and as the true smoke, little diluted, is very hot air when it leaves the ignited coal, and if it were made to pass, in contact with a vessel containing water or colder air, it would give up for use a considerable part of its heat. In many cases such saving will be profitably effected. Under the present imperfect forms of open fire, the whole of the hot smoke passes away as certainly as here, but at present is so much diluted with the colder air of the room, that ordinary observers do not perceive, and, consequently, do not regret the fact.

In many cases the contraction of the space over the fire will be more conveniently made in brick-work than by a metallic hood. Where the hood is used, unless it be made a boiler or water-vessel, it should be lined with tile to prevent that overheating which would cause in the room some smell of heated metal.

The stalk of the hood at *y* passes closely through a plate or other stopping at the bottom of the chimney, so that no air shall enter the chimney but through the hood; and there is a throttle-valve or damper in the hood-stalk, at *t*, giving perfect control over the current of air that passes through. No part of the apparatus is more important than this valve or damper, and its handle or index must be very conspicuous, and have degrees of opening marked on its plate as clearly as the points are marked on a compass-card. When the valve is quite open, the chimney acts to quicken the combustion, like that of a blast-furnace, or like a forge-bellows, but, by partially closing the valve, the current may be diminished, until only the most tranquil action remains. The valve should not be open in general more than just enough to let all the burned air or thin smoke, which is scarcely visible, pass through. When the valve is once adjusted to the usual strength of chimney action, it requires little change afterwards.

In many cases it is desirable to be able to command and modify, by a movable plate, the size of the front opening of the hood or fire-place, as well as the opening of the chimney throat. By the proper adjustment of the two, the desirable brightness of the front of the fire may be maintained.

The chimney-flue above the upper opening of the hood should have its sides made slanting, so as not to harbour dust or any soot which, from any careless use of the fire, might be produced. The size of the chimney-flue is not important.

The answer then to the second question, as to the possibility of saving fuel, is by the facts here adduced, given in the affirmative.

(To be continued.)

On Visual Education as applied to Geology.* With Plate.

It has been truly said, that the highest function of the Society of Arts must be its endeavour to promote the general advancement of education; and in the belief that such are the practical views of this Society, I presume that its members cannot view with indifference any part of that great undertaking at the Crystal Palace, which may be so justly called a grandchild of the Society of Arts. It was here that the Great Exhibition of 1851 first saw the light, and, under the happy auspices of our Royal President, was brought to maturity—a giant born of peace and good-will to men; of such parentage how much is to be hoped for!

In this the 100th year of our existence as a Society, it is most happily conceived to lay before the whole world an exhibition of all the materials of education collected from all nations; therefore, in the hope that you will consider my attempt at least seasonable, I shall endeavour, very briefly, to lay before you this evening a slight sketch of part of one of those great efforts, in an educational direction, which the Crystal Palace Company are making for the benefit of their fellow-men of all classes; and no less is it a benefit to their fellow-men because it is being done commercially, which, if properly analysed, will be found to be the most truly independent system and most congenial to the feeling of every right-minded Englishman.

The whole of the great scheme now working to completion, known as the Crystal Palace, might be properly described as one vast and combined experiment of visual education; and I think it would be easy to show that its educational powers and design constitute its legitimate claims to the support of all civilized Europe; but like its great parent, the Exhibition of 1851, it is too extensive to allow of even a short catalogue in a brief space of one hour; I therefore confine myself to a hasty sketch of part of the attempt to apply the active principle of teaching directly through the eye that branch of the truths of creation upon which I have been engaged for the last year and half.

This direct teaching through the eye has been recognized as a principle and a facility of education for some years past, even in the limited sphere of schools; and I believe the name of Pestalozzi deserves the most honorable mention in connection with its first enunciation as a recognized facility upon principle. His, and his followers' lessons on objects were urged upon the public some twenty years ago, and a writer who was quoted at the time, in support of the principle, shrewdly observed, that "we daily call a great many things by their names, without even inquiring into their nature and properties, so that in reality it is only only their names, and not the things themselves, with which we are acquainted." If this remark was and is still applicable to our superficial knowledge of every-day objects, how much more literal it becomes when applied to that branch of science and truth (for science is only a synonyme for truth) which the Crystal Palace Company have so boldly undertaken to lay before the multitude; there we shall reverse that order of teaching which is described as the names and not the things with which we become acquainted: it will be the things with their names that we shall present to the people; and not only the people in the restricted sense of the word, but to the million, including the well-informed and those above the average in education and acquirements; to the majority of these the geological restorations will present all the novelty of a first acquaintance, for, with reference to the true form and size of the extinct animals, little more than the name was known to many who had an earnest desire to acquire some knowledge of geology, but whose scanty leisure would not allow of their pursuing their inquiries sufficiently far to realize that life-like interest which becomes almost essential for the successful continuance of any pursuit. Our natural sympathies are with life. That which does or has lived will always be found to interest far beyond any inorganic object, however brilliant or beautiful.

Of course it is not my intention to offer you on the present occasion a lecture on Geology or Palæontology, but only simply to describe, in a few words, the foundation upon which I have constructed and restored these great animals, and how I have obtained that truth and accuracy which may entitle my restoration of the extinct animals to be viewed as useful and trustworthy lessons to all classes, and which we hope will render the appearance and names of the ancient inhabitants of our globe as familiar as household words.

Geology and Palæontology, though deeply interesting to all who have had the opportunity for study, have hitherto been restricted to the professed anatomist, or to those whose great resources enabled them to make collections and to bring around them the costly requisites of their enthusiastically followed pursuits. Sir Philip Egerton, Lord Enniskillen, Sir Roderick Murchison, Mr. Bowerbank, and other distinguished names, illustrate the limited number to whom the study of Geology and Palæontology was practically within reach. We have public museums, it is true, but even our national collection at the British Museum, though containing some of the finest fossils that have been collected throughout the world, from their detached state, there being only two or three skeletons for comparison, offers little more than objects of wonder, literally only dry bones or oddly-shaped stones to the majority who see them. The inevitably fragmentary state of such specimens of course left much to the imagination, even to those who looked at them with some little knowledge of comparative anatomy, and as that amount of knowledge is not found among the average acquirements of the public at large, it was a fallow field, which nothing less than the great enterprise and resources of the Crystal Palace Company could have attempted for the first time to illustrate and realise—the revivifying of the ancient world—to call up from the abyss of time and from the depths of the earth, those vast forms and gigantic beasts which the Almighty Creator designed with fitness to inhabit and precede us in possession of this part of the earth called Great Britain.

Geology has been aptly called the science of nature's antiquities, for, however fresh, renewed, and vigorous in all her operations, yet even nature has had her olden time; her early days must have seen fierce struggles, contentious storms, fire and water, like the modern theories, struggling for the mastery; then her epoch of calmer subsidence and gentler rule, each state leaving its indestructible monuments, with their carvings and inscriptions for man to decypher. Nature's pyramids are mountains of granite, slate, and limestone; her aquaducts majestic rivers, leaving gigantic boulders for land-marks; but more to our immediate purpose, the geologist, like the modern antiquarian, finds his richest stores of information in nature's cemeteries, where the bones of bygone generations lie embalmed with proof of how they lived and where they died.

* Illustrated by Diagrams and Models of the Geological Restorations at the Crystal Palace. By B. Waterhouse Hawkins, F.G.S., F.L.S. —*Journal of the Society of Arts.*

The science of Palæontology, or as the literal translation of the name indicates, the study of ancient beings, treats of the history of fossils; and its principal end is to make known the forms and the zoological relations of the beings which have inhabited the globe at divers epochs anterior to our own. It has also to fill one of the most remarkable pages in the history of the earth, by retracing the successive phases of the organization of the animals that have peopled it. It has two principal applications—1st, to Zoology, by making known those new or rather unknown forms and conditions of existence which are often wanting in living nature. It may sometimes, by offering new transitions, demonstrate natural relations of which we were ignorant; it re-acts also upon the general laws of comparative anatomy, and has contributed much to its researches and discoveries, and it is connected with all the questions relative to the origin and development of organized beings. 2dly, to Geology—Palæontology again applies to geology, by furnishing the only certain basis for the determination of the stratified earths, and by clearing up several essential points relative to the ancient limits of seas and continents. The study of fossils is destined to throw a great light upon the determination of the order of succession of the beds or strata, and of their relative age. The study of fossils may also enlighten questions of detail. Certain sorts of fish and of mollusca are known to be essentially belonging to rivers, and others to inhabit the seas. If the fossils of an earth belong to the fresh water species, we may legitimately conclude that such earth has been deposited by rivers or by lakes of fresh water. If, on the contrary, the beings that have there left their remains belong to the marine species, it may be presumed that such deposit owes its origin to the waters of the sea.

In latter years fossils have revealed remarkable facts concerning the state of the globe at various epochs. Some authors have sought to make use of them to define the shores and the configuration of the ancient seas; at least, we know that in the deep sea we find fewer molluscs than near the coasts: the depth and absence of vegetation cause the greatest part of the species to avoid the centre of the seas; the shores, on the contrary, which furnish a more abundant nourishment, and the rocks near the surface, serve as shelter to a much larger number of individuals. The presence of numerous fossils, and, above all, that of species which belong to the kinds essentially fluviatile, may then serve to indicate the shore of ancient seas, whilst rare fossils of species from the deep seas prove, on the contrary, that the earths where they are deposited have been formed far from the coasts of seas at divers epochs. Thus it will be seen that geology would be but a barren study without some knowledge of the fossil remains of those beings who apparently first peopled the waters of the earth.

An inspection of the various strata in which fossil remains have been deposited serves to prove that, in general, a constant order has existed in their formation. The sea, by which the entire earth appears to have been covered, having rested in certain situations a sufficient length of time to collect particular substances, and to sustain the life of certain genera and species of animals, has been afterwards replaced by another sea, which has collected other substances, and nourished other animals, whose remains are found in each stratum, and are generally limited to one formation, or, if reappearing in a successive stratum, much modified in size or structure. I have prepared here a diagram which will give you an idea of the succession of epochs; each epoch containing a succession of periods and formations, which, though often found to have been disturbed by some vast convulsive force, can yet be retraced to its natural order of succession and super-position.

The diagram shews those formations which constitute the secondary epoch, or, if described in ascending order, the commencement of that vertebrate existence which left unequivocal evidence of its inhabiting the earth, by leaving the imprint of its footmarks, which, at one time, was all we knew of the extraordinary inhabitants of the New Red Sandstone, when it was called Chirotherium, from the hand-like shape of the foot-marks, until the mighty genius of Professor Owen placed the teeth and head before us, with such indisputable characters as united them to the footmarks, and thus, by induction, the whole animal was presented to us.

Next, in ascending succession, we have the Tethyosaurus, Platyodon, Tenuirostris, and Cummunis, the Plesiosaurus Dolichodirus, as restored by Dean Conybeare, the Plesiosaurus Macrocephalus and Hawkinsii, the latter named by Professor Owen after Mr. Thomas Hawkins, who with great enthusiasm cleared it from its matrix of Lias, and made the first great collection of fossils of the Lias which were purchased by the trustees of the British Museum, where they are now, and form the most striking features of the national collections of fossils.

It next illustrates the upper portion of the Lias, sometimes known as the alum shale, so well developed at Whitby, in which remains of the Teleosaurus have been so frequently found. This animal will be recognised by its near resemblance to the crocodile of the Ganges called Gavial, or Garrial, as it should be called: to the casual observer the principal difference consists in its greater size. The next formation above the Lias is the Oolite, of which at present that singular reptile, the Pterodactyle, represents the inhabitants, while the intermediate formation, called the Stonesfield slate, bears the great discovery of Buckland, the Megalosaurus, or the great lizard. This, the upward strata of the great Oolite, brings us to the formation called the Wealden, which Professor Owen, in one of his elaborate descriptions of the British fossil reptiles, calls the metropolis of the Dinosaurian order, which I have here represented by the best known and most typical species, the Hylæsaurus or lizard of the mud, with its extraordinary dermal covering and long range of dorsal scutes, of which the bones were found by the late Dr. Mantell, whose persevering researches in Wealden formations first gave the idea to science of the former existence of the Iguanodon.

These restorations of the Iguanodon I made from the measurements of the great Horsham specimen, as the largest is called, from its having been found and carefully preserved by Mr. Holmes, surgeon, at Horsham, who has bestowed much care and attention on the development of the great fossils found in his neighbourhood, among which are the largest known specimens of the bones of Iguanodon, having also the greater value of being found altogether, evidently belonging to one individual. These he kindly placed at my service for comparison with the better known Maidstone specimen now in the British Museum, which was so admirably extricated from its matrix and preserved by Mr. Beusted.

This Iguanodon was the animal the mould of which I converted into a *salle a manger*, and in which I had the honour of receiving Professor Owen, Professor E. Forbes, and twenty of my scientific friends to dinner on the last day of the year 1853. This circumstance will best illustrate the great size of these animals, the restoration of which has involved some of the greatest mechanical difficulties that can come within the sculptor's experience: and, if it will not be considered out of place, I will briefly state the process by which I have constructed these large models.

