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

With Accessaries Ensuring the Healthful Warming and Ventilation of Houses.

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

(*Continued from page 6.*)

DEFECTS OF HEATING AND VENTILATING.

The third and last of the great evils of the present open fires is, that there are great irregularities and deficiencies in their heating and ventilating actions, which bear so powerfully on the public health. The hood and its damper, as influencing these, may appear perhaps of more importance than as saving the fuel.

The hood and its damper, by allowing so small a quantity of air to pass through in comparison with what rises in an open ordinary chimney, lessens in the same degree the cold draught of air towards the fire from doors and windows, and which are common causes to the inmates of winter inflammation and other diseases; and for the same reason, the heat, once radiated from the fire towards the walls of the room, not being again quickly absorbed and carried away by such currents of cold air as are referred to, remains in the room, and soon renders the temperature of the whole more equable and safe.

Still more completely to prevent cold draughts approaching from behind persons sitting around the fire, the fresh air for the room is conveniently admitted, chiefly by a channel which leads directly from the external air under the floor to the hearth, and there allows the air to spread from under the fender. The fender, exposed to the fire near it, becomes hot; the cold, fresh air then rising under it, takes from it the excess of its heat, and so becomes itself tempered before it spreads in the room. The two evils of excess of heat and excess of cold meet to neutralise each other, and to produce a good result.

The importance of general ventilation, again, is strikingly exhibited by such occurrences as the following, which was related at the meeting of scientific friends at which I first described the new fire-place, by Mr. Robert Chambers, of Edinburgh, as having happened not long ago in Glasgow. A large old building, which had been formerly a co[illegible] mill, was fitted up as a barrack or dwelling-house for per[illegible] of the working classes, and had nearly 500 inmates. Like a[illegible] and crowded human dwelling, fevers and kindred diseases soon became prevalent there. After a time, a medical man who was interested obtained permission from the proprietors of the neighbouring chemical works, in which there was a lofty and very powerful chimney, for the ventilation of the lodging-house. He then connected with this a main tube from the lodging-house, which had branches running along all the passages or galleries, and from the ceiling of every separate room a small tube communicated with these branches. Soon after, to the surprise as well as to the delight of all concerned, severe diseases entirely disappeared from the house and never returned.

Now, the chimney of the new fire-place, although not very tall, has a ventilating power scarcely inferior to that of the Glasgow chemical works. The arrangement of the hood and its valve, as above described, by allowing only unmixed and very hot smoke to enter the chimney, instead of, as in common chimneys, smoke diluted with many times its volume of colder air, increases the draught just as it does the heat of the chimney, and through an opening then made into the chimney from near the top of a room, all the hot, foul air in the room, consisting, perhaps, of the breath of inmates, smell of meals, burnt air from candles, lamps, &c., and which else accumulates and stagnates at first near the top of the room, is immediately forced into the chimney and away. This is strikingly proved by placing near the ventilating opening a light body, as feathers or shreds of paper suspended to a thread, and seeing with what force it is drawn into the opening. In the diagram the opening is represented at the letter *r*, having the common balanced chimney-valve in it, which, by the wire descending to a screw within reach of the hand, can be left open to any desired degree.

That valve I recommended many years ago, and its use has become pretty general over the country; but, in many cases, what I described as an essential concomitant—the contraction of the chimney-throat and the space over the fire—has been omitted.

This is what I had to say on the correction of the third of the great evils of the common fire, and I hope it has been shown to be possible to construct an open fire-place, scarcely differing in appearance from an ordinary English fire-place, with its pleasing associations, but which shall be smokeless, saving much fuel, and ensuring the healthful warmth and ventilation of our houses.

There are yet subordinate advantages of the new arrangement of fire-place, among which the following may be noted:—

1. Chimney-sweeping can scarce be wanted where there is no soot.

2. Chimney-flues without soot cannot catch fire; and if fire were in any way there introduced, by shutting the hood valve it would be certainly extinguished. Thus a large proportion of the conflagrations of buildings may be avoided.

3. The huge evil (almost universal) of smoky chimneys cannot occur with this grate.

4. The occasional sudden rush of air towards a hot wide chimney, when the door is opened, and which carries readily the light muslin dress of a lady towards the grate and inflames it, cannot happen with this grate.

5. The danger of sparks from exploded pieces of coal thrown on the carpet does not exist here, for all the coal is first heated and coked while deep in the coal-box, and covered over. Thus a fire-guard is not wanted on this account.

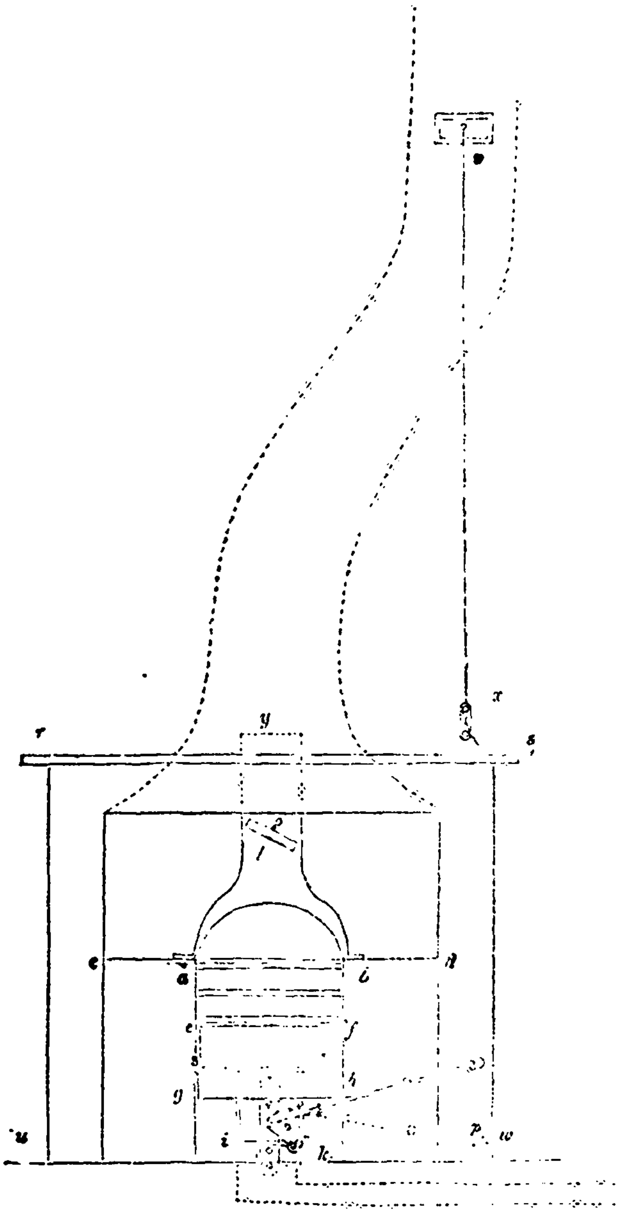
6. The strong draught of a voracious fire in one room, or in the kitchen of a house, cannot disturb and overcome the action of other chimneys in the house, which is now very common.

7. The strong draught of any well-constructed fire-place may, by a connecting tube be made to ventilate any distant rooms, staircases, cellars, closets, &c.

8. The strong and copious draught caused by momentarily opening the hood-valve or damper will prevent the diffusion of dust when the fire is stirred or disturbed.

9. The chimney-valve by its powerful ventilating effect, obviates all objections to the use of gas-lights in houses, thus leaving the beauty, cleanliness, cheapness, and many conveniences of gas unmarred. Explosion from accidental escape

of gas in a room or house, of which occurrence there have been some destructive instances, cannot happen where there is the ventilating chimney-valve, for cold coal gas entering a chimney-flue produces a more powerful draught than hot air does.



10. The improved chimney draught in attic or upper rooms will make these more valuable, and ill increase the comfort of low houses and cottages.

11. It would, moreover, be convenient occasionally to carry the flue of a close stove, or bath, or the ventilating tube from lamps in staircases, into any acting chimney.

12. This torch-fire (as some have called it, because it burns from above downwards, like a torch or candle) is remarkably adapted also for the purpose of the kitchen

13. The change of any existing grate of an old fashion into this is easy and inexpensive, and by having a piston-plate with holes it can be used as a common grate.

14. Any kind of coal or coke may be used in this grate, even the small culm or coal-dust, which is very cheap. In a common grate, coke or Welsh stone coal would be objectionable, because containing chiefly heavy carbonic acid instead of the steam and carburetted hydrogen of bituminous coal, and the gas, which is poisonous, might spread in the room, but by the strong draught of the hood this could not happen.

I might extend this list, but I need not.

Before concluding, I may direct attention to the remarkable fact, only of late well understood, that of the only four great necessaries of life, or things which Providence has left to man in various parts of the earth to procure for himself, namely, fit air, temperature, aliment, and work alternating with rest,—the skilful management of a domestic fire goes far to secure the two first-named, viz., fit air and warmth; but these are the last which men come to understand well, because they are invisible and impalpable, and, therefore, to be perceived only by the eye of the mind after much cultivation.

The diagram represents a common fire-place, with mantel, *r s*, or chimney-piece, two jambs, and a common grate with two bars and bottom, to which four parts the essentials of the new fire-place are added. *e f g h* is a box or receptacle of iron to contain the charge of coal for the day with its open mouth placed where the bottom bars of the grate had been. It may stand on feet on the hearth, or may be fixed to the grate.—Besides its fixed bottom, *g h* it has also a moveable bottom, *s s*, like a piston, on which the coal immediately rests, and is lifted as wanted, or let down as the piston moves; a piston-rod passes through the fixed bottom, steadied by a guide-hole in the stirrup or bar, *i j*, below. The piston-rod has notches or openings in it to receive the points of the poker, *p o*, which acting as a lever, having its fulerum in the foot of the box or otherwise, lifts the piston. A catch or pall, *k*, falls into the notches as the piston rises, to prevent its return until desired. In the centre of the bottom front is a door which is opened at will to admit a little air if wanted, or for removing small coal or ashes which fall past the piston. Where the grate is set low, a small opening is made in the hearth to allow the end of the piston to descend.

a b y is a hood or cover for the fire, like an inverted funnel opened in front, placed over the fire to contract the open space there, and to receive the true smoke of the fire and convey it little diluted into the chimney-flue at *y*. *t* is a valve or damper, placed in the narrow part of the stalk of the hood to give complete control of the current of air passing through. There is an index externally, showing clearly always the position of the valve. *y v* marks the direction of the chimney-flue in the wall, having generally to bend to one side to avoid the fire-place in the room above. *v* is the ventilating chimney-valve, admitting air from near the top of the room to the flue, balanced nearly on its centre of gravity, so that the least pressure from without opens it inwards, but any pressure from within, as of smoke, closes it. There is a wire descending from the valve, with a screw or loop-peg, for partially or wholly closing it. There is a channel underneath the hearth by which fresh air directly from the atmosphere, enters the room, to be warmed under the fender or near the fire, and then to spread in the room. It has a controlling valve.

Geology of Western Canada.

In the August number of this Journal we published a Geological Map of a considerable portion of Western Canada, by W. E. Logan, Esq., F.R.S. & G.S., Provincial Geologist. We now propose to furnish monthly abstracts of those portions of the Geological Reports which describe the physical structure of the country comprehended within the limits of the Map. We are induced to adopt this method of disseminating information respecting the Geology of Canada, not only on account of its intrinsic value, but also because it is a matter of extreme difficulty to meet with copies of the earlier Reports, in consequence of the destruction of the reserve during those disastrous conflagrations which destroyed the Parliament Buildings at Montreal and Quebec.

Abstract of the Provincial Geologist's Reports, dated Montreal, April 28, 1844.

WESTERN DIVISION.—PRIMARY AND METAMORPHIC ROCKS.

In availing myself of the labours of the American Geologists to illustrate the general relations of the rock formations of the Province, it will be convenient to divide the subject into two parts, and drawing a line along the Hudson River and Lake Champlain to Missisquoi Bay and thence to Quebec, to consider the region to the west of this line separately from that on the south side of the Saint Lawrence to the east, there being certain conditions in the one that do not prevail in the other.

WESTERN DIVISION.

The Western Division, as connected with the Geology of Canada, may be described as a gigantic trough of fossiliferous strata, conformable from the summit of the coal to the bottom of the very lowest formations containing organic remains, with a transverse axis reaching from the Wisconsin River and Green Bay in Lake Michigan to the neighbourhood of Washington, a distance of nearly seven hundred miles; and a longitudinal one extending from Quebec in a south-westerly direction, to some point, with which I am unacquainted, beyond the Tenessee River in Alabama.* Contained within this vast trough and resulting from gentle undulations in the strata, giving origin to broad anticlinal forms, there are three important subordinate basins, in the centre of each of which spreads out an enormous coal-field. One of these extends in length from the County of Logan on the southern borders of Kentucky, in a north-westerly direction to the Rock River in Illinois, where it falls into the Mississippi, a distance of three hundred and sixty miles, and in breadth from the mouth of the Missouri to the County of Tippecanoe, on the Wabash in Indiana, two hundred miles. Presenting an oval form intersected by the River Illinois, Wabash and Ohio, and bounded by the Mississippi, which sweeps along nearly the whole of its western margin, this coal-field covers an area of 55,000 square miles. The second occupies the heart of the State of Michigan, and reaching 100 miles in an east and west direction from within thirteen leagues of the Lake of that name to Saginaw Bay in Lake Huron, and 150 miles in a north and south line from the neighbourhood of the Rivers Manistee and Ausable, to the source of the Grand River near Jackson, on the road between Detroit and St. Josephs, it exhibits an irregular pentagonal shape and comprises a superficies of 12,000 square miles. The third carboniferous area stretches longitudinally about 600 miles in a north-easterly course from the state of Tenessee to the north-eastern corner of Pennsylvania, where many outlying patches belong to it, and 170 miles transversely from the north branch of the Potomac in Maryland, to the south-eastern corner of Summit County in Ohio, just twelve leagues south of Cleveland on Lake Erie. It possesses a sinuous subrhomboidal form and spreading over a surface somewhat larger than the first named coal-field, may comprise about 60,000 square miles. The Ohio and its tributaries unwater nearly the whole of it, and the main trunk of this great river serpentines through the centre of the region for about 400 miles of the upper part of its course. The Susquehanna and its tributaries intersect the north-eastern extremity of the deposit, and the vallies of denudation in which these waters flow, assisting the effect of a series of nearly equidistant undulations in the strata, there break its continuity into the outliers alluded to, which generally rest on sinclinal mountain tops, in the interrupted prolongation of a number of narrow subsidiary troughs resulting from the undulation in question, and giving an irregular and deeply indented contour to the outcrop of the main body of the coal. The chief part of the outliers, as well as the main body of the deposit, and also the other two great coal-fields described, yield fuel of the bituminous quality; but to the eastward of the Susquehanna, there are three large outliers almost sufficiently important to deserve the designation of another coal-field, in which the fuel contained is of the anthracitic kind.

The undulations which have been mentioned, constitute an important feature in the structure of the country between the St. Lawrence and the Atlantic.* Their ridges or anticlinal axes preserving a remarkable degree of parallelism, have been traced for vast distances, ranging in a sinuous south-westerly, course from Lower Canada to Alabama. Crossing them from north-west to south-east, those farthest from the ocean are broad and gentle, but they in succession become more acute and prominent; and as they do so the dips on the north-west side of the axes increase in inclination in a more rapid ratio than those on the south-east, giving to the undulations the form of waves driven before a gale, until at length the former assume a perpendicular attitude and even present an inversion of the strata.

It is where the flexures reach the Apalachian chain of mountains that the phenomena of these overturn dips are exhibited, and there the undulations, becoming identified with the ridges and vallies of the chain, afford an explanation of the structure of this great range of highlands. The disturbances which have given origin to these mountains, as they affect the coal measures, must, of course, take their date subsequent to the carboniferous era: but, as may be gathered from what has been said, it is only on the south-east side of the third coal-field that the measures are violently corrugated and fractured. The north-west outcrop exhibits a comparatively quiescent condition, and it would appear from the regular coutour of the Illinois and Michigan deposits, that the disturbing forces had entirely died away before reaching them. It does not seem improbable, however, that the broad low anticlinal arch which separates these two from the other, may have some relation to the expiring effort of those forces, for although its axis cannot be called precisely parallel to the Apalachian undula-

* See the geological Map of the Middle and Western States, lately published by James Hall, Esq., one of the State Geologists of New York.

* See Professor H. D. Rogers' State Reports on the Geology of Pennsylvania.

tions, there are yet bends in it that seem to correspond with some of the curves of that chain of mountains. From Monroe County in Kentucky, this axis takes a gently sinuous course, running under Cincinnati, on the Ohio, to the upper end of Lake Erie : thence it curves to the upper end of Lake Ontario, where my assistant, Mr. Murrary, has observed its influence in deflecting the strike of the strata n the neighbourhood of Burlington Bay. It then enters the lake, under the waters of which it probably dies away towards the north shore.