In the first week of September, 1852, I entered upon my engagement to make Mastodon or any other models of the extinct animals that I might find most practicable; such was the tenour of my undertaking, and being deeply impressed with its important and perfectly novel character, without precedent of any kind, I found it necessary earnestly and carefully to study the elaborate descriptions of Baron Cuvier, but more particularly the learned writings of our British Cuvier, Professor Owen. Here I found abundant material collected together, stores of knowledge, from years of labour, impressing me still more with the grave importance of attempting to present to the eye of the world at large a representation of the complete and living forms of those beings, the minutest portion of whose bones had occupied the study and research of our most profound philosophers; by the careful study of their works, I qualified myself to make preliminary drawings, with careful measurements of the fossil bones in our Museum of the College of Surgeons, British Museum, and Geological Society; thus prepared I made my sketch-models to scale, either a 6th or a 12th of the natural size, designing such attitudes as my long acquaintance with the recent and living forms of the animal kingdom enabled me to adapt to the extinct species I was endeavouring to restore. These sketch models I submitted in all instances to the criticism of Professor Owen, who with his great knowledge and profound learning most liberally aided me in every difficulty. As in the first instance it was by the light of his writings that I was enabled to interpret the fossils that I examined and compared, so it was by his criticism that I found myself guided and improved, by his profound learning being brought to bear upon my exertions to realise the truth. His sanction and approbation obtained, I caused the clay model to be built of the natural size by measurement from the sketch-model, and when it approximated to the form, I with my own hand in all instances secured the anatomical details and the characteristics of its nature.

Some of these models contained 30 tons of clay, which had to be supported on four legs, as their natural history characteristics would not allow of my having recourse to any of the expedients for support allowed to sculptors in an ordinary case. I could have no trees, nor rocks, nor foliage to support these great bodies, which, to be natural, must be built fairly on their four legs. In the instance of the Iguanodon, it is not less than building a house on four columns, as the quantities of material of which the standing Iguanodon is composed, consist of 4 iron columns 9 feet long by 7 inches diameter,

600 bricks,
650 5-inch half-round drain tiles,
900 plain tiles,
38 casks of cement,
90 casks of broken stone,

making a total of 640 bushels of artificial stone.

These, with 100 feet of iron hooping and 20 feet of cube inch bar, constitute the bones, sinews, and muscles of this large model, the largest of which there is any record of a casting being made.

I have only to add that my earnest anxiety to render my restorations truthful and trustworthy lessons has made me seek diligently for the truth and the reward of Professor Owen's sanction and approval, which I have been so fortunate to obtain, and my next sincere wish is that, thus sanctioned, they may, in conjunction with the visual lessons in every department of art, so establish the efficiency and facilities of visual education as to prove one of many sources of profit to the shareholders of the Crystal Palace Company.

On the Spheroidal State of Bodies.

By Arthur H. Church, Esq.—*To Dr. Tyndall, F.R.S. &c.**

The successful method by which, in your last lecture, the existence of a space between water in the spheroidal state and the containing vessel was proved by the complete interruption that space offered to the passage of a galvanic current, has induced me to devise a few experiments on the subject.

I have to describe in the present communication, in the first place, some experiments, I have just performed for the purpose of obtaining decisive evidence of the isolation of all bodies in the spheroidal state from the surfaces on which they roll; and in the second place, to offer a few suggestions as to the probable causes of the phenomena under consideration.

It was found by Boutigny, that if into a clean, red-hot platinum capsule acids and alkalies be placed, the acid and alkaline liquids will roll about, repelling one another violently. This, though an interesting example of the suspension of chemical affinity, does not prove the existence of a space between the platinum vessel and the spheroids.

The first experiment I have to mention was this;—I took a copper basin, three inches in diameter and rather more than half an inch deep, polished its concave surface, and covered it with a thin film of silver by the galvanic process. The plated basin was now brought to a very high temprature, and while thus heated, a few drops of a slightly alkaline solution of sulphide of sodium were poured into it. These drops instantly assumed the spheroidal form and rolled about, making, however, no mark or track upon the silver. The source of heat was now withdrawn: the temperature was soon so far reduced that the liquid exhibited its normal properties, the space between it and the silver no longer existed, and a black stain of sulphide of silver covered the dish.

Another instance of the assumption of the spheroidal state has been often noticed. It occurs when ether is placed on the surface of boiling water. Now, if a fixed inorganic acid be dissolved in ether, and the water be coloured with litmus, no reddening of the latter will take place as long as the ether remains in the spheroidal state. The acidulated ether and the tinted water cannot, therefore, be in communication; they are separated by a film of air or of vapour.

I pass on to notice in as few words as possible the remainder of my experiments. I have remarked that in certain circumstances spheroidal globules form upon the surface of liquids during the processes of filtration and distillation. The phenomenon to which I refer is exhibited by many liquids, more frequently and conspicuously perhaps by those that are the more volatile. I have observed it with alcohol, water, aqueous and alcoholic solutions, syrup, with essential oils and many other organic substances. I have sometimes, however,

* From the Lond. Edinb., and Dubl. Philosoph. Magazine, April, 1854.

found considerable difficulty in its reproduction, and will, therefore, describe in detail a method which is applicable in most cases for obtaining in this manner an example of the spheroidal state. We will employ a particular instance. If we take cymole, a hydrocarbon belonging to the benzole series, and half fill a bottle two or more inches in diameter with it, placing in the neck of the bottle a perforated cork through which passes a funnel-tube filled with cymole, and having a piece of sheet India-rubber stretched over its mouth, we shall find that on adjusting the funnel-tube till its lower extremity is rather less than half an inch from the surface of the liquid in the bottle, and on letting fall a drop of cymole from it, beautiful spheroidal globules will be formed and roll about for some time, scarcely diminishing in size. This experiment may be performed with great advantage if the cymole be warmed first. An ordinary funnel with a filter may be substituted for the funnel-tube, and will answer well if the lower aperture of the funnel has a diameter of about ·13 of an inch. The experiment may be repeated with other materials with similar effects. That the spheroids are not in contact with the surfaces on which they roll, may be proved by saturating the liquid in the tube with something that shall have a visible effect upon a substance dissolved in the liquid in the bottle. A beautiful illustration of this occurs when, under conditions similar to those before mentioned, we employ in the funnel-tube a solution of sugar containing sulphocyanide of potassium, and in the bottle a solution of sugar, containing sesquichloride of iron; no red colouration takes place until the coalescence of the spheroids with the liquid beneath them. Many other chemical reactions may be made use of with similar results. It is very curious to see a solution of ferrocyanide of potassium floating upon a solution of sesquichloride of iron, while not a trace of Prussian blue is formed. These experiments must, of course, be recommenced whenever any union of the liquids employed has taken place. The cork spoken of above should have two perforations, one to admit the funnel tube, and the other to allow the escape of air.

Is the employment of a volatile substance essential to the production of these phenomena? I imagined that this question might be answered by the following experiment. A dish of platinum might be heated strongly, and a drop of melted lead then placed upon it; now if the production of vapour from the substances employed were essential to the formation of the spheroidal state, the lead should at once dissolve and perforate the platinum; if, however, the spheroidal state occurs when when two non-volatile substances are employed, the platinum vessel should not be perforated until its temperature has been considerably reduced. The experiment was tried with every precaution to prevent the oxidation of the lead and insure an accurate result; a perforation of the platinum ensued the moment of placing the melted lead upon it. This proves that the production of vapour is essential to the occurrence of the spheroidal state; for it cannot be urged that that condition is never manifested when metals only are employed; for a drop of a volatile metal, mercury (melted mercury, we may say, in order to render its relationship to melted lead the more apparent,) placed on an intensely heated surface of platinum instantly assumes the spheroidal form, and evaporating slowly, dances about in the vessel with peculiar movements. Upon thin, sonorous vessels of copper, &c., this movement takes place with such rapidity as to produce a musical tone of high pitch. I have sometimes seen globules of mercury and water rise to the height of six inches from the capsules in which they had been formed.

A word or two in conclusion, as an attempt at an explanation of the phenomena observed may not be out of place.

Since a space always exists between the lower body and that in the spheroidal state, and since that state is not manifested by non-volatile substances, it seems reasonable to conclude that the vapour proceeding from those parts of the liquids nearest to the containing vessel or subjacent fluid tends to assist the internal molecular cohesive force of the drops in assuming and maintaining their spheroidal form. Other forces originated by the temperature may also be in operation.

I should premise that the solution of sulphide of sodium employed in my first experiment made a dark stain upon silver even in the cold. This renders the nullity of its action at a high temperature the more remarkable. It will be scarcely necessary to mention, that, for the successful performance of most of these experiments, considerable manipulative care is required.—*Royal College of Chemistry, March* 18, 1854.

Bakerian Lecture—On Osmotic Force.

By Professor Graham.

This name was applied to the power by which liquids are impelled through moist membrane and other porous septa in experiments of endosmose and exosmose. It was shown that with a solution of salt on one side of the porous septum and pure water on the other side, (the condition of the osmometer of Dutrochet when filled with a saline solution and immersed in water,) the passage of the salt outward is entirely by diffusion, and that a thin membrane does not sensibly impede that molecular process. The movement is confined to the liquid salt particles, and does not influence the water holding them in solution, which is entirely passive: it requires no further explanation. The flow of water inwards, on the other hand, affects sensible masses of fluid, and is the only one of the movements which can be correctly described as a current. It is osmose and the work of the osmotic force to be discussed. As diffusion is always a double movement,—while salt diffuses out, a certain quantity of water necessarily diffuses in at the same time, in exchange,—diffusibility might be imagined to be the osmotic force. But the water introduced into the osmometer in this way has always a definite relation to the quantity of salt which escapes, and can scarcely rise in any case above four or six times the weight of salt; while the water entering the osmometer often exceeds the salt leaving it at least one hundred times: diffusion therefore is quite insufficient to account for the water current. The theory which refers osmose to capillarity appears to have no better foundation. The great inequality of ascension assumed among aqueous fluids is found not to exist when their capillarity is correctly observed, and many of the saline solutions which give rise to the highest osmose are indistinguishable in ascension from pure water itself. Two series of experiments on osmose were described:—the first series made with the use of porous mineral septa, and the second series with animal membrane. The earthenware osmometer consisted of the porous cylinder employed in voltaic batteries, about five inches in depth, surmounted by an open glass tube 0·6 inch in diameter attached to the mouth of the cylinder by means of a cup of gutta percha. In conducting an experiment, the cylinder was filled with any saline solution to the base of the glass tube, and immediately placed in a large jar of distilled water; and as the fluid within the instrument rose in the tube during the experiment, water was added to the jar so as to prevent inequality of hydrostatic pressure. The rise (or fall) of liquid in the tube was highly uniform, as observed from hour to hour, and the experiment was generally terminated in five hours. From experiments made on solutions of every variety of soluble substances, it appeared that the rise or osmose is quite insignificant with neutral organic substances in general, such as sugar, alcohol, urea, tannin, &c.; so also with neutral salts of the earths and ordinary metals, and with chloride of sodium and potassium, nitrates of potash and soda, and chloride of mercury. A more sensible but still very moderate osmose is exhibited by hydrochloric, nitric, acetic, sulphurous, citric and tartaric acids. These are surpassed by the stronger mineral acids, such as sulphuric and phosphoric acid, and sulphate of potash; which are again exceeded by salts of potash and soda, possessing either a decided acid or alkaline reaction, such as binoxalate of potash, phosphate of soda, and carbonates of potash and soda. The highly osmotic substances were also found to act with most advantage in small proportions, producing in general the largest osmose in the proportion of one-quarter per cent. of salt dissolved. Osmose is, indeed, eminently the phenomenon of weak solutions. The same substances are likewise always chemically active bodies, and possess affinities which enable them to act upon the material of the earthenware septum. Lime and alumina were accordingly always found in solution after osmose, and the corrosion of the septum appeared to be a necessary condition of the flow. Septa of other materials, such as pure carbonate of lime, gypsum, compressed charcoal, and tanned sole-leather, although not deficient in porosity, gave no osmose, apparently because they are not acted upon chemically by the saline solutions. Capillarity alone was manifestly insufficient to produce the liquid movement, while the *vis motrix* appeared to be chemical action. The electrical endosmose of Porrett, which has lately been defined with great clearness by Weidemann, was believed to indicate the possession of a peculiar chemical constitution by water, while liquid, or at least the capacity to assume that constitution when water is poralized and acting chemically upon other substances. A large but variable number of atoms of water are associated together to form a liquid molecule of water, of which an individual atom of oxygen stands apart, forming a negative or chlorous radical, while the whole remaining atoms together are constituted into a positive or basylous radical;—which last will contain an unbalanced equivalent of hydrogen giving the molecule basicity, as in the great proportion of organic radicals. Now, it is this voluminous basylous radical, which travels in the electrical decomposition of pure water, and resolves itself into hydrogen gas and water at the negative pole, causing the accumulation of water observed there; while the oxygen alone proceeds in the opposite direction to the positive pole. Attention was also called to the fact, that acids and alkalies, when in solution, are chemically combined with much water of hydration; sulphuric acid, for instance, evolving heat when the fiftieth equivalent of water is added to it. In the combination of such bodies, the disposal of the water is generally overlooked. Osmose was considered as depending upon such secondary results of combination; that is, upon the large number or voluminous proportions of the water molecules involved in such combinations. The porous septum is the means of bringing out and rendering visible, both in electrical and ordinary osmose, this liquid movement attending chemical combinations and decompositions. Although the nature and *modus operandi* of the chemical action producing osmose remains still very obscure, considerable light is thrown upon it in the application of septa of animal membrane. Ox bladder was found to acquire greatly increased activity, and also to act with much greater regularity, when first divested of its outer muscular coat. Cotton calico also, impregnated with liquid albumen, and afterwards exposed to heat, so as to coagulate that substance, was sufficiently impervious, and formed an excellent septum, resembling membrane in every respect. The osmometer was of the usual bulb-form, but the membrane was supported by a plate of perforated zinc, and the instrument provided with a tube of considerable diameter. The diameter of the tube being one-tenth of that of the mouth of the bulb or disc of membrane exposed to the fluids, a rise of liquid in the tube amounting to 100 millimètres indicated that as much water had permeated the membrane and entered the osmometer as would cover the whole surface of the membrane to a depth of one millimètre, or one twenty-fifth part of an inch. Such millimètre divisions of the tube become degrees of osmose, which are of the same value in all instruments. Osmose in membrane presented many points of similarity to that in earthenware. The membrane is constantly undergoing decomposition, and its osmotic action is inexhaustable. Further, salts and other substances capable of determining a large osmose are all chemically active substances, while the great mass of neutral monobasic salts of the metals, such as chloride of sodium, possess only a low degree of action, or are wholly inert. The active substances are also relatively most efficient in small proportions. When a solution of the proper kind is used, the osmose or passage of fluid proceeds with a velocity wholly unprecedented in such experiments. The rise of liquid in the tube with a solution containing one-tenth per cent. of carbonate of potash in the osmometer, was 167 degrees or millimetres, and with one per cent. of the same salt, 206 degrees in five hours. With another membrane and stronger solution the rise was 863 millimetres, or upwards of 39 inches, in the same time; and as much water therefore was impelled through the membrane as would cover its whole surface to a depth of 8·6 millimetres, or one third of an inch. The chemical action must be different on the substance of the membrane at its inner and outer surfaces to induce osmose; and according to the hypothetic view which accords best with the phenomenon, the action on the two sides is not unequal in degree only, but also different in kind. It appears as an alkaline action on the albuminous substance of the membrane, at the inner surface, and as an acid action on the albumen at the outer surface. The most general empirical conclusion that can be drawn is, that the water always accumulates on the alkaline or basic side of the membrane. Hence, with an alkaline salt, such as carbonate or phosphate of soda, in the osmometer and water outside, the flow is inwards; but with an acid in the osmometer, on the contrary, the flow is outwards, or there is negative osmose, the liquid then falling in the tube. In the last case, the water outside is basic when compared with the acid within, and the flow is therefore still towards the base. The chloride of sodium, chloride of barium, chloride of magnesium, and similar neutral salts, are wholly indifferent, or appear only to act in a subordinate manner to some other active acid or basic substance,—which last may be present in the solution or membrane in the most minute quantity. Salts which admit of dividing into a basic subsalt and free acid exhibit an osmotic activity of the highest order. Such are the acetate and various other salts of alumina, iron and chromium, the protochloride of iron, chloride of copper and tin, chloride of copper, nitrate of lead, &c. The acid travels outwards by diffusion, superinducing a basic condition of the inner surface of the membrane and an acid condition of the outer surface, the favourable condition of a high positive osmose. The bibasic salts of potash and soda again such as the sulphate and tartrate of potash, although strictly neutral in properties, begin to exhibit a positive osmose, in consequence, it may be presumed, of their resolution into an acid supersalt and free alkaline base. The following table exhibits the osmose of substances of all classes:

Osmose of 1 *per cent. Solutions in Membrane.*

Oxalic Acid	—	148 degrees
Hydrochloric Acid	—	92
Terchloride of Gold	—	54
Bichloride of Tin	—	46
Bichloride of Platinum	—	30
Chloride of Magnesium	—	3
Chloride of Sodium	+	2
Chloride of Potassium		18
Nitrate of Soda		2
Nitrate of Silver		34
Sulphate of Potash		21 to 60
Sulphate of Magnesia		14
Chloride of Calcium		20
Chloride of Barium		21
Chloride of Strontium		26
Chloride of Cobalt		26
Chloride of Manganese		34
Chloride of Zinc		54
Chloride of Nickel		88
Nitrate of Lead		125 to 211
Nitrate of Cadmium		137
Nitrate of Uranium		234 to 458
Nitrate of Copper		204
Chloride of Copper		351
Protochloride of Tin		289
Protochloride of Iron		435
Chloride of Mercury		121
Protonitrate of Mercury		356
Pernitrate of Mercury		476
Acetate of Sesquioxide of Iron		194
Acetate of Alumina		280 to 393
Chloride of Aluminum		540
Phosphate of Soda		311
Carbonate of Potash		439

It may appear to some, that the chemical character which has been assigned to osmose takes away from the physiological interest of the subject in so far as the decomposition of the membrane may appear to be incompatible with vital conditions, and that osmotic movements must therefore be confined to dead matter; but such apprehensions are, it is believed, groundless, or at all events premature. All parts of living structures are allowed to be in a state of incessant change of decomposition and renewal. The decomposition occurring in a living membrane while effecting osmotic propulsion may possibly, therefore, be of a reparable kind.—In other respects chemical osmose appears to be an agency particularly adapted to take part in the animal economy. It is seen that osmose is peculiarly excited by dilute saline solutions, such as the animal juices really are, and that the alkaline or acid property which these juices always possess is another most favourable condition for their action on membrane. The natural excitation of osmose in the substance of the membranes or cell-walls dividing such solutions seems therefore almost inevitable. In osmose there is, further, a remarkably direct substitution of one of the great forces of nature by its equivalent in another force—the conversion, as it may be said, of chemical affinity into mechanical power. Now what is more wanted in the theory of animal functions than a mechanism for obtaining motive power from chemical decomposition as it occurs in the tissues? In minute microscopic cells the osmotic movements being entirely dependent upon extent of surface may attain the highest conceivable velocity. May it not be hoped therefore to find, in the osmotic injection of fluids, the deficient link which certainly intervenes between muscular movement and chemical decomposition?

Meteorology of the Second Quarter of 1854, at the Highfield House Observatory, Nottinghamshire, England.

Month.	Mean Elastic Force of Vapour or Mean Amount of Water mixed with the Air.	Mean Pressure of the Gases, or Dry Air.	Mean Pressure of the Gases and Water, or Mean Height of the Barometer.	Greatest Height of the Barometer.	Least Pressure of the Barometer.	Monthly range of Pressure.
	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.
April	0·251	29·758	30·009	30·437	29·120	1·317
May	0·330	29·310	29·640	30·141	28·879	1·262
June	0·387	29·326	29·713	30·071	29·316	·0755
Mean	0·323	29·465	29·787	30·437	28·879	1·558

The elastic force of vapour in April was slightly less than the average; in May an eleventh of an inch above the amount of 1853 and ·021 inch above that of 1852; and in June ·029 inch above that of 1853, and nearly equal with that of 1852. The pressure of the atmosphere in April was a quarter of an inch greater than the average of the last seven years; in May 0·183 inch less, and in June 0·033 inch less than the average of the past seven years.

Month.	Adopted Mean Temperature.	Mean Temperature of the Wet Bulb Thermometer.	Mean Temperature of the Dew Point.	Mean Weight of Vapour in a Cubic Foot of Air.	Mean Additional Weight required to saturate a Cubic Foot of Air.	Mean Degree of Humidity.	Mean Whole Amount of Water in a Vertical Column of the Atmosphere.
	Degree.	Degree.	Degrees	Grains.	Grains.	(1·000)	Inches.
April	45·4	43·6	38·5	1·89	1·00	0·742	3·47
May	50·0	49·1	46·7	2·82	0·67	0·851	5·66
June	55·3	53·3	51·1	4·39	0·87	0·834	5·35
Mean	50·3	48·7	45·4	3·33	0·85	0·809	4·83

The mean temperature in May and June has been exceedingly low. In April it was below that of 1853 by 0·4°, above that of 1852 by 0·1°, and below the mean of 42 years by 1°. May was 0·4° below that of 1853, 1·5° below that of 1852, and nearly 6° below the mean of the last 42 years. June was 3° below that of 1853, and 1·7° below June, 1852, and 3½° below the mean of the last 42 years. It is to be feared that this great cold will affect the yield of the wheat crop. The mean temperature of the dew point was in April ½° below, in May 1½° above, and in June 1½° below the mean of the past seven years. The mean weight of vapour in a cubic foot of air was, in April, 1·2 grains below, in May 0·2 grain above, and in June 0·4 grain below the average of the past six years. The whole amount of water in a vertical column of the atmosphere was about equal to the average in April and June, but 1·7 inches above the average in May.

Month.	Mean Weight of Cubic Foot of Air.	Maximum Heat in Shade.	Greatest Cold of Night.	Monthly Range of Temperature.	Mean Maximum Temperature.	Mean Minimum Temperature.	Diurnal Range of Temperature.
	Grains.	Degrees.	Degrees.	Degrees.	Degrees.	Degrees.	Degrees.
April	553·0	74·8	23·4	45·4	59·2	35·1	24·1
May	532·4	73·0	31·4	41·6	62·8	37·7	25·1
June	528·1	79·0	41·0	38·0	65·2	46·8	18·4
Mean	537·8	79·0	29·4	49·6	62·4	39·9	22·5

The mean weight of a cubic foot of air was in April 13 grains more than the average of the past six years. May, two grains less, and June two grains more than the mean. The greatest heat in shade was in April 5° more than in 1853, and 1° less than in 1852; in May 9° less than in 1853 and 6° less than in 1852; and in June 3° less than in 1853 and 2° more than in 1852. The greatest cold of night in April and May was about the average, and in June 4° warmer than in 1853, and 1° warmer than in 1852. The mean of all the *maximum* readings of the thermometer in April was 2° above that of 1853, and slightly below that of 1852; in May about equal to the average temperature; and in June 6° below that of 1853, and about 4° below that of 1852. The mean of all the *minimum* readings of the thermometer in April was 3° below that of 1853, and slightly above that of 1852; in May 2° below that of 1853, and 5° below that of 1852; and in June 1½° below that of 1852 and 1853.

Month.	Greatest Cold on Grass.	Mean reading of a Minimum Thermometer on Grass.	Mean Maximum Heat of a Thermometer in the Sunshine.	Amount of Evaporation.	Amount of Rain. 2 feet above the ground	Amount of Rain. 25 feet above the ground.	Number of Days on which Rain fell.
	Degrees.	Degrees.	Degrees.	Inches.	Inches.	Inches.	
April	18·4	36·3	73·2	4·703	0·480	0·457	6
May	26·2	34·2	71·9	4·585	2·176	1·952	19
June	34·2	43·6	74·1	5·028	1·002	0·955	14
Mean	18·4	38·0	73·1	4·772	1·219	1·121	13

In April there were 15 nights' frost on the grass, and in May 14. The amount of evaporation for the quarter was 14·316 inches. The amount of evaporation in April was an inch above the average of the last six years, in May half an inch less, and in June about equal to the average. The amount of rain in April was 1·2 inches less than the average of the last 10 years, in May 0·2 more, and in June 2·0 inches less than the average. April, 1844, was 0·1 inch drier than in 1854, and April 1850, equal to that of 1854; in 1846 the amount was 11 times that of April, 1854; in all other years the fall was from 0·8 inch to 3·8 inches more than in April, 1854.

Month.	General direction of wind.	Strength of the Wind.	Mean Amount of Cloud.	Mean Temperature of Evaporation.	No. of Days Thunder or Lightning occurred on.	Solar or Lunar Halos occurred on.	Hail or Snow fell on.
		(0—6)	(0—10)	Degrees.	Days.	Days.	Days.
April	E.N.E. & N.E.	0·3	4·9	42·9	3	3	1
May	S.W.	0·2	6·6	47·6	11	1	5
June	N.E. & S.	0·7	8·4	52·1	4	2	0
Mean	S.W. & NE.	0·4	6·6	47·5	6	2	2

A violent gale for this season of the year occurred on the 26th of June from the S., and afterwards from the S.W. The average amount of cloud for April (from seven years' observations) is 6·7, for May 6·0, and for June 6·6. This year, April was very free from clouds, one-fifth of the sky being less cloudy than usual. May was in a slight degree more overcast than the average, and June was much more overcast, one-fifth part of the sky being more overcast than the average of that month. The Chiff-chaff arrived on the 1st of April, four days earlier than usual; Ribes sanguineum came into bloom on the 1st of April, one day earlier than usual; the Swallow arrived on the 14th o April, its average time; Daphne cneorum was in bloom on the 16th of April, 11 days earlier than usual; the Landrail arrived on the 2nd of May, 17 days earlier than usual; the Cuckoo on the 8th of May, 11 days later than usual; the Lilac was in bloom on the 5th of May, 11 days earlier than usual; and Strawberries were ripe on the 14th of June, one day earlier than usual.—*London Times.*

E. J. LOWE.

On the Electro-Plating of Metallic Articles with White Metals, Aluminium and Silicium, from Clay, Stone, and Sand.

By G. Gore, M.D.

It has long been known to chemists that all kinds of clay, stone, and sand, of which the crust of the earth is composed, consist of metals combined with oxygen, carbonic acid, sulphuric acid, and other non-metallic elements, forming therewith oxides, carbonates, sulphates, &c.; thus clay is an oxide of aluminium, sand an oxide of silicium, limestone a carbonate of the oxide of calcium. But the separation of the metallic bases from the non-metallic elements with which they are combined, has been a matter of so great a difficulty, that but few chemists have put themselves to the trouble of accomplishing it, and those who have done so have made use of the most powerful means and reducing agents, such as large voltaic batteries, potassium, &c., and have then obtained them in a state of alloy or combination with mercury. Sir Humphrey Davy, the discoverer of most of these bases, in his experiments on the decomposition of the alkalies and earths, used a powerful battery, consisting of 500 pairs of plates, and then succeeded in obtaining them combined with mercury, from which they were afterwards separated; Wohler and Berzelius, in their discoveries of the means of separating the metals aluminium and silicium from their respective compounds, clay and sand, used a high temperature and potassium, and then, succeeded in obtaining them in the condition of dull metallic powders, nearly invisible.