From beneath the three great coal-fields which have been mentioned, the subjacent formations crop out in succession, surrounding their carboniferous nuclei with rudely concentric belts of greater or less breadth, according to the thickness or dip of the deposit, and taking a wider and a wider sweep as they decend in the order of superposition, while they conform at the same time in their superficial distribution to all the sinuosities and irregularities occasioned by geographical and geological undulations. The organic remains of these rocks proclaim them to be contemporaneous with the Silurian and Devonian epochs of Europe, including the old red sandstone; and the Pennsylvanian geologists compute that in their south-eastern developement they attain the aggregate thickness of about 30,000 feet. But in the State of New York, where the quiet condition of the northern outcrop affords an admirable opportunity of determining with certainty all the relations of the deposits to one another, not more than one third of that amount can be made out. It would seem, therefore, if the many complicated folds existing on the south-east side have occasioned no error in the estimate, that the formations must thin down greatly towards the north.

The fossiliferous formations, wherever they have been found in actual contact with the rocks beneath, appear to rest upon masses of the primary order. But the geologists of New York consider they have evidence of the existence of a series of non-fossilliferous sedementary strata, in a more or less highly crystalline condition, of an age between the two. As considerable difficulties, however, attend the question, it will be sufficient for the purposes of the present description to unite all the subjacent rocks, whether metamorphic or primary, and to class them under the latter denomination.

The lowest of the fossilliferous strata is a sandstone of variable quality, more purely silicious towards the bottom, and calciferous towards the top, which gives support to a thick and remarkably persistent deposit of limestone, strongly distinguished by its organic remains. This limestone thus becomes an admirable means of tracing out the perimeter of the great western area under consideration. From the north-west border of North Carolina, it sweeps in a broad belt across Virginia to the junction of the Shenandoah and Potomac. Thence traversing Maryland, it passes through Pennsylvania by Harrisburgh, on the Susquehanna, and Belvidere, on the Delaware, accompanied up to this point by the underlying sandstone. Diminished in its thickness, it thence crosses New Jersey, and reaching Poughkeepsie it passes up the valley of the Hudson and Champlain, keeping to the east of the river and the lake and attains the neighbourhood of Missisquoi Bay.—Entering Canada, it proceeds towards Quebec, and it reaches the vicinity of that fortress; but I am not yet aware of the precise spots at which it is visible in its course thither, farther that I have been informed stratified limestone answering its condition is quarried and burned in the Seigniory of St. Hyacinthe, east of the Yamaska River. As Quebec itself does not stand upon the formation, it probably crosses the St. Lawrence higher up the stream; but it may be seen in the quarries of Beauport and farther down the river, and its limit in that direction is to be found near Cape Tourment, where the underlying primary rocks come to the water's edge. Turning at this point, and following the northern outcrop of the deposit up the valley of the St. Lawrence, it is found to run along the foot of a range of syenitic hills of a gniesoid order, which preserve a very even and direct south-westerly course, and down the flank of which the various tributaries of the great river are successively precipitated in rapids and cascades. On the Maskinongé the syenitic range is about twelve miles in a direct line from the St. Lawrence, on the Achigan about twenty, and it strikes the Riviére du Nord about a half a mile south of the village of St. Jerome.—Following this stream, the primary rocks, which are close upon its northern bank, gradually assume a course with less of southing in it, until they reach Lachute Mills, where their direction becomes nearly due east. Along this line from Cape Tourment, the basset edge of the limestone does not in all cases come quite up to the primary rock. There is occasionally a space left between the two for the sandstone beneath, and on the Riviére du Nord the calciferous part of this rock, capped by the limestone, is seen in several places in a well defined escarpment about half a mile from the syenitic range, dipping southward at an angle of six degrees, which is probably one or two more than the average inclination along the strike of the northern outcrop thus far traced.

Leaving the Riviére du Nord, at Lachute Mills the edge of the fossilliferous strata, still well defined by the rise of the primary rocks from below them, crosses the township of Chatham, pursuing a direct course to Grenville, on the Ottawa, where the calcareous deposit is seen at the upper end of the canal. A little above the village the primary range comes upon the river, which may correctly be considered the general division between the two until we attain the township of Hull. A bend in the Ottawa there, cutting deep into the limestone, leaves four to five miles breadth of it on its left bank, and the formation displayed in lofty precipices in the neighbourhood of Bytown, affords the magnificent scenery of the Chaudiére Falls. From personal observation I cannot speak of its course farther up the Ottawa, but I undertand it reaches the island of Allumet, and thence turning southward, runs through the townships of Packenham, Ramsay, and Drummond,—crosses the Rideau Canal in Rideau Lake in Elmsley, where, with the subjacent sandstone, it is seen in section at the Upper Narrows resting on the primary rocks and dipping to the north of east at an angle of four degrees,—and sweeping round the adjoining corner of Bastard and Young, traverses Elisabethtown, and reaches the St. Lawrence in the neighbourhood of Brockville. The limestone deposit following the St. Lawrence down to St. Regis, has a wide spread of the sandstone coming from beneath it on the United States side of the river, the lower edge of which passes by Canton, Hopkin, and Malone, to Chateauguay, in a line north of east. Here it makes a sudden turn to the south-east, and the limestone sweeping round at its proportionate distance, comes upon the western shore of Lake Champlain at the mouth of the Chazy River, about five miles up which its base is seen. Running along the shore of the lake it reaches Peru, where the basset edges of both sedimentary deposits come close together. Following up the lake they attain Whitehall. They then bend round to the valley of the Mohawk, ascending which they arrive in the neighbourhood of Trenton, where a grand display of limestone in the Falls of that name gave origin to the New York designation of the upper part of the deposit. From this the limestone gains the Black River, and follows down the whole of its course to Lake Ontario, of which it forms the coast from Ellisburgh to a point below Cape St. Vincent. Again entering Canada it composes Wolfe Island and the upper part of Howe Island, and it is seen resting on the primary rocks in Cedar Island without the interposition of the sandstone. Kingston stands upon the formation, and the base of it, cropping out several miles north of the town, strikes away to the Townships of Madoc and Marmora, in each of which the primary rocks are seen giving it support near their respective iron works. Thence it runs to Rama on Lake Simcoe, and sinks under the waters of Lake Huron in Georgian Bay. Between Kingston and Lake Huron the general dip of the formation is so small, that it is next to impracticable to measure it. The breadth of the band it presents is consequently considerable, thirty-five miles being the measure from its base at Marmora to its summit at Newcastle, on Lake Ontario. The north-eastern and northern shores of Lake Huron are described by Dr. Bigsby as presenting a primary country, and they may be taken as the boundary of the semidentary deposit we are following, from the point where it is lost beneath the waters of Georgian Bay, until it re-appears at St. Mary's Falls at the exit of Lake Superior, where the Michigan geologists describe a limestone apparently answering its conditions. Thence it reaches Green Bay, on Lake Michigan, and proceeds to the Wisconsin River, following it down to its junction with the Mississippi.

1. PRIMARY AND METAMORPHIC ROCKS.*

These rocks comprise the whole of the country to the north of Lake Simcoe, and the north-eastern shores of Lake Huron; and their character, in the localities visited by me, may be described as exactly similar in appearance to that of the masses which compose the "Thousand Islands," in the St. Lawrence below Kingston. The boundary between them and the lowest beds of the stratified limestone is distinctly seen at the head of a small sheet of water called St. John's Lake, in the township of Rama, within the distance of a mile from Lake Couchiching, and it is easily traceable from one lake to the other. The River Severn, which unites the waters of Lake Simcoe with those of Huron, passes its whole length over the primary rocks: and their junction with the fossilliferous sedimentary deposits may again be observed on the south shore of Matchadash Bay, and at the mouth of the Coldwater River. The line of junction, therefore, may be considered to run in a direction about W. N. W. and E. S. E., the whole of the township of Matchadash and the northern half of Orillia being on the primary.

Considering that my object, in the first instance, should be to determine the boundaries of the several formations as they might occur, with a view to entering into more minute details at a future period, I did not penetrate into the primary region in search of metals or minerals. The general character of the region, however, is such as would justify a careful and vigilant search for them when the general geology of the country is better known. Among these rocks I obtained some specimens of noble garnet; and a rich one of sulphuret of antimony, picked up among the drift on the shores of Lake Simcoe, was, in all probability, originally derived from them. Strong local attraction of the magnet, is said to have been observed in several places in the township of Matchadash, by Mr. Hamilton, the gentleman who made its survey, and it is probable that iron ore of the magnetic kind exists in it.

The rock masses observed in the primay district partake severally of the character of granite, syenite and gneiss, and on the banks of the Severn, at a spot between the Fourth Fall and Fifth or Great Falls, they seem to me to present evidencee of stratification. The strata there rise vertically from the edge of the stream to the height of fifty to sixty feet, and have all the appearance of coarse micaceous sandstone, which is in some places much contorted and frequently intersected by quartz veins. This exhibition of divisional planes, having all the regularity of bedding, induces me to consider that the term metamorphic, is one of appropiate application to some of the rocks beneath the fossilliferous, and unconformable with them.

In an agricultural point of view, the primary region on the banks of the Severn must be considered nearly valueless. With the exception of the accumulation of vegetable matter in the hollows where swamps exist, the country presents a surface of naked rocks, the only production of which is a dwarf pine— There is some good soft timber, however, in the swamps, and were the land capable of being drained, the swamps might be reclaimedand converted into meadows. But they are in general sonearly on a level with the river, that drainage would be impossible.

* From the Reports of A. MURRAY, Esq., Assistant Provincial Geologist.—Dated Woodstock, March 14, 1854.

Industrial Pathology; or the Accidents and Diseases incident to Industrial Occupations.

BY T. K. CHAMBERS, M.D.

I come to this room to-day for the purpose of introducing a subject, not indeed wholly new to the Society of Arts, but yet probably new to most of the present members. New, too, is the mode adopted of taking it up, namely the appointment of a special committee, the undertaking of a special exhibition, and the issue of special circulars and reports upon it. I think, therefore, it cannot be devoid of use, and I hope not of interest either, to explain somewhat at length, *what Industrial Pathology is*, that is, what its aims are in the opinion of those who are taking a part in its promotion; *why the Society of Arts should concern themselves with it;* and *what the Council propose to do in the matter.*

Industrial Pathology then—(I do not particularly admire the name, but I did not make it)—Industrial Pathology is the "science of bodily SUFFERINGS connected with the carrying on of handicraft work."

Man's Creator ordained that he should eat bread in the "sweat of his brow," but he did not ordain that he should eat it in suffering, in the rotting of his vitals, the periling of his soul, and the welcoming of premature death. Though labour is the lot of our species, it is healthy, invigorating labour which is natural to them, and not that which entails misery and pain.

The highest and most natural state of man being the greatest perfection of body and soul, any occupation which tends to shorten his days, to make him a discomfort to himself and his neighbours, is unnatural, and a proof of barbarism and defective civilization. Every country where such occupations exist is lower than it might be in the social scale,—has not yet done its utmost to place man in his proper position as king of the world. As long as he that toils with the hands has a life shorter and more physically painful than he that toils with his brain, the duty of self-improvement is unperformed by a [illegible]

is

now in every known nation—that the corporeal labourers are both shorter lived and endure more physical evils than the mental labourers. Statisticians are explicit enough on that point. Now it will be found on enquiry that there are two distinct classes of evils to account for this. In the first class are included poverty, ignorance, political weakness, and other circumstances which prevent handicraftsmen surrounding themselves with the defences against pain and death placed in the power of their superiors. These causes it is the business of Political Economy, State Hygiene, and the science of Education to investigate and teach us how to remedy. But there is also a class of causes arising out of the nature of various descriptions of bodily exposure and exertion; pain, sickness and death accrue from some things necessarily part of the work, without doing which the man could not be industrious at his trade.—Here lies the field for Industrial Pathology The first class of evils depend mainly on the work not being sufficiently regular or plentiful, or being under-paid, or some such economical mismanagement; the second is aggravated by abundance; the more a man has to do the worse he fares, and hence the propriety of the term "Industrial." I will illustrate this. There are two coal-whippers at the time of a commercial crisis in the coal-trade; fewer hands are wanted; one gets turned out of work, and the other is kept on. In six months time the one out of work is starving, because he was so weakened by temporary want of food that he was not fit for employment when he could get it. It is the business of the political economist to remedy commercial crises. The other man has worked as hard as possible in the way you know these fellows are engaged, jumping up a foot or two and throwing their whole weight on to a rope for ten or twelve hours a day; it is I believe the most wasteful, unscientific, and pernicious expenditure of human muscle that ever was devised. The consequence is that his heart cannot stand it, the fibres are overstrained with these continued violent jerks, and the organ becomes diseased. After a tedious illness, during which he is an incumbrance and expense to society, the industrious, well-paid man dies at forty.—Here it is that Industrial Pathology comes into play. It is the duty of that science to find out *why* such and such labour is injurious in a special manner, and to suggest a remedy. For example, in the instance quoted above, we may find out that it is the sudden jerk which is the cause of the injury to the circulation, and devise some better mechanism than is at present in use.

Again painters are liable to colic and palsy from the use of white lead; we may introduce a substance equally convenient in the shape of white zinc or other substitutes.

Tailors sit all day in a confined atmosphere, with the legs crossed and the spine bowed, so that neither the ribs nor the digestive organs have room to act. The consequence of course is that the stomach and bowels become disordered, the spine twisted, the gait shambling, and the power of taking the exercise necessary to health obliterated. If an artist wants to represent a starveling, he takes a tailor as his model; if a plump rosy man were to tell you he was a journeyman tailor, you would not allow such an evidently inexperienced workman to mend your coat. With a life embittered by indigestion, what wonder that a tailor takes to opium, gin, and tobacco, the only things that make existence endurable. Now cannot these evils be corrected? The cross-legged position is assumed because in the ordinary sitting posture the heavy cloth could not be held near enough to the eye. The problem is to invent some sort of table which would be equally convenient.

Shoe-makers and boot-makers suffer equally from a constrained position, and also from the pressure of the last against the stomach. Heartburn and painful digestion are so common, that a certain pill in the Pharmacopeia (the *Pilula Sagapeni Comp.*) is called the coblers' pill. A patient of mine, now in St. Mary's Hospital, has a hollow big enough to put one's fist in, from the pressure inwards of the breast bone by the boot-tree; of course his lungs and heart are diseased by such distortion. Cannot some one devise a new sort of boot-tree, which will not drive its tap roots into peoples lungs?

Looking-glass makers and water-gilders are constantly coming into hospitals for mercurial paralysis; and when they go out of the hospital they are not fit for much else than the workhouse. There are two ways of remedying this: one is to give them some protection against the poisonous fumes; and the other is to improve and cheapen rival modes of gilding and silvering, in which mercury is not used.

Washerwomen constantly suffer from varicose veins and other mechanical disorders arising from the standing posture. It is the business of Industrial Pathology to devise a chair in which they could work as at present, or else to discover some mode of doing the same thing by the agency of mechanics, which is now done immediately by the unaided body—to wear out mechanism instead of muscle, iron instead of energy.

I show you here a rotten jaw-bone, which Mr. Simon was obliged to cut out of a man's head because it was corroded by the noxious fumes evolved in the manufacture of lucifer matches. It is to be hoped that there is some mode of making them without rotting men's jaws, and this mode it is the business of Industrial Pathology to find out.

Few persons who walk much in the streets can avoid often meeting a bleeding groaning mass carried by on a stretcher, having just fallen from some ill-made scaffolding. It is the business of Industrial Pathology to enquire, whether it is an essential part of the nature of our countrymen to fall from scaffolding, or whether the construction of it might be so altered as to prevent the accidents. For the encouragement of those who are possessed with the latter idea, it may be cursorily mentioned that in China they have for several thousand years used a light bamboo scaffolding, covering the entire building like a network, and certainly preventing the falls which so often happen in Europe. Our ideas seem to have travelled wholly in the direction of making it stronger, heavier, and more unmanageable.

I trust that by these few familiar illustrations, I have made clear what Industrial Pathology is and how it differs from Hygiene. It does not profess to enquire into the health of the industrious classes generally, but only into their health so far as it is affected by their special occupations. It is desirable that this division of labour among scientific observers and teachers should be fully understood, in order that the facts collected should be properly arranged, and handed directly to those who will use them aright. Into the respective utility and consequent dignity of the two sciences I have not enquired: I only wish to point out which it is that the Council feel themselves called upon to take up.