By a means recently discovered, and described in the March number of the "Philosophical Magazine" for this year, I have succeeded in depositing the metals aluminium from clay, and silicium from sand stone, each in a perfect metallic condition, by dissolving pipe-clay, common red sand, pounded stone, &c., in various chemical liquids, and passing currents of electricity from ordinary small voltaic batteries through the solutions.

My attention has since been directed to produce simple processes, whereby any person not possessing a knowledge of chemistry may readily coat articles with those metals, and cause the discovery to be immediately applied to human benefit in the arts and manufactures, and the following are the results of my experiments:—

To coat articles of copper, brass, or German silver, with aluminium, take equal measures of sulphuric acid and water, or take one measure each of sulphuric and hydrochloric acids and two measures of water; add to the water a small quantity of pipe-clay, in the proportion of five or ten grains by weight to every ounce by measure of water (or ½ oz. to the pint), rub the clay with the water until the two are perfectly mixed, then add the acid to the clay solution, and boil the mixture in a covered glass vessel one hour. Allow the liquid to settle, take the clear, supernatant solution, while hot, and immerse in it an earthern porous cell, containing a mixture of one measure of sulphuric acid and ten measures of water, together with a rod or plate of amalgamated zinc; take a small Smee's battery, of three or four pairs of plates, connected together intensity fashion, and connect its positive pole by a wire, with the piece of zinc in the porous cell. Having perfectly cleaned the surface of the article to be coated, connect it by a wire with the negative pole of the battery, and immerse it in the hot clay solution; immediately abundance of gas will be evolved from the whole of the immersed surface of the article, and in a few minutes, if the size of the article is adapted to the quantity of the current of electricity passing through it, a fine white deposit of aluminium will appear all over its surface. It may then be taken out, washed quickly in clean water, and wiped dry and polished; but, if a thicker coating is required, it must be taken out when the deposit becomes dull in appearance, washed, dried, polished, and re-immersed; and this must be repeated at intervals, as often as it becomes dull, until the required thickness is obtained. With small articles it is not absolutely necessary, either in this or the following process, that a separate battery be employed, as the article to be coated may be connected by a wire with the piece of zinc in the porous cell, and immersed in the outer liquid, when it will receive a deposit, but more slowly than when a battery is employed.

To coat articles with Silicium. Take the following proportions: three-quarters of an ounce, by measure, of hydrofluoric acid, a quarter of an ounce of hydrochloric acid, and forty or fifty grains either precipitated silica or of fine white sand, (the former dissolves most freely), and boil the whole together a few minutes, until no more silica is disolved. Use the solution, exactly in the same manner as the clay solution, and a fine white deposit of metallic silicium will be obtained, provided the size of the article is adapted to the quantity of the electric current; common red sand, or indeed any kind of silicious stone, finely powdered may be used in place of the white sand, and with equal success, if it be previously boiled in hydrochloric acid, to remove the red oxide of iron or other impurities.

Both in depositing aluminium and silicium, it is necessary to well saturate the acids with the solid ingredients by boiling, otherwise very little deposit of metal will be obtained.

Among the many experiments I have made upon this subject, the following are a few of the most interesting:—Experiment 1. Boiled some pipe-clay in caustic potash and water, poured the clear part of the solution into a glass vessel and immersed in it a small earthen porous cell, containing dilute sulphuric acid and a piece of amalgamated zinc; immersed a similar piece of bright sheet copper in the alkaline liquid, and connected it with the negative pole of a small Smee's battery of three pairs of plates connected the zinc plate with the positive pole, and let the whole stand undisturbed all night: on examining it next morning I found the piece of copper coated with a white silver-like deposit of metallic aluminium.

Experiment 2. Obtained from a railway cutting in the town, a small piece of the sand rock upon which Birmingham is built, boiled it in hydrochloric acid, to remove the red oxide of iron, washed it clean with water, and dissolved it by boiling in a mixture of hydro-fluoric acid, nitric acid, and water; immersed in this solution, a porous cell with dilute acid and zinc as before; connected a piece of brass with the zinc by a wire, and suspended it in the outer liquid, which was kept hot by means of a small spirit lamp beneath; after allowing the action to proceed several hours, I found the piece of brass beautifully coated with white metallic silicium.

Experiment 3. Took one part, by weight, of the same sand stone, after being purified by the hydrochloric acid, and 2¼ parts of carbonate of potash, fused them together in a crucible until all evolution of gas ceased, and a perfect glass was formed: poured out the melted glass, and when cold dissolved it in water and used this solutiom in the same manner as the former ones, allowing the action to proceed about twelve hours, when a good white deposit of metallic silicium was obtained.

Experiment 4. Took some stones with which the streets of Birmingham are macadamised, pounded them fine in a mortar, boiled the powder in hydrochloric acid, to purify it from iron, washed it well in water, and dissolved it by boiling an excess of it in a mixture of ¾ oz., by measure, of hydro-fluoric acid, ½ oz., of water, and ⅛ oz. each of nitric and hydro-chloric acids, until no more would dissolve; used the clear portion of this solution in the same manner as the former liquids, and readily coated in it a piece of brass with a beautifully white deposit either of aluminium or silicium.

From these and many other experiments which I have tried, it is quite clear that common metal articles may be readily coated with white metals, possessing similar characters to silver, from solutions of the most common and abundant materials, and thus bring within the purchase of the poorer classes articles of taste and cleanliness which are at present only to be obtained by the comparatively wealthy.

The following specimens accompany the communication, and may be seen at the society's house;—

1st. One specimen each of sheet copper and brass, coated with aluminium from "Pipe-clay," according to process described.

2nd. One specimen each of sheet copper and brass, coated with silicium, from silica and sand, according to process described.

3rd. Specimen of Birmingham sand rock.

4th. Specimen of ditto, purified by hydro-chloric acid.

5th. Specimen of sheet metal coated with silicium from Birmingham sand-stone.

6th. Specimen of road stone with which Birmingham streets are macadamized.

7th. Ditto in a state of powder.

8th. Ditto, purified by hydrochloric acid.

9th. Specimen of sheet brass coated with silicium from this road stone.

BIRMINGHAM, 24th MARCH, 1854.

Gold—Its Distribution.*

Notwithstanding the preceding sketch, it would ill become any geologist who throws his eye over the gold map of the world prepared by Adolf Erman, to attempt to estimate, at this day, the amount of gold which remains, like that of Australia, undetected in the vast regions of the earth, as yet unknown even to geographers; still less to speculate upon the relative proportions of it in such countries. At the same time, the board features of the case in all known lands may be appealed to, to check extravagant fears and apprehensions respecting an excessive production of the ore. For we can trace the boundaries, rude as they may be, of a metal ever destined to remain precious on account of those limits in position, breadth, and depth by which it is circumscribed in Nature's bank. Let it be borne in mind that, whilst gold has scarcely ever been found, and never in any quantity, in the secondary and tertiary rocks which occupy so large a portion of the surface, mines sunk down into the solid rocks where it does occur have hitherto, with rare exceptions, proved remunerative; and when they are so it is only in those cases where the rocks are soft, or the price of labour low. Further, it has been well ascertained, whatever may have been the agency by which this impregnation was effected, that the metal has been chiefly accumulated towards the surface of the rocks; and then, by the abrasion and dispersion of their *superficial* parts, the richest golden materials have been spread out, in limited patches, and generally near the bottom of basin-shaped accumulations of detritus. Now, as every heap of these broken auriferous materials in foreign lands has as well defined a base as each gravel-pit of our own country, it is quite certain that hollows so occupied, whether in California or Australia, must be dug out and exhausted in a greater or less period. In fact, all similar deposits in the Old or New World have had their gold abstracted from heaps whose areas have been traced and whose bottoms were reached. Not proceeding beyond the evidences registered in the stone-book of Nature, it may therefore be affirmed, that the period of such exhaustion in each country (for the deposits are much shallower in some tracts than in others) will, in great measure, depend on the amount of population and the activity of the workmen in each locality. Anglo-Saxon energy, for example, as applied in California and Australia, may in a few years accomplish results which could only have been attained in centuries by a scanty and lazy indigenous population; and thus *the present large flow of gold into Europe from such tracts, will, in my opinion, begin to diminish within a comparatively short period.* * * In conclusion, let me express my opinion, that the fear that gold may be greatly depreciated, in value relatively to silver—a fear which may have seized upon the minds of some of my readers—is unwarranted by the data registered in the crust of the earth. Gold is, after all, by far the most restricted—in its native distribution—of the precious metals. Silver and argentiferous lead, on the contrary, expand so largely downwards into the bowels of the rocks, as to lead us to believe that they must yield enormous profits to the skilful miner for ages to come; and the more so in proportion as better machinery and new inventions shall lessen the difficulty of subterranean mining. It may, indeed, well be doubted whether the quantities of gold and silver, procurable from regions unknown to our progenitors, will prove more then sufficient to meet the exigencies of an enormously increased population and our augmenting commerce and luxury. But this is not a theme for a geologist; and I would simply say, that Providence seems to have originally adjusted the relative value of these two precious metals, and that their relations, having remained the same for ages, will long survive all theories. Modern science, instead of contradicting only confirms the truth of the aphorism of the patriarch Job, which thus shadowed forth the downward persistence of the one and the superficial distribution of the other:—'Surely there is *a vein* for the silver......The earth hath *dust of gold.*,'"

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* *Siluria: or the History of the Oldest Known Rocks containing Organic Remains.* By Sir Roderick Impey Murchison.

The Society of Arts.

The Society of Arts was established at a meeting held on the 22d March, 1754, at which it received the designation which it still retains —"The Society for the Encouragement of Arts, Manufactures, and Commerce in Great Britain." The first stone of the present building was laid on the 28th March, 1772; the two brothers, ROBERT and JOHN ADAM, from whom the *Adelphi* derives its name, were its architects, and the Society first occupied it in 1774. Within the period which has since passed, many valuable inventions which now minister to our wants and our enjoyments, trace their origin to that association.—Many distinguished men owe to the opportunities it presented their eminence in public life; and favourable audiences have constantly, during the discussions of the Society blushed at the hesitating timidity of GOLDSMITH, and admired the profound and massive wisdom of JOHNSON. Its objects, like its means, were at first limited, but the six celebrated pictures in the Council Room, painted by BARRY between the years 1777 and 1783, while highly illustrative of the state of the arts at that day, enable us in some degree to contrast the advance which civilization and science have since made in manufactures and commerce. With the Society of Arts originated the conception of the Great Exhibition of 1851; and in the Crystal Palace at Sydenham, on Monday the 3d July, it celebrated its centenary by a public dinner, at which nearly 800 persons were present, and over which Earl GRANVILLE, in the absence of the Duke of NEWCASTLE, presided. The temple which then surrounded that assembly, dedicated to all the triumphs of ancient and modern art, would not now excite our admiration, exalt our race, and illustrate our age, were it not for the prudent and philosophic efforts of the humble but long unconscious founders of the early institution. A century hence will find those who joined in that celebration all equally silent; and it is beyond the speculative powers of the most reflective mind to anticipate what fresh triumphs genius, science, and art may unfold, to grace and adorn the revival of such an anniversary.

Electro-magnetic Engraving Machine.

This machine is somewhat on the principle of the well-known planing machine. The drawing to be copied and the plate to be engraved are placed side by side, on the moveable table or lid of the machine; a pointer or feeler is so connected, by means of a horizontal bar, with a graver, that when the bar is moved, the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. It is obvious that in this condition of things, a continuous line would be cut on the plate, and, a lateral motion being given to the bed, a series of such lines would be cut parallel to and touching each other, the feeler of course passing in a corresponding manner over the drawing. If, then, a means could be devised for causing the graver to act only when the point of the feeler passed over a portion of the drawing, it is clear we should get a plate engraved, line for line, with the object to be copied. This is accomplished by placing the graver under the control of two electro-magnets, acting alternately, the one to draw the graver from the plate, the other to press it down on it. The coil enveloping one of these magnets is in connexion with the feeler, which is made of metal. The drawing is made on a metallic or conducting surface, with a rosined ink or some other non-conducting substance. An electric current is then established so that when the feeler rests on the metallic surface, it passes through the coils of the magnet, and causes it to lift the graver from the plate to be engraved. As soon as the feeler reaches the drawing, and passes over the non-conducting ink, the current of electricity is broken, and the magnet ceases to act, and by a self-acting mechanical arrangement the current is at the same time diverted through the coils of the second magnet, which then acts powerfully and presses the graver down. This operation being repeated until the feeler has passed in parallel lines over the whole of the drawing, a plate is obtained engraved to a uniform depth, with a fac-simile of the drawing. From this a type-metal cast is taken, which, being a reverse in all respects of the engraved plate, is at once fitted for use as a block for surface printing. The machine is the invention of Mr. William Hansen, of Gotha.—*Journal of the Society of Arts.*

On the Colouring of Wool by Murexide.

Prout discovered the peculiar substance described by him under the name of purpurate of ammonia, which was afterwards very fully examined by Liebig and Wöhler and received from them the name of murexide, from murex, a shell-fish, from which the celebrated Syrian purple was supposed to have been obtained. This most curious substance exhibits in an extraordinary degree, the property of dichroism, being of a splendid garnet red by transmitted, and of a beautiful iridescent green by reflected light; s preparation, however, is somewhat complicated, being produced according to Gregory's process, by the action of carbonate of ammonia on a mixture of alloxan and alloxantine, two bodies resulting from the action of nitric acid, &c., upon uric acid.

No method of fixing this beautiful colour on textile fabrics has been discovered, until lately the subject having engaged the attention of M. M. Sace and Schlumberger, a process has been invented by which cloth can be dyed of a colour far surpassing that produced by cochineal.

It was well known that the skin when moistened with a solution of alloxan and exposed to the air, became purple, and M. Schlumberger soaks the cloth in a solution of that substance, squeezes out the excess of liquid by pressure between rollers, dries at a gentle temperature, and after ageing for twenty-four hours, brings out the colour completely by passing the cloth over a roller heated to 212° Fahr.

The colour appears as if by magic, and is said to be far superior to that produced by any preparation of cochineal, or by red dye-woods.—The cloth previous to being put into the dye-beck must be mordanted with weak tin salts, as unmordanted cloth does not give so satisfactory a result. It has also been found by M. Dollfuss that the process of ageing may be replaced by simple exposure to the vapors of ammonia.

The colour cannot be applied to cotton and silk, but only to wool; it resists sun-light very strongly, but it is partially destroyed by boiling water, especially if the cloth had been mordanted previous to the application of the alloxan. It is also destroyed by alkalies; and, hence, after a time by soap. Various shades can be produced by using solutions of different degrees of strength.

The price of the dye-stuff would exceed that of cochineal, but would be much lowered if uric acid became an article of commerce, as this substance can be readily obtained from pigeon's dung, guano, and the excrement of all carnivorous birds.

M. Schlumberger has indulged in some curious speculations relative to the existence of this colouring matter ready formed in nature. M. Sace has found that poultry, and especially birds with a very brilliant plumage such as the parroquets, do not produce sensible traces of the uric acid during the moulting period, whilst the quantity is very large when their feathers are fully developed. The question naturally arises, What beomes of the uric acid? May it not be transformed by some as yet unknown metamorphosis in the animal body, into a substance like alloxan, capable of colouring the feathers? From the dichroism of murexide, above noticed, it is evident that this substance is capable of producing all shades of colours which are made up of red, blue and yellow. Hence, it is probable, that murexide is the cause of the brilliant plumage in birds. Further, it is chiefly those animals which have but one exit for their excrements, and who produce large quantities of uric acid, that exhibit a display of colours. Thus we have the skin of the serpent and lizard, the wings of butterflies, the scales of fish, often coloured in the most gorgeous manner; whilst the skins of mammalia are generally dull, and without that metallic lustre and iridescence so peculiar to the animals above mentioned. These however are mere speculations.

The ancients were acquainted with a process for dyeing wool of a fine purple, which has been lost to our days; but, tradition tells us, that this beautiful tint was produced by pounding a quantity of small shell-fish, and adding to the mass, either a quantity of urine in a state of putrefaction or water in which some of the same shell-fish had been allowed to putrefy. The cloth soaked in the liquid thus produced, only developed the beautiful purple colour after long exposure to the air, and probably to heat. It seems probable that the Tyrian purple was produced by murexide.

Manufacture of Paraffine from Bituminous Shale.

Immense quantities of black bituminous Shale exist in Upper Canada. The Utica Slate and the Hamilton group are especially rich in Bitumen. The distribution of these rocks in Upper Canada will be seen by an inspection of the Geological Map which accompanies Mr. Logan's admirable paper. We have before had occasion to refer to the attention with which the bituminous Shales of Canada have been distinguished. It will be some relief to those who have speculated vainly upon their value as a combustible material to find that they may be employed for the production of Paraffine.

" The process of distilling bituminous Shale, first effected on a large scale by Selligue, in France, is now carried on with great success by Wiesmann & Co., at Beuel, near Bonn, on the Rhine. The paraffine is employed in the manufacture of candles, and has been found to *compete advantageously with wax and spermaceti*, at 66⅔ dollars (£10 6s. 4d.) the 100 lbs., or something more than 2s. per lb. The lightest volatile oil obtained has a specific gravity of 0·730, and like the benzin of coal tar, is well adapted for cleaning clothes, gloves, &c., as a solvent for various resins, &c. It is also mixed with the denser oils, and produces a mixture of a specific gravity of 0·830, which is used as camphine in lamps. It is of a light straw colour, and is sold in zinc jars, at the rate of 30 dollars (£4 12s. 6d.) per 100 quarts. or somewhat less than 1s. per quart. The fixed oils are rendered drying, and are employed for painting external wood-work, &c. It is also occasionally burned for the production of fine lamp-black for the manufacture of lithographic and letter-press printing ink. A quantity of asphalte is also obtained, which is used for various purposes; and a greasy stuff, which is used for lubricating the axles, &c., of corves and other waggons in mines, &c. The success of this manufacture is very encouraging for the promoters of the similar one from turf, now completed near Athy.—*Polytechnisches Centralblatt.*

The Ontario, Simcoe, and Huron Railroad.

The Report submitted by the Board of Directors to the Proprietors, at their annual meeting, July 17th, 1854, furnishes a very satisfactory and encouraging account of the present operation of this important line and its future prospects. This Report having already appeared, *in extenso*, in various public journals, we shall confine ourselves to a brief abstract of its contents:—

The entire length of this line, from Toronto to Collingwood Harbor, Lake Huron, is 94½ miles; 64½ miles are now in permanent operation, and served by the following way stations—

Way Stations.	Miles from Toronto.	Way Stations.	Miles from Toronto.
1. Davenport Road......	5·1	9. Holland Landing ...	38·1
2. Weston	8·0	10. Bradford	41·7
3. York	11·8	11. Scanlans..............	44·6
4. Thornhill	14·5	12. Lefroy..................	52·0
5. Richmond Hill........	18·5	13. Bell Ewart (branch)	53·5
6. King	22·8	14. Pratts	59·5
7. Aurora..................	30·1	15. Barrie..................	63·2
8. Newmarket...........	34·4		

The Company's steamer *Morning* makes the daily circuit of Lake Simcoe, and thus establishes a regular connection between Toronto and the country bordering a shore of nearly 150 miles.

The northern division of the line, from Barrie to Collingwood, 31½ miles in length, will be completed early in September. The selection of Collingwood Harbour by the Chief Engineer has proved very judicious, and the necessary works for the safety of shipping are in rapid progress.

Lighthouses are already being constructed by the Government for the safe navigation of Georgian Bay and its channels to Lake Huron. The uncertainty in which the City Esplanade works appear to be involved, will not permit of permanent wharfage and depots to be constructed at Toronto until all doubt as to the intentions of other railway companies is removed. The entire cost of the road, up to the 1st July, amounts to £702,286. 1s. 3d., including construction of line, locomotive and general rolling stock, way stations, terminal depot, harbour and steamboat services. With reference to the through route, the Chief Engineer, Mr. Cumberland, records the following encouraging opinion of the prospects of the Northern Road:—

"It has always been urged that the trade of the north-western territory of the United States, as well as of that of the mineral regions of Lake Superior, would find a cheaper, more facile, and rapid outlet to the Atlantic, by your Road, than by any other possible line of transit. Nothing has yet occurred, or is likely to present itself, to weaken this position."

The Superintendent's Report is a voluminous and talented exposition of the working cost, expenditure, returns, and, more particularly, the prospects of the line. The traffic exceeds the most sanguine expectations which had been formed of it. Without any through travel the receipts have gradually increased until they now equal the earnings per mile of the Montreal and Portland section of the Grand Trunk Railway. From a local traffic alone the road is earning £15 currency per mile per week, and Mr. Brunel estimates that, by a judicious management, a through traffic may be obtained which will yield a gross revenue of £80,000, making, with the local traffic, £135,000 per annum, of which 50 per cent. will be required for current expenses, leaving £68,000 for net revenue, or 8 per cent. on the entire cost of the Road: which, after paying 6 per cent. interest on the debt, leaves a dividend of 14 per cent on the stock issued.

With respect to the future prospects of the Road, we subjoin the following extracts from the Superintendent's Report—

"Notwithstanding the severe competition which exists between the various parallel lines of railroads terminating at the Atlantic cities of the United States, it is shown by statistics of the clearest and most satisfactory nature, given by W. J. McAlpine, Esq., in his Report on the Canals of the State of New York, for 1853, that, in the conveyance of freight, railways cannot compete with water carriage on the limited scale afforded by the Erie Canal; how much less, then, can they compete with our magnificent lake navigation! and herein lies the strength of your route as compared with all others, for by connecting the navigation of the lakes, by spanning the isthmus of Canada, at the narrowest point, your road shortens the aggregate distance between Lake Michigan and the Atlantic cities some 300 miles, avoids the tedious navigation of the St. Clair Flats, over which large vessels are usually lighted, and saves the tolls, expenses, and delays incident to the Welland Canal, by the introduction of but 93 miles of railway."

"Nor is your road less favourably situated as regards a passenger business. Your northern terminus on Lake Huron will, on completion of your line, be reached in 22 hours from New York, and in 28 hours from Boston. From your terminus the traveller can be conveyed to Milwaukie in 34 hours, through a navigation of which 200 miles is as safely sheltered as the Hudson or St. Lawrence rivers, and through which the scenery is infinitely superior to either; thus Milwaukie can be reached in 56 hours, by a route so agreeably diversified by changes from steamboat to railroad as to afford every desirable rest and refreshment."

"Comparing this with the shortest possible route between the same points, we find that the same journey can be performed by a continuous line of express railway travel, on which no rest or change is afforded, except from one set of cars to another, and by crossing the bridge and ferry at the Niagara and Detroit frontiers, in 46 hours, thus saving, at the expense of all comfort, rest, and convenience, 10 hours; for which, however, the traveller must pay not less than six dollars in money, and at least one day to recruit himself for business. Nor will the traveller for Chicago fail to discover the greater convenience of your road, for, by the loss of only 16 hours in a journey of one thousand miles, which will be spent in the enjoyment of necessary repose, he can reach his destination fresh and ready for business at a less expense than by the shortest railway route, and, if necessary, ready to proceed at once on his further journey into the interior, over any of the numerous railways diverging from Chicago."

The following statistics of the line are interesting. They are contained in the Appendix to the Report—

Number of passengers of all classes carried in cars:—

Adults	106,391
Children	3,542
Free, and carried for construction	8,038

Number of miles travelled by passengers of all classes, or number of passengers carried one mile:—

Adults	2,875,742
Children	94,749
Free, and carried for construction	215,016
	3,184,489

It is worthy of note that the traffic on this line has been in the ratio of upwards of three million passengers carried one mile in twelve months, *without* the occurrence of an accident—a circumstance without a parallel, we believe, on this continent, and one which reflects the greatest credit on the superintendence of Mr. Brunel.

NUMBER OF TONS OF FREIGHT OF 2000lbs. CARRIED.

Moving.	1st Class.	2d Class.	3d Class.	Wheat.	Flour.	Car Loads, Various.	Total.
North	1191	2462¼	3320¾	8	......	790	7772
South	264½	891	937¼	6338	7518¾	13320	29360

Total number of Tons......37,132

Total movement of freight or number of tons carried 1 mile. 1,239,763½

	Miles.
Average rate of speed adopted by ordinary Passenger Train (including stops) per hour	20
Rate of speed when in motion	25
Average rate of speed of Express Trains (including stops) per hour	25
Rate of speed when in motion	30
Average rate of speed of Freight Trains (including stops) per hour	12
Rate of speed when in motion	17
Average weight in Tons of Passenger Trains, exclusive of Engine, Passengers, and Baggage	53
Average weight in Tons of Freight Trains, exclusive of Engine and average Freight, tons (2000 lbs.)	60

Canada Grand Trunk Railway.

We have not space to notice at length the Report of the Directors and Engineer of the Grand Trunk Railroad, just published. We shall, however, give copious extracts in the next issue of this Journal. Meanwhile, we quote the opinion of the *American Railroad Journal* on that portion of this stupendous work which is in active operation:—

"The road is unquestionably one of the best constructed works of this kind in the country. Though traversing for nearly 100 miles the most mountainous portion of the Eastern States, it has an admirable line, with no grades imposing a serious impediment to a heavy traffic. There is no road in the United States where, to a stranger, there are so many apparent obstacles, but which disappear one after another as they are approached. Just the appropriate kind of solution appears to have been resorted to in each emergency, and a person riding over the road experiences a satisfaction similar to what he feels at the contemplation of any perfect specimen of *art*. The road is certainly one of our best specimens of engineering skill, and one in which *science* has contributed most in guiding and assisting *labour*. The work may be regarded as a *chef d'œuvre*."

The earnings on 292 miles of road in operation, for the week ending July 22nd, 1854, were from the following sources:—

No. 4,579	Passengers, first class	$5,332 95
No. 323½	Passengers, second class	235 90
No. 2,418¾	Tons Merchandise	5,865 84
No. 557,627	Feet of Lumber	2,027 12
No. 943	Cords of Fire Wood	1,318 90
Mails, &c.		779 27
Total earnings for the week		$15,559 98
Previous earnings since January 1, 1854		390,368 77
Total earnings since January 1st		$405,928 75

Canada Great Western Railway.

The earnings for the week ending August 4th, 1854, on 229 miles of road in operation, were from the following sources:—

From Passengers	£2,429	0	7
From Freight	589	8	6
From Sundries	268	10	4
Total earnings	£3,286	19	5
Amount of previous receipts	144,456	14	2½
Total receipts since the 1st of January	£147,743	13	7½
Total number of Passengers since 1st January	202,565½		

Nova Scotia Railways.

The *State of Maine* informs us that Nova Scotia and New Brunswick have both adopted the gauge of 5½ feet making it uniform with the line of the Grand Trunk Railway of Canada; and when the various sections, the "*disjecta membra*," in Canada, Maine, and in the provinces east, become connected, they will form an unbroken line of railway, of uniform gauge, from Halifax to Detroit.

In 1853 Nova Scotia provisionally agreed to adopt the "Company principle," similar to that of New Brunswick, and six months time was allowed after the royal assent, for the organization of the Company.—On the failure of this, "the government scheme" was to come into operation.