I come now to the third question which may be asked concerning Industrial Pathology, viz., *how does the Council propose to be of use in this matter?* This has been in a great measure answered by a circular which has lately been issued, and which was printed in the Journal a few weeks ago. They propose in the first place to have an Exhibition of contrivance and appliances for making the practice of handicrafts more healthy. What they expect to be sent to the Exhibition are, in short, means for working with less injury to the body than at present. Machinery of all sorts may appear, the express object of which is to guard against the myriads of accidents I spoke of, and save lives in numbers to be calculated statistically. Improved hand-tools will be a very valuable department; adzes which will not divide carpenters' shins, boot-trees which will not obliterate coblers' digestions, &c., may be shown to those most interested in using them. Safer ladders, scaffolding, chairs for window-cleaning, buckets for lowering men into wells, mines, &c., will save multitudes of industrious souls, if the invention of them can be stimulated. Another most important path of discovery is the inventing of substitutes for substances chemically noxious, such as lead, quicksilver, phosphorus, arsenic, the strong mineral acid sand alkalies; or modes of rendering their anxious qualities harmless, such, for instance, as fixing the putrid fumes of decaying matters preserved for manure or making leather. Another interesting department will be that of guards for the organs of sense of the individual workman—I mean such as will not interfere at all with present modes of manufacture, but will simply defend the artizan from the injuries it entails. As examples I have placed on the table a few articles referable to this class sent to us by Mr. Pillischer, of Bond-street. They consist of defences for the *eyes* against the effect of light, and mechanical injury; and if a third of the contrivances that are furnished to us are as simple and rational as these, we shall indeed be fortunate. Improved dresses for particular occupations may furnish another department.

Defences against injury by animals, such as safer harness, dog muzzles, &c., would prevent many an accident to a domestic servant and working man.

Such are a few examples of the sort of inventions which the Council trust will be sent for exhibition; and, considering the position we hold as the friend—equally and impartially—of master and workman; considering our standing with the public, and our widely extended connection with the manufacturing classes by means of the Institutes in Union, they have a right to expect many more than they themselves can name or suggest.

Thermography.

BY FELIX ABATE, OF NAPLES.*

This invention constitutes a new art, by means of which natural and artificial objects can be represented and imitated by printing directly from the objects themselves upon any suitable substance. The specimens submitted to the inspection of the Society at its last meeting, are imitations of veneering wood, some simple, and some ornamented with inlaid work, made upon wood, calico, and paper.

Before entering into the details of this invention, I may perhaps be allowed to state, in order to prevent mistakes, that it is essentially different from the well-known invention under the name of *Phytoglyphy*, or Nature printing, patented in England by Messrs. Bradbury and Evans, and practiced at the Imperial Printing Office at Vienna, and which consists in taking impressions in lead or other metals, or gutta-percha, from natural objects, making electro-plates from such impressions, and then printing with these plates in the usual way.

* Journal of the Society of Arts.

The principle of my invention dates from an epoch anterior to the Great Exhibition of 1851, as I exhibited on that occasion the first specimens of a particular application of it, called *Metallography*. For this branch of the art I was rewarded with the Prize Medal. An idea of this art will be obtained from the following notice of the principles and processes upon which it rests:

The art of *Metallography* consists in printing from engraved wood blocks upon *metallic surfaces*, so as to produce imitations of figures and ornaments inlain in wood. This effect is obtained by using, as a printing menstruum to wet the block with, solutions of such metallic or earthy salts as are decomposed when brought into contact with certain metals, and produce, through an electro-chemical action, an adhesive precipitate of a coloured metallic oxide, or any other chemical change upon the metal. Such are the salts of copper, antimony, &c., upon zinc, tin, silver, &c.; the hydrosulphuret of ammonia upon copper and brass.

There are two principles at work in this branch of the art—the one is the chemical action just referred to; the other, which is the foundation and the key-stone of the invention, in its most general sense, rests in the porousness of the printing object, which causes the absorption of the wetting fluid, and yields it, under the action of pressure, in quantity for each point, proportionate to the capacity of the pores; so that if any chemical change is wrought upon the impression, to produce a colouring of it, this colouring, by its different shades, makes a true representation of the printing object.

The application of the invention to printing upon vegetable substances instead of metallic surfaces, required the introduction into the process of some new principle to produce that chemical change which, in metallography, is spontaneous. I devised, for that purpose, two principles, which, by different means, lead to the same results. One of these principles I borrowed from the art of dyeing. It consists in the peculiar actions that the salts, acids, and alkalies have upon each other, and upon vegetable colouring matters. It is upon these actions the processes of mordant and discharge printing on textile manufactures rest. The surface of the printing object is slightly wetted with the acting fluid, which is then well wiped off from the surface; the impression is then taken, which, by combining with a previous or a subsequent dyeing of the printed surface, instantaneously appears. The other principle I found in heat, that is, in the colouring action that this most powerful agent of Nature has upon vegetable substances when acted on by acids, which colouring I believe, is the effect of an accelerated carbonization of the surfaces of these substances produced by the acid. I think I may properly call this art THERMOGRAPHY, or the art of printing by heat.

From the following description of the process, it will be remarked—perhaps with some degree of surprise—the excessive sensitiveness of vegetable substances under the joint action of acids and heat, so that an infinitesimal dose of the former, and an instantaneous application of the latter, are sufficient to produce the most striking effects. The process is as follows:—

Suppose a sheet of veneering-wood be the object from which impressions are to be taken; I expose the wood for a few minutes to the cold evaporation of hydrochloric or sulphuric acid, or I slightly wet it with either of these acids diluted, and then well wipe the acid off from the surface. Afterwards it is laid upon a piece of calico, or paper, or common wood, and by a stroke of the press an impression is taken, which is, of course, quite invisible, but by exposing this impression, immediately after, to the action of a strong heat, a most perfect and beautiful representation of the printing wood instantaneously appears. In the same way, with the same plate of wood, without any other acid preparation, a number of impressions, about twenty, or more, are taken; then, as the acid begins to be exhausted and the impressions faint, the acidification of the plate must be repeated as above, and so on progressively, as the wood is not in the least injured by the working of the process for any number of impressions. All these impressions show a general wood-like tint, most natural for the light-coloured woods, such as oak, walnut, maple &c.; but for other woods that have a peculiar colour, such as mahogany, rose-wood, &c., the impression must be taken, if a true imitation be required, on a stuff dyed of the light colour of the wood.

It must be here remarked, that the impressions as above made show an inversion of tints in reference to the original wood, so that the light are dark, and *vice versa*, which however does not interfere with the effect. The reason of it is, that all the varieties of tints which appear in the same wood are the effect of the varying closeness of its fibres in its different parts, so that where the fibres are close the colour is dark, and light where they are loose; but in the above process, as the absorption of the acid is greater in proportion to the looseness of its fibres, the effect must necessarily be the reverse of the above. However, when I wish to produce the true effect of the printing wood, I alter the process as follows:—I wet the surface upon which the impression is to be taken with dilute acid, and then I print with the veneering wood previously wetted with diluted liquid ammonia; it is evident that in this case the alkali neutralising the acid, the effect resulting from the subsequent action of heat will be a true representation of the printing surface.

Such is *Thermography*, or the art of printing by means of heat. Now it is nothing but natural to anticipate in regard to this art, as well as to the other above described processes for printing directly from objects, that they will afford most important services to the natural, botanical, mineralogical, and anatomical sciences; as it is by their means that the internal structure of bodies is unveiled to the eyes of the philosopher, and the wonders of nature in its inexhaustible varieties are indefinitely multiplied, to be subjected to the investigation and to serve the gratification of mankind.

But the new art will prove not less useful to the decorative arts, particularly in its application to produce imitations of rare and costly woods, as well as of works of art, mosaic and inlaid work, applicable for paper hangings, or for furniture in the place of veneering, these imitations being produced at an exceedingly low cost, while they rival in perfection the original objects enabling those whose means are limited to obtain decoration at once cheap and in good taste.

Materials for Paper Making.—Paper from Cow-dung.*

At the present moment, when we have every occasion to feel alarm at the serious position in which the manufacture of paper is placed, from the scarcity of the materials usually employed for making it, any suggestion, however simple, will not, I deem, be disregarded; especially when we consider how nearly this question is connected with the intellectual welfare of all classes. It is clear that should the present scarcity of rags continue, and no new substances be found applicable to supply their place, the publication of many useful periodicals must be discontinued, and the price of literature greatly enhanced.

Remembering the valuable paper printed in the Journal of the Society of Arts, about this period last year, upon the manufacture of paper from cow-dung, in which the author (Dr. Lloyd) stated he obtained a fibre from the dung of cattle, fed, or partially fed, upon flax-grass, I was induced to try a series of experiments, in order to ascertain whether the fibrous portions of common cow-dung, when the animals had been fed upon grass, hay, &c., were not applicable for the same purpose, believing that were a greater tenacity required than this article would afford, it could be more readily and more cheaply supplied by mixing with it a small portion of fibre from other substances, as from old nail-bags, &c., I am happy to report that these experiments have proved, to my mind, most successful, and that this mixture is well qualified for the manufacture of paper for printing purposes. I may also add that this opinion is confirmed by experienced paper-makers.

We have here, then, an almost inexhaustible source of material to supply the place of rags, and one which must necessarily increase with the increase of population. Nor would the use of this substance prove injurious to agriculture, as the fibrous portions of the manure are the least valuable for that purpose, and as the other portions could be returned to the land in the form best adapted to the requirements of plants.

It is not, however, in the present instance of so much importance to show from what substances paper can be made, as almost any fibrous substance is applicable for this purpose, as to point out one that will supply the place of rags, and at a much lower cost. This I believe would be the case with the substance in question, and by supplying a very simple machine to farmers, cow-keepers, and stable-keepers (for horse-dung may also be used), a very large amount of fibre might thus be obtained; it might also be collected from the fields, &c., when more of the soluble portions have sunk into the ground, leaving the fibrous portions upon the surface, affording employment to a class, unfortunately too frequently to be found, whose deficiencies of intellect unqualify them from following more profitable pursuits.

As the results of several experiments, I find that 1lb. of cow-dung yields about 1oz. of dried fibre. and this of course in a condition requiring a much smaller amount of mechanical labor to reduce it to the state of pulp than is the case with rags. Though I have made no very close calculations, I am induced to believe that it may be obtained at a very much lower price than that of rags at the present time. I have found no difficulty in bleaching it, and shall feel happy to forward samples of the unbleached and bleached fibre, also, if possible, of some paper made from it, in the course of a few days.

* By Alfred Coleman, Journal of the Society of Arts.

Political and Social Wealth.

The greatness, the wealth, and the comfort of the people of any country depend, as it appears to me, upon three main causes:—First, the natural advantages of the country; secondly, its acquired advantages; and thirdly, its social regulations. With regard to the natural advantages of this country, we have first our insulated situation, giving us for centuries past safety—giving us every advantage that can be had by our wide extended coasts for the commerce of the world—and giving us great and important natural advantages.

Secondly, we have a climate more equable, perhaps, than that of any other country in Europe, of which one of our monarchs remarked, that there are more hours in the day in which a man may enjoy himself out of doors in this country than in any other country in Europe. But is that all? It gives us a constant industry; it gives the means of working from early morn till night during the whole year. These are some of our natural advantages. It allows out-of-door work to go on continually. What have we besides? We have vast mineral wealth, greater than the gold of California or Australia—mines of iron and coal—short words, but having a wide and extended meaning. Iron means arms and ploughshares, tools and engines, bridges and aqueducts. It means those vast bridges that span the Menai Straits, one of which now stands the monument of the genius of one who is an ornament to this or any other country—I mean Mr. Stephenson—and it means, moreover, railways, which are now the highways for the whole world. These are some of our natural advantages. But have we not more? In that short word "coal," besides the fire which gives comfort in our dwelling, it is the foundation of our great hardware manufactures; it moves by steam all our factories; it gives employment to myriads of women and children—the tender sex and the tenderest age; it moves all our trains; it moves half our vessels. Coal and iron together mean a moving power equal to millions of pairs of hands, requiring neither clothing nor food to maintain them. The coal which is obtained in Great Britain alone amounts to thirty-seven millions of tons annually, whilst the produce of all Europe amounts to only seventeen millions of tons—not half what is raised in this island. Now what are our acquired advantages? They are still greater than our natural advantages. First of all, after a century of struggle, we get our religious freedom by the Reformation of 1530, and after a century of contest we had our civil freedom established by the Revolution of 1688. This country has afforded an asylum to foreigners from intolerance and bigotry in other countries, which has been repaid by a hundred inventions and discoveries. Our freedom was won, as Burke says, by our ancestors, owing to their spirit in the hour of contest, and their tenderness in the triumph of victory. Freedom is the mother of many blessings—of order and security, of industry, and enterprise, of wealth and plenty. Now, let us look for a moment at the effects of these natural and acquired advantages combined with the forty years' peace we have till recently enjoyed. Look at the changes they have produced, calling for corresponding alterations in the laws and corresponding facilities in our commercial transactions. But I have spoken of our social regulations as the third cause of the greatness, safety, and happiness of this country. What has the change been? First, in the population. In 1780 our rural population was to the civic population as 2 to 1; now the proportions are exactly reversed, and the population of our cities and towns employed in manufactures and commerce are as 2 to 1 of those employed in agriculture. From the census of 1801 you will find there has been a general increase of the population of 15 per cent—in the rural population of 10 per cent., and in our cities of 30 per cent.—that is, those who possess personal property in our cities have increased threefold as compared with the other portion of the population.—(*Jour. Society Arts.*)

On M. Marie-Davy's New Electro-Magnetic Engine.

BY M. BECQUEREL.

Attempts have been made for the last 20 years, to construct machines in which the magnetic property imparted to soft iron by the electric current should be employed as a motive power; but the electro-motive machines hitherto brought forward have been far from presenting any economical advantages over steam-engines.

Any electro-magnetic engine must be composed essentially of a series of electro-magnets of soft iron, of armatures also of soft iron, or arranged as electro-magnets, with various adjuncts, for the transmission of the electricity furnished by a battery or electro-magnetic machine, and of a commutator or breaker, for the purpose of producing a continuous circular or backward and forward motion.

In the machines hitherto constructed, these various parts do not combine all the conditions desirable for making use of all the power set in action; a cheap, constant, and powerful source of electricity does not yet exist; the soft iron, never being pure or perfectly malleable, retains for a longer or shorter period after each interruption a portion of the magnetization which had been communicated to it by the current; the primitive current and the extra current produce contrary effects, causing a mutual injury; and the commutators often present alterations when the circuit is closed.

M. Jacobi, moreover, who has carefully studied the subject of the practical employment of electro-magnetic engines, has arrived at this result—that the mechanical effect or amount of work, considering the expenses necessary to keep them in action, is far inferior to that of the other motive powers in use. But this does not set the question at rest; for if we succeed in discovering sources of electricity more economical and powerful than those at present in use, and in avoiding a portion of the inconveniences already mentioned, electricity and magnetism may take their place with heat as motive forces.

These considerations show that all researches having for their object the removal of some of the difficulties encountered in the employment of electricity as a motive power, should be received favourably; and the memoir recently presented by M. Marie Davy to the Academy contains some new views worthy of attention, as will be seen from the following report.

M. Marie thought, and with reason, that in order to obtain the maximum of effect in electro-magnetic engines, the electro-magnets and the armatures must act up to the point of contact, seeing that the electro-magnetic force, as he found by calculation and experiment, decreases so rapidly with the distance, that in employing two electro-magnets, when these are brought together from a distance to the point of contact, they develope an amount of work in such a manner that five-sixths are produced in the last millimetre, and the half of the remainder in the last but one; when the second electro-magnet is replaced by an armature of soft iron, three-fourths of the quantity of work are produced in the last millimetre through which the armature passes, and more than half the remainder in the last but one. In most of the rotatory electro-magnetic machines hitherto constructed, the moveable armatures pass rapidly before the fixed electro-magnets, following a line perpendicular to the axis, without coming into contact; thus the entire amount of work that might be obtained is not made use of. We must, however, refer to the fact that Mr. Froment, who has paid much attention to the electro-magnetic motor apparatus, has constructed a machine in which an interior wheel, furnished with armatures of soft iron, revolves upon the terminal faces of the fixed electro-magnets, so as to make use of the magnetic attraction even up to the point of contact of the magnetized surfaces; but this arrangement produces, during the action of the machine, a series of shocks or concussions, which are opposed to the construction of a powerful machine upon this model.

M. Marie makes the moveable electro-magnets or armatures revolve in such a manner as to approach the fixed electro-magnets in the direction of the axis up to the point of contact, without any shock. Upon this principle are constructed the two electro-motive machines described in his note, one of which has a continuous rotatory, the other an oscillatory motion. We shall only refer to the former apparatus, of which he has prepared a model, which has worked in our presence.

This machine consists of 63 electro-magnets, arranged at equal distances round a circle of wood, furnished internally with a circle of copper. All the electro-magnets have their axis directed towards the centre of the wheel, and their surface coincides with the concave surface of the copper circle.

In the interior of this large wheel there are two others, of which the radius is one-third of that of the former; these are also furnished with a circle of copper, and bear each 21 equidistant electro-magnets, of which the axis are directed towards the centre, and the polar surfaces coincide with the concave surface of the copper wheels; these little wheels can then revolve, without slipping, in the interior of the large wheel, and carry round by their movement the axle of the machine, which corresponds with the axis of the large wheel. The moveable electro-magnets come successively in contact with the fixed electro-magnets. The large and small wheels are furnished with teeth for the maintenance of the coincidence, when this is once established.

The machine is also provided with various pieces of apparatus for putting each of the electro-magnets successively in communication with the battery, and giving a different magnetization to the two electro-magnets at the moment when they act upon each other.

M. Marie has made a change which appears advantageous, by replacing the internal wheels by others, which, instead of bearing electro-magnets, are surrounded by a ring of soft iron, which forms the armature; the moveable portion is thus rendered lighter, and the teeth are rendered unnecessary. It is this modification of the machine that we have seen in action. The circular electro-magnets of Mr. Nickels will here find an interesting application; and, at our suggestion, M. Marie proposes to make some experiments with this addition, which will enable him to augment the power of the machine without increasing the expense.

The construction of the machine is somewhat affected by the inexperience of the maker, so that it required a battery of 24 Bunsen's elements to produce 1-23d horse power. But, according to M. Marie's calculations, one of the same energy, or perhaps even one of less intensity, would be sufficient, with a machine of large size, to produce 300 times the power, seeing that the friction would not increase in the same proportion as the force of the machine; the means of electrical communication not being changed, and the power produced by the attraction of the magnets being capable of multiplication in a great degree, by making use of electro-magnets formed of large cylinders of soft iron. The model was constructed with a view to show the relations between the effect calculated from the magnetic force developed in the electro-magnet, and the actual force produced. The proportion was as 4 to 3, which is already a very close approximation, considering the numerous imperfections resulting from the bad construction of the machine.—*Comptes Rendus.*

Photography.

WAX PAPER PROCESS.

At the last meeting of the Photographic Society, a paper was read by Mr. Townsend, giving the results of a series of experiments instituted by him in reference to the wax-paper process. One of the great objections hitherto made to this process has been its slowness, as compared with the original Calotype process, and its various modifications; and another that its preparation involved some complexity of manipulation. Mr. Townsend has simplified the process materially, having found that the use of the fluoride and cyanide of potassium, as directed by Le Gray, in no way adds to the efficiency of the process, either in accelerating or otherwise. The iodide and bromide of potassium with free iodine give a paper which produces rapid, sure and clean results. He discards whey, sugar of milk, grape sugar, &c., hitherto deemed essential, but which his experience shows to be unnecessary. He exhibited three negatives of the same view taken consecutively at eight o'clock in the morning, with the respective exposures of 30 seconds, 2½ minutes, and ten minutes, each of which was good and perfect. The formula he adopts is:—

Iodide of Potassium	600 grs.
Bromide of Potassium, from 150 to 250	„
Re-sublimed Iodine	6 „
Distilled Water	40 oz.

The waxed papers are wholly immersed in this solution, and left to soak at least two hours, and are then hung to dry in the usual way. The papers are made sensitive by wholly immersing them in aceto-nitrate of silver of the following proportions:—

Nitrate of Silver	30 grs.
Acetic Acid	30 minims.
Distilled Water	1 oz.

the papers remaining in this solution not less than eight minutes. They are washed in two waters for eight minutes each, and then blotted off in the ordinary manner. Mr. Townsend states that there is no need to fear leaving the paper in the sensitive bath too long. He has left it in the bath 14 hours without any injury. The paper thus prepared will keep ten or twelve days; it may be longer, but his experience does not extend beyond that time. With paper thus prepared a portrait was exhibited, taken in 55 seconds, in a room with a side light, but it must be added that in this instance the paper was not washed, but was blotted off immediately on its leaving the sensitive bath, though not used until two hours had elapsed.—Mr. Townsend used for developing a saturated solution of gallic acid with a dram of aceto-nitrate to every four ounces of it, but he considers that this proportion of aceto-nitrate may be beneficially lessened. He finds that by this process he is certain of success, and is never troubled with that browning over of the paper which so often attends the use of the other methods of preparation. Besides the rapidity of action which he states, there is the further advantage that a lengthened exposure is not injurious. The proportion of bromide may vary from 150 grs. to 250; less than 150 is not sufficient to produce a maximum of rapidity, whilst more than 250 adds nothing to the effect.

Summary of a Report by Sir Charles Lyell,

*On the Industrial Exhibition at New York.—Geological Section.**

The mining products which formed the most prominent features of that department of the Exhibition, consisted of the different varieties of coal and metallic substances. The coal and iron ore were derived chiefly from the Eastern or Alleghany coal field; the lead from limestone and other rocks of Silurian age, as well as from the metamorphic formations; the zinc from the rocks of the latter character in New Jersey; and the copper from the similar regions in the eastern part of the States, but chiefly from the sandstone and trap district of Lake Superior. In the existing condition of the States, mining operations are, according to the report, for the most part in their infancy, beyond mining operations in coal and iron ore; and, perhaps, copper and lead may be now added. The mining enterprises hitherto undertaken have been more the result of chance and speculation than of any systematic effort to develope the mineral resources of the country; it consequently happens that the districts in which metallic products of value may be looked for, are but little known beyond their general geological features, and a few attractive or accidentally discovered localities of mineral wealth. Sir Charles observes, that in considering the industrial resources of a country of such vast extent, and which is still in its infancy, a juster idea of its capabilities can be formed by studying its leading physical and geological features, than by examining collections of its minerals and rocks in any place of exhibition. Gold is found in the Eastern States, or those on the eastern side of the Appalachian chain, occurring in the alluvial and drift formations and derived from the destruction of certain auriferous metamorphic rocks. The gold bearing drift extends from the northern limits of the States, in Vermont and New Hampshire, along the Green Mountain range, through the south-eastern part of New York, over the eastern flank of the Appalachian chain, to Georgia and Alabama. Gold has been obtained from the drift, in considerable quantities, in Georgia, North and South Carolina, and Virginia, but it has not been wrought for gold further north within the limits of the States, although it has long attracted attention in the same direction in Canada, and a considerable quantity of gold has been obtained from washings on the Chaudiere River. In California, the gold-bearing alluvium is derived from rocks of similar character: these auriferous sands and gravels are very extensively distributed; and the collections in the Exhibition showed samples of gold from nearly 200 different washings or localities in California alone.

Magnetic iron sand is a very general accompaniment of the same drift in the vicinity of mountain ranges; it has not, however, been applied to economic uses. Bog iron ore is almost universal, though in quantities to be valuable only in comparatively few places. The carbonates and per-oxide of iron occur in the coal fields, which contain rich deposits of those ores. In Pennsylvania and Ohio, where they are wrought to a greater extent than elsewhere, the beds appear to be inexhaustible, and will supply, for an indefinite period, the requirements of advancing physical improvements and civilisation. In Tennessee, Alabama, and Western Virginia, the coal formation abounds in iron ores; in the western coal field there is far less iron manufactured than in the east. The geological survey of Illinois, now in progress, has already shown that this state is richly supplied with iron ore in the midst of its inexhaustible coal fields, although they are as yet but two furnaces in that state. The iron ores from the coal formation presented at the Exhibition, were principally from Pennsylvania. The red shale formation in that state has a thickness of 2949 feet at Pottsville, and extends in a broad belt along the eastern margin of the coal fields. The ores of the red shale are chiefly carbonates of iron, with variable proportions of silica, alumina, &c.; they yield from 60 to 80 per cent, of carbonate of iron, and some of them give peroxide of iron in about the same proportion. The collection exhibited from Pennsylvania comprised the ore and furnace products—viz., ore, coal, slag, pig-iron, as well as manufactured iron; ores from geological formations below the coal, and occurring in the midst of the coal fields, having been exhibited in company with the coals by which they were smelted.

It is well known that the Americans set a far higher value on anthracite than on bituminous coals, although the United States are rich in vast coal fields of both descriptions. The anthracite basins of Pennsylvania produce coal of that character of a superior quality, and from its accessibility, it furnishes [illegible]ge portion of the fossil fuel now used in the towns and cities of the Atlantic coast. A specimen of anthracite coal, of enormous size, from the Mammoth vein, Wilkesbarre, Pennsylvania, was presented to the exhibition by the citizens of that town, showing a vertical section of the vein, being a shaft, 5 feet square at the base, 30 feet high, and weighing 60 tons. Several other large masses—one 10 feet long by 4 ft. wide, and 3½ ft. high—were exhibited, from the same locality, with specimens of the same bed from other places. Coals from the Carbondale and Pittstown Mine, a collection of about 60 varieties of anthracite from the Schylkill County, were also presented with specimens of bituminous coal from Pennsylvania, accompanying samples of iron ore, and likewise from Maryland, in large masses, showing the thickness of beds, 11 and 15 feet respectively. Some of the coal seams are underlaid with beds of fire-clay, of greater or less thickness; and in some parts there are extensive beds of fire-clay not directly associated with coal seams, but they are everywhere co-extensive with the great coal fields. The iron ores of the coal formation, with their accompanying mineral fuel, are distributed more or less abundantly over an area exceeding 160,000 square miles; we are, from this extent, enabled to form some faint conception of their vast amount, and of the important results of their influence on the future industrial interests and prospects of such a country as the United States.

Galena, and the carbonate, sulphate, and phosphate of lead, have been found, but their economic value has not been as yet fully tested; and the sulphuret of lead occurs in considerable quantities in some of the copper mines recently opened in Maryland. The lead-bearing rock, or "galena limestone," of Wisconsin, Northern Illinois, Iowa, and part of Missouri, is a lower Silurian limestone, which has yielded immense quantities of lead ore for many years past. The products of a lead mine now wrought in the Shawangunk Mountain, in Ulster County, are galena, copper pyrites, and a small quantity of blende; and this mine has yielded some remarkably large masses of galena, one of which weighed 16,000 pounds. Native silver occurs in Davidson County and other counties in North Carolina. The native copper contains a small amount of native silver; and recently a vein of silver has been wrought upon the north shore

* From the Mining Journal.

of Lake Superior, specimens of which were shown in the exhibition.

Veins or lodes of sulphuret or carbonate of copper occur in the lead region, particularly at Mineral Point, Wisconsin, where they were formerly worked, but proved unprofitable; and they have been likewise found in Missouri. Metallic copper occurs mainly in the trap rocks, and the copper ores, running through sandstone and conglomerate, are not worked. Sulphurets and carbonates of copper occur in the gold region of Virginia and North Carolina, and in the same formation in Maryland. Native copper in large quantities is obtained from the trap rocks of Lake Superior; and numerous mines have been opened on the south shore of that lake. The copper is met with in sheets of greater or less thickness, in vein cutting the trap range nearly at right angles, and associated with various vein stones. These sheets of copper vary in extent, weighing from a few pounds to 80 tons; while the produce of copper from the mines of Lake Superior during the past year will reach 4,000 or 5000 tons. A mass of native copper in the Exhibition from one of these mines, weighed 6300 pounds; it was cut from a mass weighing 40 tons, and the thickness between the two natural surfaces was more than two feet.

A vein or bed of sulphuret of zinc, within the State of New York, has been somewhat extensively wrought. Zinc blende often occurs with the lead ores, and the red oxide of zinc and franklinite are found in New Jersy. The red oxide is largely employed in the manufacture of the white oxide of zinc, and the mixture of this ore with the franklinite, ground in oil in its natural state, forms a brown paint much in use. The franklinite has been of late successfully employed in a process by which the ozide of zinc is obtained, and the iron reduced, both operations being accomplished by the same furnace. Tin ore (oxide of tin) has been found in New Hampshire, and it also, in small quantities, accompanies the gold in Virginia and North Carolina.

On some of the Crystalline Limestones of North America.

BY T. S. HUNT, OF THE GEOLOGICAL COMMISSION OF CANADA.*

THE crystalline limestones of Canada, with those of New York and the New England States, may be divided into four classes, belonging to as many different geological periods. The first and most ancient occur in that system of rocks, named by Mr. Logan the Laurentian series, which extending from Labrador to Lake Huron, forms the northern boundary of the Silurian system of Canada and the United States. The lowest beds of the Silurian repose horizontally upon the disturbed strata of this oldest American system, a southern prolongation of which crosses the Ottawa near Bytown, and the St. Lawrence at the Thousand Isles, and spreading out, forms the mountainous region of northern New York. This series consists in large part of a gneiss, which is often garnetiferous; but beds of mica slate, quartz and garnet rock, hornblende slate and hornblendic gneiss are also met with, besides large masses of a coarsely crystalline, often porphyritic rock, consisting chiefly of a lime and soda feldspar, which is sometimes labradorite, and at others andesine, or some related species, and is generally associated with hypersthene. It often holds beds or masses of titaniferous iron ore, and from its extent, occupies a conspicuous place in the series. It is the *hypersthene rock* of McCulloch and Emmons.

With these, the limestones are interstratified, but their relations to the formation have not yet been fully made out. All of these rocks bear evidences in their structure, that they are of sedimentary origin, and are really stratified deposits, but their investigation is rendered difficult by the greatly disturbed state of the whole formation. Among these stratified rocks, there are however dykes, veins, and masses of trap, granite and syenite, often of considerable extent, which are undoubtedly intrusive. There are abundant evidences that the agencies which have given to the strata, their present crystalline condition, have been such as to render the limestone almost liquid, and to subject it at the same time to great pressure, so that in many cases it has flowed around and among the broken, and often distorted fragments of the accompanying silicious strata, as if it had been an injected hypogene rock.

The limestone strata are from two or three feet to several hundred feet in thickness, and often present a succession of thin beds, divided by feldspathic or silicious layers, the latter being sometimes a conglomerate of quartz pebbles and silicious sand; in one instance, similar pebbles are contained in a base of dolomite. Beds frequently occur in which the carbonate of lime has been mixed with silicious sand, in some cases yielding an arenaceous limestone, while in others, a chemical union has produced beds of tabular spar, often passing into pyroxene from an admixture of magnesia. These minerals sometimes form beds, in a nearly pure state, but in other cases they are intermixed with quartz, carbonate of lime, orthoclase, scapolite, sphene and other species.

The limestones are sometimes coarsely crystalline, at others finely granular or almost compact; their color is white passing into reddish, bluish, and grayish tints, which are often arranged in bands coincident with the stratification. Some of the dark grey bands, harder than the adjacent white limestone, were found by Mr. Murray to owe their color to very finely disseminated plumbago, and their hardness to intermingled grains of rounded silicious sand. The limestone is often magnesian, and the manner in which the beds of dolomite are interstratified with the pure limestone, is such as to lead us to suppose that some of the original sedimentary deposits contained the two carbonates, and that the dolomite is not the result of any subsequent process.

The principal mineral species found in these limestones are apatite, serpentine, phlogopite, scapolite, orthoclase, pyroxene, wollastonite, idocrase, garnet, brown tourmaline, chondrodite, spinel, corundum, zircon, sphene and graphite. All of these appear to belong to the stratification, and the chondrodite and graphite especially, are seen running in bands parallel to the bedding. Magnetic iron ore is sometimes found in beds interstratified with the limestone. The apatite which is in general sparingly distributed, is occasionally very abundant in imperfect crystals and irregular crystalline masses, giving to small beds of the limestone the aspect of a conglomerate. Some of the coarsely crystalline varieties of this limestone give a very fetid odor when bruised.

In some parts of this formation, in the rear of the bay of Quinté, the rocks are less altered than in most other places, and here the limestones, although more or less crystalline in texture, afford none of the fine crystalized species elsewhere met with. The foreign ingredients seem to be mechanically intermixed, giving an earthy appearance to the weathered surface of the rock, or are separated in the form of small grains of pyroxene, showing an imperfect metamorphism. For further descriptions of the rocks of this series, see the Reports of the Geological Survey of Canada, particularly that of Mr. Logan for 1846, and Mr. Murray's for 1853; also Dr. Emmons's Report on the Northern District of New York. In position and in lithological characters, the Laurentian series appears to correspond to the old gneiss formation of Lapland, Finland and Scandinavia.

In the second class we include the crystalline limestones of western New England, and their continuation in southeastern New York, and the adjacent parts of New Jersey and Pennsylvania. The limestones of the Champlain division of the Lower Silurian rocks which are found on the Yamaska River, enter Vermont near Misisquoi Bay, where they show a commencement of alteration. Farther south, they become the white granular marbles of western Vermont, and of Berkshire, Massachusetts, which according to Hall, still exhibit upon their weathered surfaces, the fossils of the Trenton limestone; thence passing southwest, they cross the Hudson near West Point, and appear in Orange and Rockland counties, New York, and in Sussex county New Jersey, in a highly altered condition, closely resembling the crystalline limestones of the Laurentian series, and containing in great abundance the same imbedded minerals. These limestones are some-

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* An Abstract of a paper read before the American Association for the Advancement of Science, at Washington, April, 1854.

times dolomitic, and Hitchcock observes that in the granular marbles of Berkshire, pure and magnesian limestones occasionally form different layers in the same bed. (Geology of Massachusetts, p. 84.)