The war in Europe checked, and in fact defeated the plans of those who sought to inaugurate the Company within the six months, and at the end of that time Mr. Howe introduced and carried through Parliament his scheme for a government line.

The work was commenced on the 8th of June, 1854, at Halifax, and a section of some ten miles is under contract to be opened this year.—An additional section of fifteen miles will be opened in 1855.

The first 25 miles forms a common Trunk for the lines running to Amherst, to Windsor and to Pictou, and we learn from Mr. Howe that they intend to push the Trunk line to the frontier of New Brunswick, so as to meet their line at that point, as soon as it can reach it, from St. John. They will then extend branch lines to Windsor and Pictou as occasion may require.

The Province of Nova Scotia has an overflowing Treasury, and is free of debt. For some years to come, the city of Halifax will furnish a ready market for her debentures, at 5 per cent, and as the line proposed will form an important link in the Great Trunk Railway from Halifax to the United States and Canada, no fears are entertained as to the paying qualities of the Line."

Railways in New Brunswick.

We learn (says the same authority) from A. C. Morton, Esq. Chief Engineer of the European and North American Railway, in New Brunswick, who is now in this city, that the contractors for building the East and North American Railway in that Province, Messrs. Jackson, Brassey, Peto and Betts, are pushing on, with all practicable despatch, the construction of the entire line from St. John to the Gulf of St. Lawrence, and to the frontier of Nova Scotia. A large portion of the rails are already delivered, and the iron bridges are either all received, or already shipped from England. All the principal bridges are of iron, similar to those going up on the Quebec and Richmond Railway, and the road is to be of a superior character throughout.

Some difficulty exists, from the scarcity of labourers, but from the present posture of the work it is believed that during the coming year the line may be completed from St. John to the Nova Scotia line. The locating surveys are finished, and the work is sub-let to American contractors.

Niagara Suspension Bridge.—The new Suspension Bridge over the Niagara River, connecting the Great Western and New York Centr l Railways, will possess a strength equal to six times the tension that can be produced by a maximum strain on the upper floor and a full load on the lower floor at the same time. —The permanent tension of the cables from their own weight and that of the superstructure, will be only one-tenth of their ultimate strength. There is, therefore, ample provision for safety. Moreover, the whole structure will be so arranged and stayed, that no oscillations or very perceptible movement can take place. A hurricane which would prostrate the whole city of Buffalo, and every wooden bridge in the country would be harmless to this bridge—so well will it be guarded by stays.

Angle Railroad Wheels.—One of the most interesting sights in Paris, and one that no American ever thinks of visiting, as he probably never heard of it, is the railroad from the Barrier d' Enfer to Sceaux. It is but seven miles long, and was built as an experiment upon a new system of wheels. The engine, tender, and hindermost car of the train, are furnished with oblique wheels, under the ordinary upright ones. Where the track is straight, these do not touch the rails; but at the curves, they come into play, rattling along the inner edge of the rails, and preventing the train from running off the track. The road was therefore made purposely tortuous, and the most sudden and seemingly dangerous bends were introduced at frequent intervals. The two stations are circular, and the train as it receives its passengers, is doubled up into a ring of 50 feet radius. The smallest curve upon the road is 68 feet radius, and over this the train goes at full speed. The corners of the cars are cut off, so that the vehicles, in following the curves, do not infringe upon each other. Sceaux is upon an eminence, which the road ascends spirally, with something like a mile of tract—it only going, in advance, a hundred feet. The invention—which, by the way, is ten years old—has proved practically very successful; but it has never been applied to any extent. *Daily Times N. Y.*

Paper from Wood.—In the last sitting of the Societe d'Encouragement pour l'Industrie Nationale a paper was read setting forth a plan for making paper from wood. The bark is first taken off the wood, and the wood is then cut in such a way as to be easily made into shavings; the shavings are then cut very thin; next they are placed in water for six or eight days, then they are dried, afterwards they are reduced to the finest powder possible by the means of a corn mill. This powder is then mixed with the rags which serve to prepare the pulp of paper, and the ordinary operation of paper making is proceeded to. All white woods, such as the poplar, the lime, and the willow, are suitable for the purpose, but the discoverer ascribes a good deal of his success to the quality of water he employed—that of the little river Dollar, which runs near Mulhouse. For the first experiment he employed the wood of the trembling poplar, and he presented specimens of paper made from it.

Canadian Institute.

EXTRACTS FROM THE MINUTES OF COUNCIL, JUNE 3RD, 1854.

G. W. Allan, Esq., Secretary of the Canadian Institute, offered a piece of ground on George Street, 50 feet frontage by 130 in depth, as a site for a building for the purposes of the Institute.

Mr. Allan's liberal offer was cordially accepted by the Council, and the thanks of the Institute were ordered to be given to that gentleman.

A donation from the Rev. G. Bell, of Simcoe, was announced. Mr. Bell's donation consisted of a large number of Indian Remains and Geological Specimens.

The thanks of the Institute were ordered to be transmitted to the Rev. Mr. Bell, for his valuable donations.

The following gentlemen were proposed Members of the Institute:—

Mr. Small, ... Collingwood Harbour.
Rev. Professor J. Smith, ... Kingston.
Rev. Professor J. Williamson,... Kingston.
Mr. H. N. Courtlandt .... Simcoe.

COUNCIL MEETING, JULY 21ST, 1854.

The following donations were announced by the Vice President.—

"The Bombay Magnetical and Meteorological Observations," presented by the Hon. East India Company.

A specimen of the Ornithorhyncus, from Australia, presented by Mr. Maurice Baldwin, of Toronto.

Twenty-four volumes of Bohn's Scientific, Standard, Antiquarian, Classical, and Illustrated Library, presented by H. G. Bohn, Esq., London, through A. H. Armour, Esq., Toronto.

The Census of the United States, and the Documentary History of the State of New York, presented by A. H. Armour, Esq.

The thanks of the Council were ordered to be transmitted to the Honourable East India Company, Mr. Maurice Baldwin, Mr. Bohn, and Mr. Armour, for their respective donations.

Mr. Richard Denison, of the township of York, and Mr. George Wilson, of the City of New York, United States, were proposed members of the Institute.

COUNCIL MEETING, AUGUST 9TH, 1854.

The following Donation from A. H. Armour, Esq., Toronto, was announced:—

Schoolcraft's History, Condition and Prospects of the Indian Tribes; Parts First, Third, and Fourth.

Report of the Superintendent of the United States Coast Survey for the year 1852.

Report of the Commissioners of Patents for the year 1853; Part I., Arts and Manufactures.

Mr. Armour's donation was accompanied by a letter, informing the Council that he was indebted to the liberality of the Hon. G. W. Manypenny, Commissioner of Indian Affairs, the Hon. J. M. Brodhead, Washington, and Ellicott Evans, Esq., Buffalo, for the above-mentioned valuable works.

The following resolutions were ordered to be transmitted to Mr. Armour:—

"*Resolved*—That the best thanks of the Council be tendered to Mr. Armour for his valuable donation, and for his constant and active zeal in promoting the interests of the Institute."

"*Resolved*,—That the thanks of the Council be tendered to the gentlemen mentioned by Mr. Armour as having so liberally assisted in obtaining this valuable addition to the Library."

COUNCIL MEETING, AUGUST 23RD, 1854.

The following gentlemen were proposed members:—

Mr. J. U. Thomson .... Toronto.
Mr. D. B. Reid .... "
Mr. D. O. French .... "

"*Resolved*,—That the thanks of the Council be transmitted to Lieutenant A. Noble, R.A., for his valuable Monthly tables of the Meteorology of Quebec, communicated by him to the Canadian Journal, and that the Council desire to express their regret at the suspension of the Quebec table, on account of the removal of Lieutenant Noble to Montreal.

"*Resolved*,—That the thanks of the Council be transmitted to Dr, Smallwood, St. Martin, Isle Jesus, and to Professor Cherriman, Director of the Provincial Magnetic Observatory, for the valuable monthly Meteorological tables of Isle Jesus and Toronto.

Robert Stephenson, M.P.

The Library of the Canadian Institute has recently been enriched by contributions from various sources. Appropriate acknowledgments of this encouraging liberality—which is rapidly creating a permanent and most valuable adjunct to the Institute—have been duly inserted in the extracts from the Minutes of Council. It is with great pleasure that we have to announce in addition to recent contributions already noticed, a most valuable donation from the distinguished engineer, Robert Stephenson, Esq., M.P.

Mr. Stephenson's donation consists of the celebrated work on "The Britannia and Conway Tubular Bridges, with general inquiries on Beams and on the Properties of Materials used in construction, by Edwin Clark, resident Engineer. Published with the sanction, and under the supervision, of Robert Stephenson."

A magnificent folio volume of plates, illustrating the Britannia and Conway Tubular Bridges.

The Quebec Meteorological Table.

The Meteorological Table for Quebec, which has been kindly furnished to this Journal for several months past by Lieutenant A. Noble, R.A., will no longer appear in its usual place. It is with great regret that we make this announcement, as we conceive that the absence of so important a link in the chain of Meteorological observation, which has hitherto been so well sustained, will be seriously felt by all interested in this department of Science. The occasion of the suspension of the Quebec observations is the removal of Lieutenant Noble to Montreal. The Council of the Institute have expressed their sense of Lieutenant Noble's active exertions in the cause of Canadian Meteorology, by transmitting to him their thanks for his monthly contribution to this journal. A copy of this resolution, as well as of one transmitted to Dr. Smallwood, of St. Martin, Isle Jesus, and Professor Cherriman, Toronto, will be found in the Extracts of the Minutes of Council.

Geological Map of a portion of Western Canada.

We are most reluctantly compelled to issue a considerable quantity of the August number of this journal with *uncoloured* geological Maps and sections illustrating Mr. Logan's valuable paper on the Physical Structure of the Western District of Upper Canada. Notwithstanding every effort made to ensure and expedite the rather tedious process of carefully colouring many hundred Maps with not less than fourteen different tints, we have been disappointed in procuring the requisite number. We have preferred, however, to publish the full complement of our present issue, rather than disappoint by delay a considerable proportion of the members of the Institute, as well as Subscribers to the Journal. This determination has been less reluctantly adopted on account of the expressed intention of the Council to furnish all those gentlemen whose names are now upon the books of the Institute, with a coloured copy of Mr. Logan's Map, as soon as they are completed.

Miscellanea.

Gold Mining in England—Extraction of Sulphur—Age of Man on the Earth—Sewage Manure—Electric Colour Company—Crystal Palace—Wheeling Suspension Bridge—Trade Museum in London—Wisconsin Lead—Longitude of Cambridge—New Planet—Moon's Surface—Specula of Telescopes—Columbiades—Iron Furnaces in Great Britain—Revenue, Expenditure, and Commerce of Great Britain—Cotton from India—Casualties at Sea—Egyptian Railroad—Madame Sontag—Canadian Exports to Oswego.

Gold Mining in England is a failure. The auriferous gossan of the Poltimore appears to be already practically exhausted. Strong suspicions of "Salting" the specimens upon which the examinations were made and reports founded, are expressed. The gold Mining share market (England) is in a very depressed condition. A general want of confidence exists in all Quartz Mining Gold Companies. This feeling extends both to California and Australia.

Several Companies have been formed in England for the extraction of Sulphur from various Minerals. This is a consequence of the eccentric manœuvre of the King of the Two Sicilies, who declared Sulphur one of the articles contraband of war,—and hence prohibited its exportation from his dominions, much to the discomfiture of a vast multitude of chemical and other manufacturers in England. The annual consumption in Great Britain and Ireland, amounts to 60,000 tons, which at £5 a ton, equals £300,000 a year. It appears, however, that owing to the remonstrances of her Majesty's Minister at the Court of Naples, the King has removed the prohibition regarding the export of Sulphur, which is only considered contraband of war according to circumstances, and the port to which it may be conveyed; and that when sent out in its native or unmanufactured state, it may be presumed to be destined for peaceful and not warlike purposes, especially when shipped to a mercantile port—all vessels being allowed to convey it, with the exception of native bottoms,

The Mining Journal says that the volcanic Sulphur, which we have hitherto obtained from Sicily, owing to its freedom from impurities, has been of great importance to us in several of our manufanufacfor many purposes. Were we to avail ourselves of the resources we possess at home, in a great measure we should be independent of the supply derived from foreign sources.

It is with considerable satisfaction we see that the question has already excited some interest among many influential people connected with our home mines. A company has been formed at Conway for working the Sulphur in that district, which, it is stated, is nearly free from any deleterious mixture. Several other associations are in course of formation for the same purpose. Mines in Wales which are not profitable for copper would, if worked for sulphur, become paying; and the refuse which is thrown away in Cornwall might be likewise rendered available. In several of the States of Germany, where mining operations are carried on by a very simple process, a comparatively pure Sulphur is obtained from the mundicy ores there produced.

In an essay just published, Dr. Usher, an American geologist, unhesitatingly pronounces on the age of man on the surface of the earth, from remains, found more especially in America. Speaking of the remains of a single human being found on the banks of the Mississippi, at a depth of 16 feet in the soil, he says, from this it appears that the human race existed in the delta of the Mississippi more than 57,000 years ago.

Prof. White, agricultural chemist, and Mr. Henry Stothert, patentee, of the Sewage Deodorising and Patent Manure Company, have had an interview with Viscount Palmerston, for the purpose of submitting to his Lordship specimens of oats and barley grown upon clean sand, and cultivated by means of pellucid sewage water.

The Electric Power, Light and Colour Company, are advertising their Colours and state that they are prepared to supply the trade with Colours unequalled in quality and lowness of price. A notice of this important manufacture will be found in the 1st vol. of the Canadian Journal.