In Orange county, according to Mather, it is easy to trace the transition from the unaltered blue and gray fossiliferous limestones of the Champlain division, (including the Calciferous sandrock and the Trenton,) to the highly crystalline white limestone with its characteristic minerals. (See his Report on the Geology of the first district of New York, pp. 465 and 486.) This view is fully sustained by H. D. Rogers in his description of the limestones of Sussex Co., given in his final report on New Jersey, (cited by Mather, as above, p. 468 et seq.(Mather farther concludes very justly that all the limestones of Western Vermont, Massachusetts and Connecticut, and those between the latter state and the Hudson River, are in like manner altered Lower Silurian strata. (p. 464.) From the similarity of mineral characters, he moreover supposes that the crystalline limestones about Lake George are of the same age, and he extends this view to those of St. Lawrence County. Both of these however belong to the Laurentian series, and are distinguished by their want of conformity with the Champlain division, and by their association with labradorite and hypersthene rocks which seem to be wanting in the altered Silurian strata. The slates of this division in Eastern Canada, generally contain some magnesia, with very little lime, and four or five per cent, of alkalies, chiefly potash;* hence the feldspar which has resulted from their metamorphosis is generally orthoclase, and they have yielded gneiss, and mica slate, which with quartz rock, and chloritic and talcose slates, make up the Green Mountains.

In the upper part of the Champlain division, there are found some beds of a limestone, often conglomerate, which is generally magnesian and ferruginous, and often contains a great deal of silicious sand; and associated with it are beds of carbonate of magnesia without a trace of lime, though sometimes very silicious. These beds are interstratified with slates and sandstones, and in the metamorphic region are replaced by the serpentines, which are often intermixed or associated with limestones and dolomites, and, with their accompanying talcose slates, may be traced one hundred and thirty-five miles in Canada, and thence by Vermont, Massachusetts and Connecticut, through New York, New Jersey, Pennsylvannia and Maryland, southward. These rocks are everywhere marked by the occurrence of chromic iron ore, in masses running with the stratification, or in disseminated grains, in the serpentine, and sometimes in the dolomite; they are also the auriferous rocks of the great Appalachian chain. Gold, associated with talcose slates, serpentine, chromic and titaniferous iron ores, is traceable along their outcrop from Canada to Georgia. Gold-bearing veins have also been found in the slates which in Eastern Canada, from the base of the Upper Silurian. I remark that in a somewhat chloritic and very silicious magnesian limestone, which is associated at Granby with red and green slates and sandstones, a portion of oxyd of chromium was detected by analysis. I have also found titanium in some of the very ferruginous slates, which by their alteration become chloritic schists holding magnetic and specular iron, ilmenite and rutile.

Serpentine is found as an imbedded mineral in the Laurentian limestones, but the extensive deposits of serpentine rock, with its associated talcose slates and chromic iron, appear to be confined to the upper part of the altered Champlain division. The examinations of C. U. Shepard, and those subsequent of J. Lawrence Smith and G. J. Brush, have shown that many at least of the so-called serpentine rocks of northern New York, are hydrous silicates of alumina, iron, and potash, containing very little lime or magnesia; they are the dysyntribite of Shepard.

As the north-western limit of the metamorphic belt in Eastern Canada runs southwesterly into Vermont, the undulations of the strata, which are nearly N. and S., escape from it to the northward. Proceeding E. S. E. however, from the unaltered Trenton limestones of the Yamaska, we cross the overlying slates, sandstones, and dolomites, and entering the metamorphic region find the serpentines, talcose, chloritic and micaceous schist, with gneiss and quartzite, very much disturbed, and repeated by undulations. On reaching the valley of Lake Memphramagog, we come upon the third class of crystalline limestones, which are Upper Silurian. This limestone formation has a continuous outcrop from the Connecticut valley, by the lake just mentioned and the upper part of the St. Francis river, to the Chaudière, and is thence traceable by intervals as far as Gaspé, where it is clearly unconformable with the Lower Silurian. It holds the characteristic fossils of the Niagara group, but for some distance from the line of Vermont, is so much altered as to be white and crystalline, and to contain abundance of brownish mica, the fossils being often obliterated.—At Dudswell on the St. Francis, the beds of white granular marble show upon their weathered surfaces or in polished sections, the forms of encrinal discs and corals, among which the characteristic *Favosites gothlandica*, and various species of *Porites* and *Cyathophyllum*, have been identified. These fossils in a similar condition are also found at Georgeville on Lake Memphramagog. Following the section in a S. E. direction, to Canaan on the Connecticut river, we meet with calcareo-micaceous schists, which are gradually replaced by mica slates, with quartzose beds. Some of the fine dark-coloured mica-slates exhibit crystals of chiastolite, and others near Canaan, abound with black hornblende and small garnets. (For the details of this section see Mr. Logan's Report for 1847—48.)*

These Upper Silurian strata constitute the micaceo-calcareous rocks of Vermont, which Prof. Adams traced through the state, to Halifax on the border of Massachusetts, and they are continued in what Hitchcock has called the micaceous limestone of this state, which according to him pass by insensible degrees into mica slate. The limestones of Coleraine, Ashfield, Deerfield and Whately, Mass., belong to this formation and perhaps also the crystalline limestone which is found at Bernardston, with magnetic iron and quartz rock, and shows imperfect fossils upon its weathered surfaces. (Hitchcock's Geol. of Mass. p. 560.) The condition of these limestones resembles that of the granular marbles on the other side of the Green Mountains, and they nowhere exhibit that degree of alteration which distinguishes the latter farther south. . The same calcareo-micaceous rocks are conspicuous in western Connecticut; but in the towns of Salisbury, Sharon, and Canaan the crystalline limestones, and in Litchfield and Winchester, the serpentines, of the Lower Silurian are met with, and these rocks appear again in the southwestern part of the state.

In the fourth class we include the crystalline limestone of Eastern Massachusetts, which occurs in a great number of places in the towns of Bolton, Boxborough, Chelmsford, Carlisle, Littleton, Acton, Natick, and Sherburne. It appears according to Hitchcock, in interrupted lenticular masses, lying in the gneissoid formation, or in the hornblendic slates, and occasionally presenting distinct marks of stratification. Still further east at Stoneham and Newbury, we find crystalline limestone, sometimes magnesian, in irregular masses, lying in a rock intermediate between syenite and hornblende slate. Serpentine is found with that of Newbury; and at Lynnfield, a band of serpentine has been traced two or three miles N. E. and S. W. Dr. Hitchcock, to whose report on the Geology of Massachusetts we are indebted for the present details, says of this serpentine, "I am satisfied that it is embraced in the great gneiss formation, whose strata run from N. E. to S. W. across the state." p. 159. He further remarks of the syenite of Newbury and Stoneham, which includes the crystalline limestones, "I have every reason to believe that it is o. 'y a portion of a gneiss formation which has undergone fusion to a great degree; for portions of the rock still retain a slaty or stratified structure." and he conceives it probable that all the crystalline limestones of Massachusetts are of sedimentary origin; p. 586. It may be remarked that the irregular shape of these interstratified masses, is analagous to the interrupted stratification and lenticular beds, frequently met with in fossiliferous limestones.

The limestones of Bolton, Chelmsford and the adjoining towns are in general highly crystalline, and are remarkable for the variety of fine crystallized minerals which they contain. Among these are apatite, serpentine, amianthus, talc, scapolite, pyroxene, petalite, chondrodite, spinel, cinnamon-stone, sphene and allanite, which include the species characterizing the Laurentian and Lower Silurian metamorphic limestones. The limestone of these quarries evolves a very fetid odor when bruised. Chromic iron ore has never so far as I am aware, been observed with the serpentines of this region.

We have now to inquire as to the geological age of this great mass of crystalline rocks which is so conspicuous in Eastern New England. Mr. Logan has shown that the rocks of the Devonian System in Gaspé, assuming the Oriskany sandstone as its base, attain a thickness of more

* See my remarks On the Composition and Metamorphoses of some Sedimentary Rocks, L. E. and D. Philos. Magazine for April, 1854, p. 233.

* See also on the Geology of Canada, Silliman's Journal [2] vol. ix. p. 12, and xiv. p. 224.

than 7000 feet, and as they are still 2,500 feet thick in New York, and do not die away before reaching the Mississippi, it is to be expected "that they would follow the Upper Silurian zone in its southwestern course from the eastern extremity of Gaspé, and display a conspicuous figure either in a metamorphic or unaltered condition, between it and the carboniferous areas of Eastern America; to one of which New Brunswick belongs, while another is met with in the state of Rhode Island, and in a metamorphic condition in Massachusetts." (Report for 1848, p. 58.) The lower part of the Devonian, farther west, embraces beds of limestone, but in Gaspé the formation consists almost entirely of siliceous and argillaceous beds. In Mr. Logan's section of the whole 7000 feet on the Gulf of the St. Lawrence, he observed only one small bed of limestone, and a few thin bands of limestone conglomerate. When we consider the geographical position of the Upper Silurian rocks in the Connecticut valley on the one hand, and the coal field of southeastern Massachusetts on the other, we can scarcely doubt that the intermediate gneissoid, and hornblendic rocks with their accompanying limestones, are the Devonian strata in an altered condition. Prof. Agassiz from his own examination of the region, was led to a similar conclusion as to the age of the so-called syenites, and in August, 1850, presented to the American Association for the Advancement of Science at New Haven, a paper on the age of the Metamorphic rocks of Eastern Massachusetts, which has never I believe been published. The less altered limestones which, according to Dr. Hitchcock are found interstratified with red slates at Attleborough and Walpole, may correspond to those which with similar slate and sandstone, are met with at the base of the carboniferous formation in Canada on the Bay de Chaleurs, and in New Brunswick.

We have then distinguished four classes of crystalline limestones: first, those of the Laurentian series with their accompanying garnetiferous gneiss, labradorite and hypersthene rocks. secondly those of the Lower Silurian formation, with their attendant auriferous rocks, talcose slates and chromiferous serpentines; thirdly those of the Upper Silurian age, with their associated calcareo-micaceous schists; and fourthly, those which belong to the gneissoid rocks of eastern Massachusetts, and are probably of the Devonian period.

I have endeavoured in this paper to bring together the facts known with regard to the different crystalline limestones, and their associated strata in this portion of the continent, and to show how far these may serve as a guide in the geological investigation of the metamorphic rocks While the result confirms the observations of European Geologists that similar crystallized minerals may occur in the metamorphic limestones of very different geological epochs; it also shows that within certain limits, the mineral characters of the altered silicious strata, may serve as important guides to our investigation.

On the Position of Fire-Places.

By Dr. Neil Arnott, F.R.S.*

This is the fit place for remarking on the fashion lately introduced in this country of placing the fire-grates much lower down than formerly—in some cases, on the very hearth—the reasons usually assigned being that a lower fire burns better, or gives out more heat from the same quantity of fuel, than a higher; and, because lower and nearer the floor, that it must warm the carpet better, and so lessen the evil of cold feet. Now, both these suppositions are curious errors or delusions, having their origin, in popular misconceptions respecting heat, and particularly respecting the radiation of heat.

Radius is the Latin word for the spoke of a wheel, and anything which diverges or spreads around from a centre, in some degree like spokes, is said to radiate. Light and heat are of this nature; the portion of either which passes in a straight line from the centre is called a ray.

The simplest observation teaches all that a lamp placed in the middle of a room radiates its light nearly equally in all directions; and most persons are aware that if an opaque mirror be placed close to a lamp on one side, it not only intercepts all the rays that fall upon it —and that means nearly half of the light given out—but it returns or reflects these rays back in contrary corresponding directions, and nearly doubles the illumination in those directions.

Most persons also have observed that if a fire, or a red-hot mass of metal, be placed in free space, it radiates its heat as well as its light nearly equally in all directions; but many do not learn, by their unaided observation, that if a surface of any substance, like fire-brick, which strongly resists the passage of heat through it, be placed near a fire, it not only intercepts the heat-rays falling on it, but after absorbing them, and so becoming heated, often to redness, it then reflects and radiates back the greater part of the heat, almost as if it were additional hot fuel in the fire, and thereby nearly doubles the warmth felt in directions away from the surface,

Neither does common observation make persons aware of the truth that of the heat produced by combustion in a common fire, one part—being somewhat more than half—is diffused, like the light, by radiation, into the open space around, and the remainder is given, by contact and conduction, to the air which supports the combustion, and to the solid material of the fire-place; Thus, with a common open fire-place, it is the radiant heat almost alone which warms the room, the remainder either at once combining with the burned air or smoke, and passing up the chimney, or being given by the heated grate to pure air, which touches that, then passing into the chimney with the smoke.

And, lastly, many persons do not at first learn the truth, that the rays of heat passing through pure or transparent air do not at all warm that air, but warm only the solid or opaque bodies by which the rays are intercepted, and that thus the air of a room is warmed only at second-hand, by contact with the solid walls and furniture, which having intercepted the heat rays, have themselves first become heated. Yet most educated persons know similar facts, such as that the sunbeams, bringing both light and heat to the earth, as they descend to warm the hottest valleys or plains of the earth, pass through the upper strata of the atmosphere, which are always of a temperature much below freezing. This is proved by the fact that all lofty mountains, even under the equator, are capped with never-melting snows, and that the higher the peaks are—and, therefore, the nearer to the sun—the colder they are. Thus, also, all persons who have attended to the subject know that aeronauts, in their balloon-car, if they amount very high, would be frozen to death, but that they are protected by very warm clothing. Another fact of the same kind is, that a glass globe, filled with cold water, or even ice, may in the sun's ray be used as a burning-lens.

These explanations being premised, the two popular delusions respecting the low fires become at once apparent.

1st. The supposition that fuel burnt in a low fire gives out more heat, has arisen from the experimenter not reflecting that his hand held over the low fire feels not only the heat radiated from the fire itself, but also that reflected from the hearth close beneath it, which second portion, if the grate were high, would have room to spread or radiate downwards and outwards to the more distant floor or carpet, and to warm them.

2nd. The notion that the fire, because near the floor, must warm the carpet more, springs from what may be called an error in the logic of the reasoner, who is assuming that the hearth, floor, and carpet being parts of the same level, are in the same predicament—the truth being, however, that in such a case the hearth within the fender gets nearly all the downward rays, and the carpet almost none—as a candle held before a looking-glass at a moderate distance diffuses its heat pretty uniformly over the whole, but if moved close to one part of the glass it overheats and probably cracks that part, leaving the rest unaffected. A low fire on a heated hearth is to the general floor or carpet of a room nearly what the sun, at the moment of rising or setting is to the surface of a field. The rays are nearly all shooting upwards from the surface, and the few which approach it slant obliquely along or nearly parallel to the surface, without touching, and therefore without warming it.

Striking proof of the facts here set forth is obtained by laying thermometers on the floors of a room with a low fire, and of a room with the fire, as usual of old at a height of about 15 or 16 inches above the hearth. An experiment, tried in two such rooms, in both of which thermometers on the pianofortes, four feet above the floor, stood at 62°, showed the carpet, not far from the hearth, to be at 56° with the low and at 73° with the high fire.

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* The subject of this article was referred to by Dr. Arnott, during the reading of his paper on the Smoke-consuming Fire-grate, on the 10th of May last before the Society of Arts; and as it has been deemed important, he has been good enough to give his remarks in writing, which may be taken as forming part of his original paper.

As would be anticipated by a person understanding the subject aright, low fires make cold feet very common, unless to those who sit near the fire with their feet on the fender: but, deceived by their fallacious reasoning, the advocates are disposed to blame the state of their health or the weather at the cause, and they rejoice at having the low fire, which can quickly warm their feet when placed near it. A company of such persons seen sitting close around their fire with thankfulness for its warmth near their feet, might suggest the case of a party of good-natured people duped out of their property by a swindler, and afterwards gratefully accepting as charity from him a part of their own property.

Many persons have been prevented from detecting the truths connected with low fires by the fact, that where the chimney breast or opening is also made low, the mass or stratum of comparatively stagnant warm air in the room is deeper or descends lower than where the chimney opening is high, and the room thus arranged may be, except near the floor, warmer than before. But advantages from this arrangement is often missed by the chimney throat being left too wide, causing strong cold draughts below; and where there are many persons in the room, the possible good is more than counterbalanced by the ventilation above being rendered in proportion more faulty. In the new smokeless grate, there is the advantage of a low chimney opening, although with a high fire, and yet the ventilation is maintained perfect for any amount of crowd by the ventilating valve, placed near the ceiling of the room.

It may be observed here, that the smoke-consuming grate exhibited in the Hall of the Society of Arts is of small size, fitted for a room of moderate dimensions, and was originally intended to be placed for inspection on the table, merely to show the principle; but the Secretary, judging that it would be more interesting if seen in action, desired it, although so disproportionate, to be fixed for the time in the fire-place of the large Hall. That grate was constructed by Messrs. Bailey, of Holborn; but the deviser hopes, as the whole arrangement is so simple, that intelligent manufacturers everywhere will be able to make it perfectly. He deems himself bound to publish, soon, any further instruction with regard to it which further and more varied experience may suggest.—*Journal of the Society of Arts.*

On the Decomposition of Rocks, and the re-composition of their metallic constituents.

By John Calvert, Esq.

The large quantity of gold found in the detritus of Australia, California, and other acknowledged gold regions, has called forth much speculation from many scientific minds as to the origin of so much alluvial gold, when the source from which it appeared to emanate (viz., the quartz veins) have so generally failed to produce it on being entered into or worked below the surface, thereby causing so much disappointment to gold mining speculations, the promoters thinking they had only to rip open the goose to ensure to themselves a plentiful harvest of golden eggs. The delusions and failures of gold quartz companies are such acknowledged facts, that it will be unnecessary for me to enter upon that part of the subject here. The origin or development of gold may be thus classified,—viz.:

1. When precipitation takes place simultaneously with the intrusion and upheaval of the palæozoic formations.

2. An after-precipitation, through the electric and atmospheric decomposition of the various rocks and metalliferous formations.

But a small portion of the gold we use owes its origin to the first circumstances; and gold having a surface determination, it will always percipitate itself there, and therefore would long ago have been an extinct metal in inhabited countries, were it not for the fact of the after-precipitation and development which is always going on wherever the matrix containing it is thrown under circumstances sufficiently kind to render the decomposition of the matrix favourable to the re-composition of the gold it may contain.

By far the greater portion of the gold we obtain at the various diggings and mines owes its realisation and development to this after-precipitation. The vast granite ranges in Australia and other places, the flanks of which are so constantly undergoing decomposition, and keeping up the supply of detritus and sands in the river and creeks which flow from them, are not found to contain any gold at the head of the creek, or in the granite detritus, until it has been washed into hollows, and beds of creeks and rivers, in company with an accumulation of organic matter: then, with sufficient moisture, the battery-power is active enough to precipitate the gold in nodules of various sizes, just in the same way that flint forms in chalk, or iron in bogs. an atmospheric decomposition of granite, containing a very small quantity of any other metal, is not sufficient to develope the gold it contains; but in the case of many of the various metallic ores, when in their combination exists sufficient of the opposing metal to create a self-acting battery, they will, after being exposed to a succession of winters' rain and summers' heat, be decomposed, and the gold and other metals they contain will be found to have re-composed themselves in other chemical states. But in many cases of rapid decomposition the waste of such a tender electric metal as gold will be very great, and more especially when decomposed by heat.

Nature's workings are beautiful, but in many instances very slow. Now, with regard to the gold in England, I have shown in my book, by many facts of history and tradition, that large quantities have been obtained at various periods. The English gold-fields, therefore, cannot be put upon a par with the virgin ground of Australia and other places, where Nature has been undisturbed and quietly producing it for many centuries, perhaps ever since that continent existed; still there are a few patches of ground here which have escaped the craving thirst of the ancient gold-diggers, and may yet be worked in England with a profit. Of those few isolated veins and spots that contain sufficient precipitated gold to pay for working, but two or three have been discovered and made known, and none properly worked.

If we would work gold in England on a large scale, we must seek it in other forms than its precipitated or metallic state; or the alternative will be to vigilantly search for the comparatively small quantity precipitated, and having worked that, wait patiently for some centuries whilst Nature accumulates more. I have watched the decomposition of rocks in many countries, have studied this subject the greater part of my lifetime, and have long since fallen into all the blunders and errors that so singularly characterise the gold-seeker's career, and which seem to so engross the public mind at present.

Whilst on my geological researches in Australia, in 1846, I discovered a boulder of granite, partially embedded in rich black soil, at the side of a river; it seemed as though it had been undisturbed for many years; it was in a state of discomposition. On the under side it was almost decomposed, and tinged with the oxide of iron; I could pick that part to pieces with my fingers; there were visible nodules of gold in all that portion that yielded to my fingers; there was no gold visible in the upper portion. This was a problem set me by Nature, which I toiled for many weeks and months to solve; many were the experiments and methods I fruitlessly tried. I could decompose the upper portion of that block of granite, but the gold was wanting. After some time I travelled back to the spot from which I had obtained it, carefully watched the chemical and electric conditions under which it had there been acted upon. I returned, tried fresh experiments, and succeeded in decomposing a piece of the upper portion of the granite block: the only difference was, that the grains of gold I obtained were smaller than those formed by the natural process. Ever since that time I have been able to perform the same experiments successfully upon rocks and ores, providing they contained any.

Now, as the great and Almighty Providence has so generously seen fit to invest man with the power to assist and force so many of Nature's productions, may it not likewise be within his scope to forestall Nature's decomposition of the vast masses she so slowly attacks, and by artificial means to perform that in a week or a month which otherwise would take years or centuries?—*Mining Journal.*

Materials for Paper-making.*

The question is frequently asked, "Why do not the Americans collect their own rags?" I apprehend the answer to be twofold:—First, happily the sources of employment open are so numerous and profitable that most persons can earn more at some other occupation than collect-

* By Alfred Coleman.—Journal of the Society of Arts.

ing rags, secondly, the ability to read, and the power of purchasing newspapers, books, &c., are so universal, that the demand for paper is much greater than can be met by any possible internal supply of rags. I could wish the European nations were similarly situated, and should be willing to risk the probable effects on the price of paper.

From the best estimate I can form, I think we shall not err in setting down the cost at which manufacturers now produce the 177,633,009 lbs. weight of paper, which it may be assumed will be made this year, at £1,000,000 more than the same weight would have cost in 1852. In 1832 only 64,935,655 lbs. of paper were manufactured in Great Britain, so that in twenty years the manufacture has nearly trebled its production, in 1853 the quantity being 177,633,009 lbs.

If the manufacture should keep at its present point only, the high price of material is likely to be permanent, but as the demand for paper will probably go on increasing, it well becomes the Society of Arts to prospect, if I may use the expression, for raw materials for this commodity. That the supply of paper will ever fail I have no fear, inasmuch as nearly a century ago paper was experimentally made from upwards of thirty different materials, and more recently attempts have been made, not without some success, to manufacture it on a large scale from plantain fibre, peat, wood shavings, hop-bines, straw, &c. Some specimens made a year or two ago from plantain fibre, were undistinguishable from good printing paper made from rags, I am not aware of the cause of suspension of operations. Experiments are still going on, I believe under a recent patent for the manufacture of wood paper. A patent has also been recently taken out for the manufacture of paper from hop-bines. I fear the cost of reducing several of these substances to pulp will be found too great to allow of the preparation being remunerative, even at the present high price of rags.

According to the views propounded on Wednesday evening, Dr. Royle and the speakers generally seemed to regard the various fibres then described as sources of ample supply for the paper-makers. In quantity and quality I will not for a moment dispute the point, but, with every desire to see the price of paper materials low, and, in my opinion, it is second to "cheap bread" only in importance, I am certain we shall not accomplish the object by self-deception on any one important fact; and neither hopes, wishes nor experiments can overcome market price; and on this ground I venture to express my doubts of the present availableness of the substances so ably pleaded for by Dr. Royle.

I find on inquiry this day, that the present market price of Manilla hemp is from 70s. to 76s.; jute, 27s. to 32s.; per cwt.; for plantain fibre I could not obtain the quotation. Now the best white-English and foreign cotton and linen rags, suitable for making writing paper, do not range above 34s. per cwt., and these suggested raw fibres would require much more chemical treatment than the rags of the same price. The rags have been brought into a textile condition from original fibrous state at a certain cost, which has been defrayed by the use to which rags were applied whilst in the state of garments, &c.; if, therefore, the substances mentioned on Wednesday *could* be used in lieu of the best rags it would only be a case of substitution—no advantage in price would be gained. The greatest rise, be it observed, has occurred in the lower quality of paper materials, and it is additional supplies of this description which are needed. If these new fibres be introduced for this purpose the case is still worse, manufacturers would be using a 32s. article for the production of paper, the ordinary materials for which are now only 10s. per cwt. It is not the original cost of fibre merely which must be considered, but also waste in manufacture, chemical cost of power, wear and tear and replacement of machinery, wages, duty, and profit, truly a formidable list of obstacles to cheapness.

Having offered these remarks on the various propositions which have been brought forward for removing the difficulty, I may be allowed to direct attention to what I conceive to be the true source of relief. I had hoped to have celebrated the repeal of the duty long ere this, but under present circumstances this happy event must be considered as indefinitely postponed; the repeal, however, come when it may, will be equivalent to an average reduction in price of about 20 per cent. The repeal of the duty, although it would to a certain extent lower the actual price of paper would, I have no doubt, have a tendency to raise the price of materials by increasing the demand for the manufactured articles. I should not, however, trouble you with these remarks if I depended principally upon the repeal of the duty for a reduction in price, but I am of opinion that an unlimited supply of a cheap and a suitable material exists in our own country. I refer to straw. The sheet upon which I write is made entirely from straw, and leaves little to be desired for ordinary uses, and for many purposes it is preferable to paper made from rags. Moreover, less power is required to prepare the materials, the process being more chemical than mechanical, an important matter, when the high price of coals in some parts of the country is considered. Why, then, has this manufacture been comparatively neglected? Solely, I believe, from the circumstance that the large quantity of alkali required to prepare straw for pulp, by combining with its resinous and silicious matters, causes that article, the alkali, to become a more important element of cost in the manufacture than the straw itself. To reduce the cost by recovering a portion of the alkali, an expensive mode of evaporation has been hitherto adopted. It has long been my decided conviction that this alkaline solution could be used as the raw material of some other manufactures, such as soap making, or for common glass, probably both, thus saving, at any rate partly, the expense of evaporation; and the great point I wish to bring before the Society is the desirableness of ascertaining to what uses this residuum can be profitably applied. If the expense of evaporation could be saved, the manufacture of paper from straw would be rendered more profitable, and a large supply would be the result, the rag market particularly for the inferior description of goods suitable for the manufacture of printing paper, be kept low, and the desired object would be thus accomplished. The proprietors of the following straw-paper mills, I believe all at present in existence, would, I have no doubt, supply some of their "black liquor" to any soapmaker, glass manufacturer, or chemist who might be disposed to try experiments with it, viz:—Tovil Mills, Maidstone, Kent; Quenington Mills, Fairford, Gloucestershire; Burnside Mills, Kendal, Westmorland; Golden Bridge Mills, near Dublin.

I understand Mr. Simson, of Maidstone, has patented some process connected with this subject, but with the particulars I am not acquainted.

Irish Peat Company.

At a meeting of the shareholders of the Irish Peat Company, (July 1, 1854,) the following report of Mr. Powell, the temporary manager was read:—

In compliance with your request, I forward a short report on the working of the factory at Kilberry, from the period that the furnaces were lighted up to the present period.

Turf Consumed.—The turf consumed in the furnaces since the 18th March, the day on which the furnaces were first lighted, up to this day, amounted to 19,674 wagon loads, such as are used in charging the furnaces. Six of these wagon loads average 1 ton, giving the total amount of turf consumed as 3279 tons.

Tar Produced.—The quantity of tar collected up to the present time amounts to a little more than 70 tons, in addition to which there is now in the various tanks about 10 tons not yet collected, giving a total of 80 tons, or, as near as possible, 2¾ per cent. on the amount of turf consumed.

Tar Distilled.—47,518 lbs. of tar have now been distilled, which has yielded 730 gallons of rough oil, and 21,950 lbs. of rough paraffine and oil mixed, the whole of which is in course of separation and purification.

Naphtha.—From the ammoniacal liquor has been distilled, up to the present time, 223 gallons of rough naphtha, averaging more than 45 degrees above proof, and which, when re-distilled, and reduced to 37½ degrees, the usual marketable strength, will yield more than the same amount of rectified spirit.

Sulphate of Ammonia—We have further obtained from the ammoniacal liquor distilled 1½ ton of sulphate of ammonia, fit for market, and about ½ ton more in course of draining and evaporation: 6000 gallons of ammoniacal liquor yield, on an average, 10 gallons of naphtha and 200 lbs. of sulphate of ammonia, and we have at present about 30,000 gallons not yet distilled. These are the simple statistical facts relative to the products obtained from the turf hitherto consumed, but I do not consider that they are a fair criterion of what we have a right to expect from the same amount of turf consumed, when the factory is in regular work, for the following reasons:—In the first place, on the furnaces being lighted the expansion in them was very considerable, and for some weeks I believe that the greater proportion of the products escaped through the innumerable openings thus formed; this evil gradually abated as the furnaces became vitrified: 4 or 5 tons of tar may be considered as having been lost on first starting by the coating which the various tubes through which it passes have taken up; but a far greater source of loss in products than either of these has been caused by the constant necessity of blowing out the furnaces from the front, in order to keep the bottoms of the furnaces sufficiently heated to prevent the slag from choking them. The great cause of this having been so constantly requisite, has been the excessive irregularity of burning, consequent upon the inefficiency of the blowing machine.

Gas.—For the last week or ten days since the blowing machine has been put in somewhat more efficient condition, the amount of gas has been very satisfactory. We have frequently had more gas than we required, though only working with two cylinders. Previously to this, there has been generally a deficiency of gas, and we have not, therefore attempted as yet to make any charcoal.

Iron Ore.—A considerable quantity of iron ore, both clay-band, and brown hematite, is calcined, and ready for putting into the furnaces, as soon as we can again get them sufficiently hot for smelting. This, however, cannot be, until we have had the four cylinders of the blowing machine continuously at work for a considerable period.

Turf Cutting.—We have cut this season up to the present time about 10,000 tons—1100 of which is now clamped. The excessive quantity of rain for the last month has prevented a greater proportion from being clamped. We have still on hand from last year's cutting 1690 tons of turf. The difficulty in procuring labourers for turf cutting has been this year unparalleled throughout the country.

I have strictly confined myself in this report to plain statistical facts, for these are what all will look to; but had the general meeting been a month later, I feel confident, provided no unforeseen accident should occur, that I should have been enabled to form statistics relative to the further purifying of the products, that would have been much more satisfactory to the meeting than those I am at present enabled to afford—I allude more especially to the amount of pure parafine, and also of valuable oil that we now expect to obtain from a given quantity of tar. I trust, however, that the unvarnished statements which I have now given will be satisfactory as far as they go.—[I. F. Powell.

Product of the Precious Metals throughout the World in 1853.

	GOLD.	SILVER.	TOTAL.
America.	$109,156,748	$29,807,456	$138,964,204
Europe.	22,138,914	8,648,937	30,787,851
Asia.	19,847,658	5,197,218	25,044,876
Africa, &c. &c. .	4,000,000	. . . . .	4,000,000
Australia. . . .	96,000,000	. . . . .	96,000,000
Grand total. . .	$251,143,320	$43,653,611	$294,796,931

The following will exhibit the annual product at various periods prior to above:

1492.	$250,000	1800.	$52,529,867
1500.	3,000,000	1842.	69,987,681
1600.	11,000,000	1848.	86,661,060
1700.	23,000,000	1851.	180,173,873

The statistics lately collected by the Secretary of the Treasury (U. S.) present some interesting facts. According to the statement of Mr. Crawford, the amount of specie in the country in 1820 was only $37,000,000.

Product of the mines from that date to 1849.		$37,705,250
Import of specie from 1820 to 1849 amounted to.	$252,169,841	
Exported during the same time. . . .	180,462,406	
Leaving an excess of imports over exports of specie to 1849 of.		71,707,435
In the country on the 1st of January 1849.		$122,412,685
Supply from the mines from 1849 to 1854.		194,363,117
Imported in same time.		26,508,774
		$343,294,576
Exported from the country between January, 1849, and January, 1854.		112,695,574
Specie in the country, in January, 1854.		$230,589,502

—being one hundred and eight millions of dollars more in the country now than in 1849. But there are large amounts of money brought into the country that cannot appear in statistical tables. It is estimated that over $30,000,000 in coin have been brought in by immigrants since 1849. Of the two hundred and thirty millions in specie in the country now, a little less than sixty millions is in the banks: a little more than twenty seven millions in the national treasury: and the balance is in circulation, or hoarded up by private owners. The gold and silver in circulation is over one hundred and forty-three millions of dollars now, and the circulation of bank paper is over one hundred and ninety-four millions of dollars. Together they make over three hundred and thirty-eight million dollars as the active money of the country at the present time.

Results of some recent Investigations of M. Vicat,

Upon the Destructive Action which Sea Water exerts on the Silicates known in the Arts as Hydraulic Mortars, Cements, and Puozzolanas.