Twenty thousand three hundred and seventy Season Tickets of the Crystal Palace, Sydenham, have been sold up to July 7th.

A Boston journal says, that the original cost of the Wheeling Suspension Bridge, which was blown down in a heavy gale some weeks since, was $170,000, and the damage occasioned by its recent fall was about $100,000. The towers from which it was suspen ed rise 153½ feet above the low water level of the Ohio River on the Wheeling side, and 132¾ ft. high on Zane's Island. The Bridge flooring in the centre of the river was 93 feet above low-water mark—or so low that in times of great freshets some of the river steamers, with their tall chimneys, were unable to pass beneath it. The bridge was suspended from ten cables, each composed of 550 strands of No. 10 wire, and two smaller cables of 140 strands each. The cables were 1380 feet long from anchor to anchor, and were estimated, by Mr. Ellett, the builder, to be capable of supporting a weight of 297 tons, equal to 4000 men. The length of the span was greater than any other suspension bridge in the world.

The Council of the Society of Arts have determined to organize a Trade Museum. Her Majesty's Commissioners of the Great Exhibition of 1851, have agreed to co-operate most cordially with the Council of the Society of Arts, and to contribute annually out of their surplus funds in aid of a simultaneous collection of materials for the several branches of the proposed Trade Museum. The Smithsonian Institution at Washington has undertaken the general agency for the United States, and it is said that promises of assistance have been received from influential parties in the British Provinces. In an article on this important subject, the Mining Journal gives the names of gentlemen in England, Europe and India, whose active co-operation has been solicited or tendered. We should like to know how far and by whom Canada is represented in this undertaking.

In the same paper we find that irrespective altogether of the intended Trade Museum, the Society opened, in St. Martin's Hall, on the evening of Tuesday, the 4th July, their Educational Exhibition of Apparatus and School Literature, contributed by nearly 400 exhibitors. A numerous body of its members assembled for the special purpose of meeting Prince Albert, the president of the society. The exhibition is now open to the public; several commissioners have been appointed by Foreign Governments to visit, inspect it, and report on its results. The visitor will find it exclusively devoted to educational advancement, and although to a certain extent experimental, and the arrangements as yet incomplete, it must prove pre-eminently useful in centralizing for public inspection the evidences and examples of all the most approved systems, for the benefit of all engaged or interested in educational pursuits. Those who come in the hope of such attractions as dazzle by the glare of their splendour at Sydenham, will be disappointed; the design, the arrangements and the display are purely utilitarian, the avowed object being the improved condition of the people.

During the past 12 years, the quantity of lead produced from the Wisconsin Lead region alone was 7,103,418 pigs, weighing 497,241,360 lbs., and realizing $16,657,989. The yearly returns have varied from 425,814 pigs to 778,498, or from 28,603,960 lbs. to 54,494,862 lbs.

At a late meeting of the Astronomical Society, Professor Challis read a paper on "the Determination of the Longitude of Cambridge, from observations by Galvanic signals, it was stated that the result was obtained from 281 signals, which gave the final determination of the longitude of Cambridge Observatory at 22·69 east. This determination is 0·85 *less* than that which had been used, and upon which no suspicion at all rested of being in error to any thing like that amount.

Mr. J. R. Hind, London, has discovered another new planet. It is like a star of the tenth magnitude, and is situated almost exactly upon the ecliptic, about midway between two stars of the fifth magnitude—29 and 32 of Hamsteed in Capricornus.

The Earl of Rosse says, that he does not believe there is any known photographic process, which is sufficiently sensitive to give details of the Moon's surface in the least degree approaching to the way in which they are brought out by the eye.

The same Nobleman in a letter to the Astronomer Royal, a portion of which is published in the Atheneum of June 17th, says, in relation to specula for telescopes:—"You recollect, no doubt, how greatly superior silver would be to speculum metal, if it could be as well and and as easily polished as speculum metal. At the Ipswich meeting of the British Association, I described a process which had been, to a certain extent, successful. It is difficult, however, and uncertain; and as a silver surface is very perishable, it would scarcely be worth while to employ it, except under special circumstances. Another method which I have very recently tried is perfectly easy, and promises well. A plate of glass is coated with silver by precipitation from saccharate of silver. The silver film is then varnished with tincture of shell-lac, and when dry, the temperature of the glass is gradually raised to the fusing point of shell-lac. Pieces of shell-lac are then laid upon it, and over them a piece of thick glass. A slight weight presses out the superfluous shell-lac, and the whole having gradually cooled, the silver film adheres permanently to the shell-lac, the glass upon which it had been originally precipitated being easily removed without injuring it. We have thus a silver surface apparently as true as the glass upon which it has been precipitated, and with a beautiful polish. The experiment is imperfect so far as this, that as yet merely common plate glass has been tried, and not a true glass surface; and as I am about to set out for London, I shall have no opportunity for some time of completing these experiments. With the view of applying Mr. Lassell's levers to one of our 6-foot specula, should there be a reasonable prospect of improving its performance in that way, I have tried some experiments as to the practicability of drilling speculum metal. I find it can be drilled by a tubular drill of soft iron and emery, the core being from time to time removed by a pointed chisel, and a very light hammer, by which it can be safely broken up gradually. A drill with diamonds set in a groove, cuts it well also; and even a drill of perfectly hard steel, revolving slowly, cuts it well; so that there can be no serious difficulty in making the necessary perforations."

At the Fort Pitt works, Pittsburg, the proprietors are engaged on a Government order for 21 guns of the heaviest calibre, called "Columbiades," having a ten-inch bore and throwing a 124 pound shot. Lieutenant Rodman is the inventor of a new principle in casting ordnance. The cannon is cast hollow, and a constant and ever-renewed stream of water forced in, thus cooling the interior first instead of, as was the old plan, casting solid and allowing the outside to cool first. Cannon cast by both methods have been subjected to powerful tests, and it is found that those cast on the new principle bear five and six times the number of charges of those cast by the old method.

In the year 1806 the total number of Iron Furnaces in Great Britain was 216 and the production 243,851 tons: in 1852 the total number of Furnaces was 655 and the production 2,701,000 tons.

A Parliamentary paper just printed contains the following satisfactory statements relative to the Revenue, Expenditure and Commerce of the United Kingdom.

In the year 1853 the surplus of revenue was 3,254,505*l*, being the largest excess for ten years. The net amount of the several branches of the revenue of the United Kingdom paid in the exchequer was 54,430,344*l*. The expenditure out of the revenue paid in the same year was 51,174,839*l*. In 1853 the taxes repealed or reduced amounted to 3,247,474*l*, and the estimated amount imposed was 3,356,383*l*. At the end of last year the balances in the exchequer were 4,485,230*l*. The capital of the national debt last year was 770,-923,091*l*. The quantity of raw cotton imported last year was 895,266,-789*l*, and of wool, 111,396,445*l*. The total declared value of British and Irish produce exported last year was 93,357,306*l*. Last year the number of vessels built and registered was 798, of 203,171 tons. The number of vessels belonging to the United Kingdom last year, exclusive of river steamers, was 18,206, of 3,730,087 tons, and the men employed, exclusive of masters, was 172,525. The coinage in the year was 12,664,125*l*. The births in the year were 612,341, the deaths 421,775, and the marriages 162,185. The total paupers relieved were 818,315.

There appears to be no longer any doubt as to the capabilities of India to supply the United Kingdom with cotton. The London *Morning Chronicle* considers it as demonstrated beyond all question, that India can furnish cotton for the British Market. The inferiority of Indian Cotton compared with American arises from what befalls it subsequently to its production in the fields. Railways for transportation, and an improved method of collecting, cleaning, and packing are all alone required to enable Central India to furnish an immense and continually increasing supply.

In a list of casualities to British Shipping taken from a Parliamentary blue book, the startling fact is announced, that during the four years ending 1850, not less than 204 ships and their crews departed from the various ports of the United Kingdom, of which *not one was ever heard of again.*

The *Daily News* says, that the Egyptian Railroad is in good working order, and answers exceedingly well. The trains do not run on it at present at any stated periods. It is chiefly used when European or Indian passengers arrive in Egypt. English engine drivers are employed on it. The speed is about 20 miles an hour. The railway the whole distance between Alexandria and Cairo will soon be open. It passes through a level and most fertile country The Arabs do not know what to make of it. They were dancing before it some time since, and having no conception of its speed, they did not get out of the way in time, and an Arab woman was killed.

Madame Sontag, who died in Mexico, on June 18th, was forty-eight years old, having been born at Coblentz, on the 13th of May, 1805. She was the child of an obscure German actor and actress. She married a foreign gentleman of noble family, and until 1848, did not appear on the public stage. As one of the consequences of the Revolution of 1848, Madame Sontag was compelled by the vicissitudes of fortune to return to the Opera Houses of Europe.

In Hunt's Merchant Magazine, under the head "Foreign Trade of Oswego," we find the following statement:—"There has been a handsome aggregate increase, although there has been a falling off in the Importations of Canadian flour, of near one-half, as compared with last year. The cause of this we have before explained, the principal one *being the reciprocal free trade adopted between the Provinces, which has tended to divert Canadian Flour from our channels down the St. Lawrence.*" The deficiency at this point this year, is made up by the increased receipts of Canadian wheat. The receipts of three articles of largest import, from Canada for two seasons, have been as follows:—

		1852.	1853.
Flour	barrels	193,190	113,008
Wheat......................	bushels	1,362,482	1,781,157
Lumber	feet	75,500,000	121,288,329

Large amounts of the products of the forests, such as shingles, lath, railroad ties, oak and pine timber, &c., imported at this point, are not embraced in the above lumber figures.

Supplying Locomotives with Water.—A resident of Fredonia (N.S.), has invented a curious apparatus for supplying locomotives with water, according to which, a cistern must be constructed beneath the track, having connected with it a force pump, which in its turn is connected with a series of "friction wheels," inserted above it in the track. The locomotive is run upon these wheels, and then, however swiftly its wheels may revolve, it can go no further, as the friction wheels upon which it stands revolve with those of the engine. The force pump is in this manner set at work, and made to raise from 1500 to 5000 gallons per minute.

Properties of Iron.—The Philadelphia *Ledger* states, that in the concluding lecture of Prof. Smith at the Smithsonian Institute, the lecturer dwelt upon the tendency of iron to undergo a change from a fibrous to a granular condition—thus causing the abstraction of an indefinite amount of its tenacity and strength. Fibrous iron, by being for a considerable time subjected to concussion, will become granular and therefore weak. A knowledge of this principle has induced the French government to disallow the use of iron axles on their public *diligences* beyond a certain time; they must then be removed. Iron cannon, originally very strong, become weaker and weaker by use, from the loosening of the texture of their substance.

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

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

Magnet.	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.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch	Snow in inch.
						°	°	°	°														
a	1	29·940	29·928	29·897	29·919	47·4	60·2	49·4	54·25	0·236	0·300	0·266	0·269	·75	·59	·77	·66	E	S E b E	E	3·01	...	...
a	2	·918	·831	·769	·832	52·3	66·8	54·2	58 57	·251	·348	·262	·289	65	54	64	60	N N E	S S W	S S W	2·60	...	...
a	3	·773	·716	·658	·709	53·2	71·1	57·1	62·28	·319	·395	·335	·370	81	53	73	69	Calm	S	Calm	1·72	...	...
a	4	·647	·593	—	—	56·7	75·2	—	—	·316	·402	—	—	70	48	—	—	Calm	S	—	2·59	...	...
a	5	·553	·505	·480	·511	60·5	77·9	61·3	67·28	·366	·501	·414	·434	69	54	78	68	N b W	W N W	Calm	1·93	...	...
a	6	·493	·392	·398	·427	59·6	67·4	57·1	60·67	·376	·418	·367	·378	75	63	80	73	E	E	E N E	5·97	0·085	...
a	7	·396	·374	·385	·384	56·9	71·3	55·2	60·07	·417	·342	·367	·402	92	73	86	86	N E b E	S E b E	E b N	5·69	0·085	...
a	8	·310	·290	·334	·308	49·8	53·0	55·6	53·60	·338	·351	·410	·380	96	89	95	94	E S E	E S E	S W b S	2·80	0 635	...
a	9	·349	·388	·544	·437	53·6	57·9	54·2	56·03	·366	·459	·379	·411	90	97	91	92	S W b W	S S W	N N W	3·91	0·055	...
a	10	·654	·729	·712	·703	54·0	64·9	57·3	59·75	·390	·467	·422	·430	96	78	92	86	N b W	S W b S	Calm	4·17	...	...
c	11	·677	·648	—	—	55·6	64·6	—	—	·362	·468	—	—	84	79	—	—	W b S	S E b E	—	3·82	...	...
e	12	·588	·523	·498	·535	60·7	72·2	57·8	63·92	·447	·506	·389	·453	86	65	83	78	N E b N	S	Calm	2·69	...	...
b	13	·500	·460	·512	.490	61·7	74·7	60·0	66·80	·412	·508	·465	·459	77	61	91	73	N b W	S W b S	Calm	3·59	0·105	...
b	14	·533	·496	·504	·507	58·1	77·2	66·9	67·92	·393	·572	·419	·439	83	64	65	66	W	S S W	W S W	3·63	0·020	...
c	15	·528	·490	·586	·539	69·3	80·0	63·5	70·62	·550	·618	·423	·514	80	62	75	70	W S W	S S W	N b E	4·90	...	...
c	16	·718	·763	·771	·750	57·4	68 9	51·4	59·87	·312	·389	·301	·347	68	57	80	69	N N E	S	S E	3·17	...	...
b	17	·814	·739	·682	·738	52·7	67·6	51·3	58·50	·313	·324	·231	·301	80	49	63	64	S E b E	E b S	E N E	4·50	...	...
a	18	·649	·560	—	—	59·4	72·2	—	—	·371	·518	—	—	75	68	—	—	N E b N	S E b E	—	1·68	...	...
b	19	·593	·608	·602	·601	66·1	79·1	65·4	71·45	·450	·656	·474	·546	72	68	77	72	N W b N	W N W	Calm	3·00	...	...
a	20	·641	·611	·565	·607	66·4	71·6	63·5	67·82	·473	·410	·407	·432	75	55	71	66	N N E	E S E	E N E	5·03	...	...
a	21	·512	·412	·393	·434	63·0	68·6	61·9	63·92	·462	·471	·441	·462	82	70	82	80	E b N	E b N	E b N	5·76	Inap.	...
a	22	·429	·451	·468	·454	63·0	76·8	60·4	66·37	·427	·600	·415	·471	76	68	81	74	Calm	S E	Calm	2·90	0 090	...
c	23	·391	·462	·517	·466	59·8	66·6	57·8	61·83	·444	·486	·390	·447	88	76	85	83	E N E	N	N W	4·67	0·255	...
a	24	·510	·524	·649	·563	58·5	71·1	56·5	62·03	·394	·569	·393	·452	82	77	88	82	N W b W	N N W	N b W	6·38	...	...
*	25	·672	·639	—	—	58·7	72·1	—	—	·378	·494	—	—	78	65	—	—	N b W	S b W	—	3·77	...	...
—	26	·504	·415	·453	·457	63·5	84·0	73·7	75·67	·469	·834	·626	·673	82	74	78	77	S S W	Calm	Calm	†	...	...
—	27	·600	·536	·469	·530	67·1	81·3	64·8	70·33	·513	·707	·487	·544	80	68	82	75	E	E S E	Calm	...	...	...
—	28	·400	·461	·572	·481	73·0	86·9	59·2	73·00	·727	·342	·403	·498	93	28	82	67	S	N W	N W b N	9·85	...	...
—	29	·580	·520	·337	·467	60·9	69 6	63·2	63·97	·375	·516	·512	·460	72	73	91	79	Calm	Calm	E b N	1·15	0·130	...
—	30	·310	·483	·656	·499	66·4	77·0	62·6	68·57	·620	·408	·422	·444	83	46	76	67	N W	N N W	N b W	10·45	...	...
																		Miles	Miles.	Miles	Miles		
	M	29·562	29·544	29·551	29·5514	59·86	71·70	59·39	64·12	0·414	0·476	0·401	0·434	81	64	80	74	3·50	6·44	2·05	4·12	1·460	0·0