M. Vicat, to whom we are so much indebted for our knowledge of the preparation of cements, has recently presented to the French Academy of Sciences the following *resumé* of the chief general results to which a very long course of experiments upon that very important subject, the durability of cements in marine construction, has led him:—

1. That the double hydrated silicates of lime and alumina just mentioned are very unstable compounds.

2. That pure water, when poured upon all of them in the state of as fine powder as can be produced by ordinary means, no matter what might be their age or hardness, will dissolve a portion of their lime, provided they have not been in any way, or at least a very slight degree, exposed to the action of carbonic acid.

3. That if, under the same circumstances, a very dilute solution of sulphate of magnesia or Epsom salt be substituted for the pure water, the greater part, and often the whole, of the lime existing as silicates passes into the condition of sulphate. If any carbonic acid had previously acted upon it, the carbonate of lime thus formed is not decomposed by the sulphate of magnesia.

4. That all puozzolanas, no matter what might be their ages, require for their complete saturation a very much smaller quantity of lime than is added in practice, especially when we take into account their very imperfect state of division from the rough way in which they are usually prepared.

5. That the affinity of carbonic acid for the lime in combination in these various silicates is so strong, that it is possible, with the aid of a little moisture, to completely neutralise it, wherever it can penetrate, and thus leave all the other constituents of the cement, whether in combination or not among themselves, as mere mixtures in the mass.

It follows, from these results, that sea-water will destroy every cement, mortar, or puozzalana, if it can penetrate into the mass immersed in it. As, however, certain of these compounds are perfectly durable when constantly immersed in sea-water, they cannot have been penetrated by it. Its penetration has been prevented by the surfaces, and the source of this inability to penetrate is chiefly caused by a superficial coating of carbonate of lime, which has formed either anteriorly or posteriorly to their immersion, and which in time augments in thickness. The effect of a kind of cementation produced by the decomposition of the sulphate of magnesia, of the sea-water, and the deposition of carbonate of magnesia in the superficial tissue of the mass, and the formation of incrustations and of submarine vegetation, contributes also to this impermeability. But all such superficial impermeable coatings are not attached with the same force to the mass which they envelope. The differences which have been observed in this respect depend in some cases upon the chemical constitution, and upon the peculiar cohesion of the silicates, and in others upon the submarine situation, relative to the action of the waves and the rolling or dashing of shingle upon them. Hence the differences which have been observed by engineers in the durability of concretes of which such silicates form the gangue.

M. Vicat is preparing a memoir, in which he will attempt to explain the nature of the chemical constitution of those silicates which are durable, compared with those which are not; and which will show the preponderating influence of silica in such phenomena. He will also point out a simple and certain method of classifying all such compounds, as to their fitness or not for submarine constructions, and thus will assist in very much shortening the time necessary at present for testing them by exposure to the action of sea-water. From the great practical importance of the subject, and the attention at present directed to it, this memoir will be looked forward to with considerable interest.—*Comptes Rendus de l'Academie, No. 4. January,* 1854.

Gulf Stream Exploration.*

This great and singular peculiarity, embracing in its mighty sweep our entire Atlantic offshore vicinage, is so important to navigation and so essential a feature of our coast hydrography, both in its practical and scientific character, that its thorough exploration ought certainly to form an integral part of the Coast Survey, whence our offshore charts are all to be derived. A specific and complete delineation and theory of this unique oceanic movement can only be reached as a result of elaborate and continued observations on all its physical and phenominal elements. This giant problem is thrown down as a gage at our national door, and the honour code of philosophic chivalry bids us accept the challenge. With a clear perception of the requirements of this great research, Prof. Bache in 1845 organized and began the execution of a plan of operations, which provided for running a system of perpendicular sections across the axis of the stream from selected points of the coast and observing at frequent stations along these sections, the several elements required. Between 1845 and 1848, sections were run from Montauk Point, Sandy Hook, Cape Henlopen, Cape Henry, and Cape Hatteras; when from accidents and other hindrances, the work was intermitted until in 1853, when sections were run from Cape Hatteras, Cape Fear, Charleston, St. Simons, St. Augustine, and Cape Canaveral. The results for 1853 are given in a sketch of detailed sections, and a general delineation of the Gulf Stream in its several component bands or threads, as thus far determined, will be found among the sketches. Over six pages of the Report are devoted to a full exposition of the results already reached.

The element of temperature, superficial and at various depths, has been chiefly observed up to this time; the instruments used being Six's registering thermometer for moderate depths and Saxton's metallic deep-sea thermometer, for the greater depths, a temperature sounding of 2160 fathoms having been made. One general result of the investigation is that "there are alternations of temperature across the Gulf Stream, cold water intruding and dividing the warm, making thus alternate streaks or streams of warm and cold water. In fact, the Gulf Stream is merely one of a number of bands of warm water separated by cold water." A "cold wall" limiting the Gulf Stream on the shore side, is clearly made out, as also its slight shoreward slope from the warm water overlying the cold. A distinct current of underlying cold water from the northern regions is found alike in the northern and southern sections. "It can hardly be doubted that this cold water off our southern coast may be rendered practically useful by the ingenuity of our countrymen. The bottom of the sea fourteen miles E. N. E. from Cape Florida, 450 fathoms in depth, was in June, 1853, at the temperature of 49° Fahrenheit, while the air was 81° Fahrenheit. A temperature of 38° (only six degrees above the freezing point of fresh water) was found at 1050 fathoms in depth about 80 miles east of Cape Canaveral. The mean temperature of the air at St. Augustine is 69°·9 Fahrenheit, and for the three 57°·5. The importance of the facts above stated in reference to the natural history of the ocean in these regions, is very great, but, of course, requires to be studied in connection with other physical data. It has also a bearing upon the important problems of the tides of the coast. This exploration of the Gulf Stream will be steadily prosecuted to its close, the different problems being taken up in turn or in connexion as may be found practicable."

The most remarkable fact brought to light in relation to the Gulf Stream is probably that of the existence of two submarine ranges of hills near its origin, which produced most marked effects on the distribution of its parts. The form of the Charleston and Canaveral sections," as shown in the diagram, shoals gradually from the shore to 63 and 36 miles respectively, then suddenly falling off to below the depth of 600 fathoms. On the Charleston section, 96 miles from the coast is a range of hills steep on the land side and having a height of 1800 feet and a base of about eleven miles on the seaward side; a second range 136 miles from the coast, 1500 feet high, with a base of about seventeen miles, on the outer side. Beyond this there is a more gradual rise. On the Canaveral section the inner range is 68 miles from the coast. The effect of this form of the bottom in forcing up the deep cold water stratum is very marked, so that the deep isothermals of section, exhibited a general conformity to the bottom curve. It is undoubtedly due in a considerable degree to these submarine hill-ranges, and to their uplifting of the cold water, that the Gulf Stream is divided into several superficial bands, though to what exact extent and how far subject to variations remain to be studied. Horizontally, the conformity of the Gulf Stream to the coast line configuration is verified even in detail, and its modifications by the variation of steepness in the off-shore bottom slope, are strongly marked. With these results the names of Lieuts. Davis, George M. Bache, Richard Bache, S. P. Lee, Maffitt and Craven are conspicuously associated; George M. Bache being distinguished as a martyr to his zeal, in the very glow of talent, hope and success.

The results of the microscopic examinations of seventeen Gulf Stream bottoms made by Assist. L. F. Pourtales (Appendix No. 30), are of great interest. From these and many other investigations of bottoms, he has derived the generalization that the per-centage of shells, chiefly Foraminiferæ, progressively increases with the depth, and he remarks of a bottom from the depth of 1050 fathoms that it "is no longer sand containing Foraminiferæ, but Foraminiferæ containing little or no sand. The grains of sand have to be searched for carefully under the microscope to be noticed at all." It will be seen that this result coincides with Prof. Bailey's recent announcement, thus closely linking the Gulf Stream bottoms with those of the remoter parts of the Atlantic. Mr. Pourtales also somewhat examines the question whether these minute animals lived where they were found, or have been gradually washed down from the reefs. Though not decisive the evidence inclines him to the opinion that they lived where found. This is indicated by the fact that most of the individuals are found perfect, notwithstanding the extreme delicacy of the shells, and again by the delicate pink colour of the Globigerinæ, which could scarcely survive transportation. The fact of the occurrence of the same species off the New Jersey coast and off Cuba and other West India islands under very dissimilar circumstances of light and temperature is also indicative that they are actually drawn from their true habitat in these Gulf Stream soundings. Mr. Pourtales well remarks on the importance of "a knowledge of the habitation and distribution of the Foraminiferæ" to geologists, "since of all classes of the animal kingdom, none has contributed so large a share to the formation of rocks, at least in the cretaceous and tertiary formations."

Railroad Traffic in Great Britain and Ireland.

From the semi-annual returns of the British Board of Trade it appears that the number of passengers conveyed on railways in England and Wales, Scotland, and Ireland, during the half-year ended 31st Dec., 1853, was 57,206,344, of which 29,529,696, were parliamentary and third class; 20,634,682 second class; and 7,028,966 first class passengers. The total receipts for passengers amounted to £4,821,686, of which the sum of £62,061 was for periodical tickets, £1,534,863 parliamentary and third class, £1,46,646 for second class, and £1,468,196 for the first class passengers. As compared with the corresponding period of 1832, the total increase in the number of passengers was 7,320,221, or 14.6 per cent., and in the receipts of £461 ,519, or 10.6 per cent.; of which increase the sum of £7,449 was the periodical tickets, £173,962 for parliamentary and third-class, £115,297 for second class, and £159,224 for first-class passengers.

The total receipts from general merchandise, cattle, minerals, horses, carriages, luggage, parcels and mails, amounted for the half-year ending 31st December, 1853, to £5,023,904, and for the corresponding period of 1852, to £4,154,836, showing an increase of £869,068, or 20.9 per cent.

The total receipts from all sources of traffic, amounted on 7,641 miles of railway in the United Kingdom to £9,844,690, and for the corresponding period of the year previous, on 7,336 miles of railway, to £8,

*Extracts from a review of the Coast Survey Report for 1853 in Silliman's Journal for September.

515,003, showing an increase in the mileage of 305 miles, or 4.16 per cent., and in the receipts of £1,329,687, or 15.61 per cent.

The total receipts on 5811 miles of railway in England and Wales for the half-year ending December, 1853, amounted to £8,402.214,and for the corresponding period of 1852, to £7,289·180, showing an increase of £1,113,035; on 996 miles in Scotland to £971,742, and for the *corresponding period of 1852 on 978 miles to £854,867; showing an* increase of 28 miles,in the receipts of £116,876; and on 834 miles in Ireland, the receipts amounted to £470,733, and for the corresponding period in 1852, on 708 miles to £370,956, showing an increase in the mileage of 126 miles, and in the receipts of £99,777.

It appears also from the returns, that the mileage run by the trains on 5,588 miles in England and Wales, was by 522,142 passenger trains, 15,249,202 miles; and by 263,380 goods trains, 13,386,966 miles; on 823 34 miles of railway in Scotland, the mileage run by 56,060 passenger trains, was 1,694,244 miles, and by 43,306 goods trains, 1,548, 253 miles; and on 826 1-2 miles of railway in Ireland, the mileage run by 43,016 passenger trains was 1,321,296 miles, and by 5,614 goods trains, 338,751, miles. From this it would appear that the average distance run by trains conveying the passengers in England and Wales was 29·2 miles, in Scotland 25·3 miles, and in Ireland 30·7 miles. The average distance run by goods trains in England and Wales appears to be 50·8 miles, in Scotland 35·9 miles, and in Ireland 56·4 miles.

The receipts per mile per passenger train amounted in England and Wales to 5·32s., in Scotland to 4·79s., and in Ireland to 4·79s. The receipts per mile for goods trains amounted in England and Wales to 6·43s., in Scotland to 7·31s., and in Ireland to 9·24s. per mile per train.

Statistics of British America.

	TERRITORY.	POPULATION.	EXPORTS, 1853	IMPORTS, 1853	REVENUE.
	Square Miles	Inhabitants	£.	£	£.
Canada, ...	400,000	1,842,264	5,570,000	8,200,642	1,053,026
New Brunswick, ...	28,000	200,000	796,335	1,110,600	180,000
Nova Scotia,	19,000	300,000	970,780	1,194,175*	125,000
Prince Ed. Island, .	2,000	75,000	242,675	298,543	35,345
Newfoundland, ...	37,000	100,000	965,772	795,737*	84,323
Total, ...	486.000	2.517.264	£8.545.562	£11.499697	£1.476.694

* 1852.

Toronto Harbour.

We understand it is the intention of the Harbour Commissioners to strengthen the peninsular boundary of the Bay at the narrows near the Hotel. Although the breach through which the water of the Lake flowed with a considerable current during the autumn of last year has been closed so effectually that it is now difficult to discover traces of its former existence, yet the present beach affords very doubtful security against future inroads. The narrowest part of the sand beach which occupies the late opening is about seventy-four yards broad, and nowhere exposes an altitude exceeding three feet above the present level of the waters of the Lake. There can be no doubt that stability is not a property of the sand beach at the narrows, nor is it probable that a firm barrier will be made until the waters of the Lake have assumed their minimum level, which they exceed at the present moment by more than two feet, that is to say the level of Lake Ontario is now about 2 feet 3 inches above the minimum level on the 25th Oct. 1849, or 2 feet 5 inches below the maximum level of June 1st., 1853. The Harbour Commissioners do not contemplate constructing any extensive works at the narrows; we believe that they will at present confine their operations to throwing up a sand beach a few yards broad and a few feet high. The effect of throwing up this artificial barrier will be to assist and expedite the natural process by which the integrity of the peninsula has hitherto been maintained, We forbear offering any opinions on the subject of Toronto Harbour at present, in consequence of the approaching publication of the Premium Reports on its Improvement and Preservation. The Harbour Commissioners have made a very liberal appropriation of funds for the publication of the Reports in the *Canadian Journal*, and we hope to furnish our readers with a supplementary number containing these documents in October.

The Provincial Show.

This great Agricultural Exhibition will be held at London, on the 26th, 27th, 28th, and 29th September. The most sanguine expectations are entertained of its success. Every facility has been offered by public bodies to increase the attractions which enliven, and remove the restrictions which impair, the progress of this great national Festival. The Great Western Railway Company will forward all articles of exhibition from Hamilton to London free of charge.

Changes in the Level of the Lakes.

Considerable anxiety exists among mercantile men at Buffalo, respecting the supply of Water to the Erie Canal. Grave doubts are felt whether the present feeders have the capacity to afford the necessary supply during a period of low water in Lake Erie. A memorial on this subject has recently been addressed to the Legislature of the State of New York, in which several ominous facts are pointed out. It appears that if Lake Erie should subside to the minimum level of 1820, which year was taken as the zero of comparison by Dr. Houghton and other geologists, the depth of water on the mitre sill at Black Rock Guardlock, would be less than five feet, through which all the water for the supply of a canal 150 miles long would have to flow. The average depth of water on the sill is about eight feet. In an elaborate paper on the periodical rise and fall of the Lakes, by Major Lachlan, Montreal, published in the July number of this Journal, we find the subjoined notices of the minimum and maximum periods of level in Lake Erie;—

MINIMUM PERIODS.			MAXIMUM PERIODS.		
1st	Min.	1795	1st	Max.	1790
2nd	„	1810	2nd	„	1801
3rd	„	1820 zero.	3rd	„	1815
4th	„	1832	4th	„	1827
5th	„	1846 (2 feet above 1820)	5th	„	1838
6th	„	——	6th	„	1853 very high.

In July, 1840, nine feet ten inches of water were recorded on the mitre sill at Black Rock, whereas, during the present year, there has been a short period when a depth of only five feet ten inches was to be found—a difference of four feet, and sufficiently important to cause the grounding of boats in the gore through the mountain ridge at Lockport. The memorialists ask "how shall navigation proceed in this canal, when the Lake shall fall nine inches or a foot more, as it must, to attain the level of 1820." It appears, too, that the Welland Canal has suffered from the rapid falling of the waters of Lake Erie. If they should continue to subside, and thus impede the navigation of that noble link between Erie and Ontario, we fear the prospects of the "lateral cut" will diminish with the receding waters, and the attention of the Board of Works be drawn to the enlargement of feeders, rather than to additional drains.

The New York memorialists are filled with gloomy anticipations in consequence of Lake Erie's decline. "From the above state of facts, we are drawn to the conclusion that there is imminent danger that with our present canal, and the probable level of the lake, our navigation will be partially or wholly obstructed. That for this impending evil there is but one remedy, and that this remedy should be applied forthwith; it is the immediate enlargement of the canal from Black

Rock Dam to Lockport. Next year the canal in its best condition, will be thronged with the products of the boundless, enterprising west. A slight interruption would be mischief—a total one, destruction to interests too extensive and momentous to be perilled for an hour. The welfare of the city of New York, New England, this entire State, and the vast West; the prosperity of our own city, and the solvency of the Treasury of our State, the credit of its stock, its faith and honour, depend on enough being done and done in time to arrest a catastrophe, which we are forced, against our own hopes of prosperity, to admit is like to happen. The remedy is within reach, and there should be no hesitation in making the application."