Highest Barometer...... 29·955, at 8 a.m. on 1st } Monthly range:
Lowest Barometer....... 29·287, at midnight on 29th } 0·668 inches.

Highest registered temperature 92°·5, at p.m. on 26th } Monthly range:
Lowest registered temperature 35°·2, at a.m. on 1st } 57°·3.

Mean Maximum Thermometer............. 74°·50 } Mean daily range:
Mean Minimum Thermometer...... ...... 49°·84 } 24°·66.

Greatest daily range......... 41°·8, from p.m. of 28th to a.m. of 29th.

Warmest day....... 26th. Mean temperature ..... 75°·67 } Difference,
Coldest day......... 8th. Mean temperature...... 53°·60 } 22°·07.

Aurora observed on 2 nights.
Possible to see Aurora on 21 nights.
Impossible to see Aurora 9 nights.

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

North.	West.	South.	East.
1123·86	790·73	618·68	983·62

Mean direction of the Wind, N 10° E.
Mean velocity of the Wind, 4·12 miles per hour.
Maximum velocity, 33·4 miles per hour, from 3½ to 4½ p.m. on 28th.
Most windy day, the 30th; mean velocity, 10·45 miles per hour.
Least windy day, the 29th; mean velocity, 1·15 " "
Raining on 9 days. Raining 26·2 hours: depth, 1·460 inches.
Greatest intensity of Solar Radiation, 95°·2 on 28th } Range, 63°·0.
Lowest point of Terrestrial Radiation, 32°·2 on 1st }
4th. Fire Flies first observed this season.
12th. Wild Strawberries ripe.
23rd. Yellow matter (Pine Pollen) fell in the rain this day.
Thunder Storms occurred on the 7th, 8th, 13th, 14th and 23rd.
The quantity of rain recorded for this month is the least for any June during the last 15 years.

Comparative Table for May.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind. Mean Vel'y.	
	°	°	°	°						
1840	60·0	78·5	37·1	41·4	11	4.860	0	...	...	
1841	65·6	92·8	45·7	47·1	9	1·560	0	...	0·36	lb.
1842	55.6	73·9	28·0	45·9	15	5·755	0	...	0·31	lb.
1843	58·4	81·3	28·5	52·8	12	4·595	0	...	0·27	lb.
1844	59·9	82·8	33·1	49·7	9	3·535	0	...	0·19	lb.
1845	61·0	83·6	40·9	42·7	11	3.715	0	...	0·27	lb.
1846	63·3	83·3	41·5	41·8	10	1·920	0	...	0·32	lb.
1847	58·4	78·3	36·7	41·6	14	2·625	0	...	0·30	lb.
1848	62·9	92·5	38·3	54·2	8	1·8·0	0	...	4·51	Miles.
1849	63·2	84·9	45·2	39·7	7	2 020	0	...	3·32	Miles.
1850	64·3	83·2	49.0	34·2	10	3·345	0	...	4·54	Miles.
1851	59·2	79·2	41.2	38·0	11	2·695	0	...	4·42	Miles.
1852	60·8	86·1	43·6	42 5	10	3·160	0	...	4·09	Miles.
1853	65·5	86·3	43·3	43·0	9	1·550	0	...	3·67	Miles.
1854	64·1	88·7	47·4	41·3	9	1·460	0	...	4·12	Miles.
									0·29	lb.
M'n.	61·48	83 69	39·97	43·73	10·3	2·974	0·0	0·00	4·10	Miles.

* Magnetic instruments dismounted on the 25th; magnetic character of the day deficient from that date.

† The record of the components of the Wind—the mean direction and the velocity are not complete for the 26th and 27th of this month, on account of removing the position of the Anemometer during the rebuilding of the Observatory.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—June, 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.	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	30·047	30·031	30·015	41·0	74·2	54·5	·180	·393	·304	·64	·47	·70	N	W b S	W	0·29	0·80	0·65	...	Clear.	Clear.	Clear.
2	30.066	29·824	29·809	56·1	80·3	61·2	363	435	362	79	43	66	W b N	W b N	W b N	0·87	4·02	Calm	...	Do.	Cum. Str. 4.	Hazy.
3	29·813	·780	·741	60·0	84·0	66·4	360	533	373	68	47	58	W b N	W b N	W	Calm	Calm	0·09	...	Do.	Clear.	Clear.
4	·723	·647	·645	65·5	79·9	67·8	402	465	480	65	47	72	W N W	W	N W b W	0·28	0·57	0·12	...	Do.	Do.	Do.
5	·654	·662	·705	66·0	79·6	62·0	516	489	573	80	50	67	W b S	E N E	E N E	0·01	0·29	Calm	...	Cum. Str. 8.	Do.	Do.
6	·803	·761	·710	54·6	61·1	52·6	246	362	349	57	66	87	E N E	E N E	E b N	0·19	1·56	Calm	Inap.	Str. 8. Thunder	Str. 9.	Cum. Str. 8.*
7	·646	·669	·682	51·0	64·6	54·0	260	501	373	68	84	87	E b N	E N E	E N E	4·24	5·17	8·94	1·251	Rain. [at 11.	Str. 8.	Cir. Str. 9.
8	·617	·587	·699	49·0	53·1	50·0	336	386	350	93	93	98	E N E	E N E	E N E	21·45	7·21	30·43	1·566	Cum. Str. 10.	Rain.	Rain.
9	·496	·568	·668	50·0	53·0	52·1	552	386	361	99	[illegible]	94	E N E	E N E	E b N	9·30	6·45	15·67	3·252	Rain.	Str. 10.	Str. 10.
10	·733	·785	·847	53·5	65·9	58·1	361	499	462	87	80	94	N E	E b N	E	0·82	3·14	Calm	...	Cum. Str. 10.	Cum. Str. 4.	Cum. Str. 9.
11	·926	·928	·784	56·0	75·1	60·2	385	578	467	84	67	89	E	S S W	W S W	Calm	Calm	Calm	...	Cum. Cir. Str. 8.	Str. 2.	Clear.
12	·747	·760	·656	55·0	84·5	60·2	382	638	467	85	56	89	W	S W	W b N	Calm	1·24	Calm	...	Clear.	Cir. Str. 2. Dist.	Cir. Str. 2.†
13	·700	·684	·642	66·6	85·0	69·0	489	659	486	76	56	69	W b S	W b S	E b S	Calm	1·12	2·11	...	Do.	Clear. [thunder.	Str. 10.‡
14	·651	·641	·712	58·0	83·1	69·0	462	827	570	94	75	81	S E b E	W S W	W S W	2·24	Calm	Calm	...	Hazy.	Do.	Hazy.
15	·704	·660	·758	57·0	83·0	65·6	422	681	425	89	61	68	W N W	W b N	N N E	Inap.	1·00	2·46	...	Fog.	Hazy.	Do.
16	·964	30·074	30·068	53·2	69·1	52·0	274	351	326	66	49	81	N E	E b N	S W b W	5·14	1·18	1·01	...	Do.	Do.	Do.
17	30·135	30·047	29·924	53·6	70·0	59·1	315	628	402	76	86	79	N W	S W b W	S W b W	Calm	Inap.	Calm	...	Hazy.	Do.	Do.
18	30·010	29·848	·811	57·8	85·9	65·0	422	597	527	89	50	85	Calm	Calm	N W b W	Calm	Calm	Calm	...	Do.	Do.	Do.
19	29·818	·730	·801	65·0	87·8	64·0	586	854	534	94	68	89	W b N	N W	N W b W	2·42	6·12	6·30	0·100	Clear.	Str. 4. Distant	Str. 10.
20	·946	·912	·863	61·2	83·0	63·3	431	571	461	79	68	79	W S W	W S W	W S W	5·12	1·46	0·84	...	Do.	Clear. [thunder.	Clear.
21	·890	·830	·832	60·3	77·8	58·9	441	588	462	84	64	94	E b N	E N E	E b N	1·96	3·26	2·75	...	Do.	Do.	Overcast.
22	·899	·921	·921	57·0	68·8	64·6	451	523	504	96	76	84	E b N	S S W	S S E	1·80	6·26	2·87	...	Do.	Cir. Cum. Str. 9.	Cir. Str. 9.
23	·809	·812	·766	60·1	66·7	63·0	512	574	520	98	89	90	S b E	S S E	S b E	2·77	4·90	4·50	0·540	Rain.	Str. 8.	Cir. Str. 9.§
24	·707	·658	·796	60·6	76·0	60·0	521	659	467	99	74	89	S b E	W S W	N	0·11	2·00	7·37	0·088	Cir. Str. 8.	Cum. Str. 4.	Cir. Str. 10.
25	·893	·874	·847	52·0	68·9	57·2	291	541	398	78	76	84	N E b N	W S W	W S W	11·41	3·79	4·50	...	Str. 8.	Cum. Str. 2.	Cir. Str. 2.‖
26	·893	·726	·773	59·0	65·1	60·4	452	586	511	89	94	96	W	S S W	W N W	0·50	8·25	Calm	0·231	Clear.	Rain.	Cir. Str. 4.
27	·929	·852	·773	62·7	83·0	68·6	472	910	582	84	82	85	N N E	N E b E	N E b E	0·67	0 68	Calm	...	Cir. 2.	Cir. Str. 4.	Cum. 4.
28	·611	·581	·821	69 0	80·0	65·4	668	692	449	95	69	72	S S E	S W	N W b W	0.58	8·34	8·34	0·290	Cum. Str. 9.	Do. 9. Thunder.	Cir. Str. 8.
29	·986	·903	·768	58·3	75·0	63·0	346	550	516	70	64	84	N W	S W	S E	2·65	Inap.	0·15	...	Clear.	Clear.	Light Cirrs.
30	698	·598	·827	60·0	60·2	57·2	600	694	472	96	94	99	N E b N	N W b N	W N W	1·25	4·28	6·80	1·066	Rain.	Cum. Str. 8.	Clear.

Barometer ....
- Highest, the 17th day .... 30·135
- Lowest, the 8th day .... 29·499
- Monthly Mean .... 29·814
- " Range .... ·636

Thermometer.
- Highest, the 19th day .... 89°·0
- Lowest, the 2nd day .... 42°·4
- Monthly Mean .... 63°·8
- " Range .... 46°·6
- Mean Humidity .... ·780

Greatest Intensity of the Sun's Rays .... 130°·1

Rain fell on 10 days, amounting to 8·384 inches, and was accompanied by thunder and lightning on 4 days. Raining 48 hours, 5 minutes.

Amount of evaporation, 2·95 inches. The greatest amount of evaporation observed here was during the first 6 days of this month, and amounted to 1 inch.

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

Most Windy Day, the 8th day; mean miles per hour, 23·03.

Least Windy Day, the 18th day; mean miles per hour, 0·0.

Aurora Borealis visible on 2 nights. Might have been seen on 13 nights.

The electrical state of the atmosphere has been marked by rather high intensity during the month, varying frequently from positive to negative.

* Thunder and lightning at 8·45 p.m. † Faint Aurora Borealis. ‡ Distant thunder and lightning. § Lightning. ‖ Faint Aurora Borealis.