It is an ill wind that blows nobody any good.—What, if a stoppage of the navigation of the Erie Canal should bring into unexpected activity the Grand Trunk, the Great Western and the Ontario, Simcoe, and Huron Railroads? What, if Hamilton, Collingwood Harbour, and Toronto, should share much of the carrying trade which has hitherto passed through Buffalo, and the vast granaries of the Great West disburden themselves through the natural outlet to that region, the valley of the St. Lawrence, until the gentle stimulus of "Free Navigation?"

Materials for Paper-making.

In our present number we publish two articles on "Materials for Paper-making." The growing importance of this subject is attracting general attention in the United Kingdom, and has already secured a small corner in the public mind, by the recent increase in price of many newspapers and periodicals, solely on account of the scarcity of materials for making paper.

As is always the case, whenever any undue pressure is felt among the great manufacturing interests, arising from any dearth in the supply of raw materials, numerous attempts are made to relieve the want by the introduction and adoption of new sources of supply or of appropriate substitutes. For centuries past, by far the greater part of the paper consumed has been made from rags. There is, however, every reason to believe that a considerable supply has been manufactured from other kinds of fibrous matter. The natives of China manufacture the greatest part of their paper from the inner bark of the bamboo and various other trees. No inconsiderable portion of their common wrapping paper is made from rice straw.

The best materials for this manufacture are unquestionably linen, cotton, and hempen rags. They are the best, because they are as yet the cheapest. It is, however, a question not yet solved, whether they are artistically best adapted for making paper. For many years paper has been made from hop-bines, wood-shavings, straw, plantain, the inner bark of trees, and even from cow-dung, as will be seen by reference to page 32 of this Journal. Among the list of patents recently published in the Canada *Gazette*, is one for the manufacture of paper from Cudweed or Everlasting. We have good reason to believe that the search for paper-making materials is very assiduously pursued in Canada West. We had recently an opportunity of examining a raw material from the banks of the St. Clair, which appeared, from its fibrous nature, to give fair promise of successful application. The new material can be obtained in vast quantities, and without much labour or expense. No paper has yet been made from it, but we understand, that Frederick Widder, Esq., Chief Commissioner of the Canada Company, has made arrangements for procuring a supply of the fibre, and placing it in the hands of competent persons to examine its fitness for the important manufacture it is desirable to promote.

We may here remind our readers that many varieties of fibre are found to be well adapted for the manufacture of paper, and, indeed superior to rags; but their commercial value for other purposes does not admit of their application, or the expense of preparing the pulp from them precludes their adoption. If we suppose that the question of fibre is satisfactorily answered, the next question involves the preparation of the pulp; at what price can the fibre be converted into pulp?

We are indebted to a friend for a suggestion which we hope will arrest the attention of those who have the opportunity and means to engage in this useful and highly interesting search after raw material for paper manufacture. Why not make paper from bass-wood logs? Every one is familiar with the fibrous character not only of the bark but of the body of the tree itself. Partially decayed bass-wood logs may be procured to any extent in our forests, and they furnish a fibre of great tenacity, and comparative freedom from those impurities which it is necessary to abstract before a good sample of paper can be manufactured.

New York Industrial Exhibition.

We are indebted to the politeness of Mr. W. Antrobus Holwell, Commissioner from Canada to the Exhibition at New York, for the Special Report of Mr. Dilke, which was presented to the House of Commons by command of her Majesty, February 6, 1854. That portion of Mr. Dilke's Report which comprehends the Reports on Class 8 and 10, was written altogether by Mr. Holwell, and in our opinion constitutes by far the most important portion of the whole. The Report having arrived at the moment of our going to press, we are compelled to reserve further notice until our next issue.

Miscellanea.

Theory of Glaciers—Shadow of the Moon—Weight of the Earth—Discovery of Iron-Stone in Ireland and England—Canadian Shipping—The Copyright—Distribution of Public Documents in the United States—Metallic Wealth of the United States.

Professor Forbes' work on "Norway and its Glaciers," completely established his theory of the growth and march of these stupendous moving masses of ice, as explained in his former works.

The leading facts on which that theory was then established are as follows:—1. That the downward motion of the ice from the mountains towards the valleys, is a continuous and regular motion, going on night and day without starts or stops. 2. That it occurs in winter as well as in summer, though less in amount. 3. That it varies at all times, with the temperature, being less in cold than in hot weather. 4. That rain and melted snow tend to accelerate the glacier motion. 5. That the *centre* of the glacier moves faster than the sides, as is the case in a river. 6. The *surface* of the glacier moves faster than the bottom, also as in a river. 7. That the glacier moves faster (*other things being supposed alike*) on steep inclinations. 8. The motion of a glacier is not prevented, nor its continuity hindered, by contractions of a rocky channel in which it moves, nor by the inequalities of its bed. 9. The crevasses are for the most part formed annually.—the old ones disappearing by the collapse of the ice during and after the hot season. The theory of motion, deduced from the facts above referred to, is thus given by Professor Forbes:—

"That a glacier is a plastic mass impelled by gravity, having tenacity sufficient to mould itself upon the obstacles which it encounters, and to permit one portion to slide past another without fracture, except when the forces are so violent as to produce discontinuity in the form of a crevasse, or more generally of a bruised condition of the mass so acted on;—that, in consequence, the motion of such a mass on a great scale resembles that of a river, allowance being made for almost incomparable greater viscosity,—hence the retardation of the sides and bottom. Finally, that diminution of temperature, diminishing the plasticity of the ice and also the hydrostatic pressure of the water which fills every pore in summer, retards its motion, whilst warmth and wet produce a contrary effect. These are the opinions which I laid down in 1842, and which ten years' experience and consideration have only tended to confirm."

The dark shadow of the Moon sweeping through the air during a total eclipse, was seen this year by Professor Forbes in Norway. He says that the approach of the eclipse had been denoted by the appearance of a great black cloud in the north-west, which gradually rose above the horizon like an approaching storm; but its boundary (for it was merely the shadow in the sky) was too vague to produce the appalling sense of the onward movement of a real substance, with a speed exceeding about one hundred fold that of the most rapid railway train, and making right for the spectator, as I had observed on the plain of Piedmont on occasion of the total eclipse of 1842. But the restoration of the light,—the new dawn, when the shadow of darkness had passed by,—was perhaps quite as grand.

Professor Airey, the Astronomer-Royal, has paid a visit to the colliery district of the Tyne, in pursuit of curious and important astronomical observations. For that purpose he was taken by Mr. J. Mather, a scientific gentleman belonging to South Shields, down Horton pit, the deepest in the Tyne, 1260 feet deep, to examine if it were possible to make arrangements in it for a series of delicate experiments and observations in reference to the pendulum, and the earth's action upon it there, simultaneously with similar ones on the surface, with a view to determine the weight of the earth and planets. Mr. Anderson, and the other proprietors and officers of this splendid mine, gave every facility to the Astronomer-Royal, and tendered not only the use of the mine, but their own personal services, for any future occasion. Everything at present looks encouraging for these important scientific experiments.

A valuable discovery has recently been made in Ireland. It is no less than the certain existence of very extensive deposits of ironstone on the estates of Lord Carew, at Dysart, in the Queen's County. This discovery is considered very important, as there is a great demand for ironstone now in England, to supply the furnaces. An extensive field of the same mineral has also been found at Rosedale, near Pickering, Yorkshire. Samples sent to Newcastle have been found to contain not less than 67 per cent. of pure iron.

We extract from the August number of the *Artizan* the following list of steam and sailing vessels, built or building on the Clyde, since March, 1853, for British American marine and lake service:—

STEAMERS.

DESCRIPTION.	TONS.	HORSE POWER.	OWNERS OR STATION.
Paddle,	600	200	Hon. J. Hamilton, Kingston, C.W.
Screw,	1900	400	Liverpool and Canada.
Screw,	1900	400	" "
Paddle,	120	110	Canada.
Screw,	2300	450	Liverpool and Canada.

SAILING VESSELS.

DESCRIPTION.	TONS.	HORSE POWER.	OWNERS OR STATION.
....	150	......	Montreal.
....	800	......	Glasgow and Montreal.
....	800	......	Liverpool and Montreal.
....	363	......	Henderson & Fulton, Montreal.
....	780	......	Liverpool and Montreal.
....	850	......	Montreal Trade.
....	700	......	Montreal Trade.
....	800	......	Montreal Trade.

With reference to the question of Copyright, the Athenæum has a letter on the last decision of the House of Lords, from which we take the following:—

"This last reversal of judgment was made at one o'clock on Tuesday, in the House of Lords—a reversal which, among other things, in effect upsets all American copyrights, and before six o'clock that day the printers in London were engaged in reprinting cheap editions of American Works. Messrs. Low & Co., alarmed for their property in "Sunny Memoirs of Foreign Lands," rushed to their printers to order a cheap edition; they found them already engaged for another house! By aid, however, of Mr. Clowes, Mr. Low hopes to forestall the printers, and we cannot but hope that he will succeed, seeing that he had already embarked capital in the production of the work, in a belief that his property was protected by law. The mails will carry out bad news to America; between the authors of that country and the publishers here. Mr. Bentley, we believe, has just concluded a treaty with Mr. Prescott, the historian, for his "Phillip the Second," at a thousand pounds a volume. It is now waste paper. The American historian is now in the same position as regards England, as the English author is as regards America. Bancroft's volume, also, has just appeared in London, though it has not yet been announced by his American publishers. Whatever has been, or is to be, paid for, the English copyright will, of course, be lost to him or to his publishers. We can form no estimate of the number of American books copyrighted in England, but they must form no insignificant part of the book trade of Great Britain. The English sales have certainly been greatly relied upon by American writers, and this decision will cut off a very substantial portion of the income of several of the more eminent of them."

Silliman's journal for September contains an article on the Coast Survey Report for 1853, in which some curious facts respecting the distribution of public documents, are brought to light. Every one is aware that for many years a most wanton system has been pursued in the distribution of valuable scientific, historical and documentary works, published by the authority of Congress, and at the expense of Government. Unfortunately, the scientific value of materials published in the documentary series whether of Congress or of State legislatures, is very much impaired by the unsystematic and injudicious plan *of distribution* actually pursued. Men of science, to whom particular reports would be of direct practical use, are often entirely unable to procure copies of them, while many men of more political importance, but who will never even look into them, have these same reports profusely lavished upon them. Valuable documents which are reported to applicants as all exhausted, do wholesale duty as wrapping paper for Washington grocers and market men, at a standard price of four cents a pound, maps and plates included. This subject of documentary distribution deserves the serious attention of Congress, and it would not seem a vain hope that some system could be devised which would be indefinitely superior to that now prevailing, as well in respect to securing rigid responsibility for documents as property, and in promoting the economy, order and convenience of their practical distribution, as in the more important point of securing something like fitness in sending special documents to their appropriate recipients. Distributing Owen's Geological Report to a dry goods importer and the Treasury report on commerce to a geologist, would seem too great an absurdity to exist if we did not know that hundreds of truly valuable volumes are annually thus wasted.

"The Metallic Wealth of the United States described and compared with that of other Countries," from the pen of S. D. Whitney, contains many valuable facts concerning the distribution of mineral wealth in the United States. The following note of the estimated amount and value of metals produced throughout the world in 1851, is taken from a review of Mr. Whitney's work in the September number of Silliman's Journal:—

"The metals selected are gold, silver, mercury, tin, copper, zinc, lead and iron. The aggregate of these are as follows:—

Gold.	Silver.	Mercury.	Tin.	Copper.	Zinc.	Lead.	Iron.
lbs. troy.	lbs. troy.	lbs. av.	tons.	tons.	tons.	tons.	tons.
481,950	2,965,200	4,200,000	13,660	56,900	60,550	133,000	5,817,000

The product of the United States in gold is set down at 200,000 pounds, Australia and Oceanica at 150,000, and Russia at 60,000, Mexico and South America 47,100. Of silver, the New World supplies 2,473,700 pounds, leaving only the small residue of 491,500 lbs. for all other countries. Of mercury, Spain gives the world 2,500,000 lbs. and the United States 100,000 lbs. England and Australia furnish over half of all the copper produced by the world: the present product of the United States being in this metal only 3,500 tons. Prussia and Belgium furnish four-fifths of all the zinc used in the world (viz. 16,000 + 33,600 tons.) Lead is distributed between Great Britain, Spain and the United States in the ratio of 4, 2, 1 (viz. 61,000, 30,000 and 15,000 tons each.) England furnishes more than half the Iron of the world, 3,000,000 tons, and the United States 1,000,000 tons. France is the next most productive country in iron, 600,000 tons. Russia produces but 200,000 tons, and Sweden 150,000 tons, quantities bearing a very small relation to the celebrity of product of those countries.

STANNO-PLUMBATED IRON.—Several important experiments on the preservation of iron from oxidation and decay having been made by the Rev. N. Callan, of Maynooth college, who has introduced many improvements in practical science, he has found that an alloy of tin and lead, or of tin, lead, zinc, and antimony, is the most effectual. He recommends that all the alloy should contain at least as much lead as tin, but not more than 7 or 8 parts of lead to one of tin, the iron being treated with this composition just as it is usually coated with tin. In a series of experiments on the decomposition of water by the galvanic battery, the patentee found that concentrated nitric acid acted far more powerfully on lead than on iron coated with an alloy of lead and tin. He afterwards made experiments, comparing the action of strong nitric, sulphuric, and muriatic acids, on lead and galvanised iron, and iron coated with the new alloy, and found that the latter was far less oxidisable than lead, and very far less than iron galvanised, the zinc coating of which is rapidly dissolved, even by very dilute acids; hence, iron coated with this alloy will answer all the purposes for which sheet lead, lead pipes, or zinced iron are employed. The addition of a small portion of zinc hardens the coat, but diminishes the power to resist corrosion; while a little antimony hardens it, and increases its anti-corrosive powers. Stanno-plumbated iron will answer better for wire-rope than iron coated with zinc, as it will resist the action of sea-water better. It is preferable to lead, as cheaper, more durable, and less subject to changes from variations of temperature; and it may be used for all the purposes for which galvanised iron is employed; it is more easily worked and soldered. It may be used instead of copper for sheathing ships, and bolts and nails of cast-iron may be employed. As the proportion of tin need not be more than the seventh or eighth of lead, the alloy will be very little dearer than zinc, and from the greater durability, stanno-plumbated iron must be quite as economical as galvanised iron.

The Great Subterranean Railway.—The preamble of the North Metropolitan Railway has been declared proved by a committee of the House of Commons. The promoters had a hard battle to fight, and which lasted 11 days, but they triumphed in the end. This interesting and novel undertaking will commence at the General Post Office, in St. Martin's-le-Grand, and proceed beneath the streets and roads of the metropolis all the way to the terminus of the Great Western Railway at Paddington. The entire distance will be 4½ miles. It will cross Smithfield, and proceed along Fleet Valley to the New-road, taking Coldbath-fields Prison in its way. For the removal of this building the promoters have made an arrangement with the Middlesex magistrates. The terms are, that the promoters of the railway, in return for the ground in Coldbath-fields, are to build a prison for the county of Middlesex, not less than six, and not more than nine miles from London—the building to contain accommodation for 1500 prisoners, with 50 acres of ground attached, so as that those of the prisoners who have not learned in-door trades may be made to perform rural labour, in accordance with the industrial principle on which the prison is conducted. Three miles of the North Metropolitan Railway will run underneath roads, or unoccupied property, which will considerably lessen the expenses incident to the construction of the line. The entire estimated cost is 1,000,000*l*. The Subterranean Railway will join the Great Northern, the London and North Western, and Great Western lines. The stations are to be at Victoria-street, Clerkenwell, King's-Cross, Euston-square, Hampstead-road. Osnaburg-street, Baker-street, Edgware-road, and opposite the Great Western Hotel, with a branch to the Great Western station. Trains will start every five minutes. The time required to perform the journey will be a quarter of an hour, and the fares for the whole-distance will be 2d. for the third-class, 4d. for the second class, and 6d. for the first-class carriages. The North Metropolitan Railway will, therefore, be a great accommodation to the people of London, and will doubtless have an immense traffic.—At a special meeting of proprietors, on Monday, the solicitor read the heads of a bill, for extending the authorized line to the Great Western Railway and to the General Post- office, when a resolution, approving the bill, was carried unanimously

Soapstone.—A new building material is coming into notice in New York which promises to supersede everything else. This is steatite, or soapstone, either in its purest state or in combination with other rocks. Its common qualities are perfectly familiar. It is so soft that it can be cut with a chisel, planed, bored, sawed, or turned in a lathe. Yet it resists pressure very well indeed, particularly when mixed with the harder ingredients, such as hornblende or serpentine. In beauty it is often found equal to marble, with even a greater variety of appearance. It bears an excellent polish, and, if broken, can easily be mended, by using its own powder as cement, so nicely as to be detected only by a critical examination. A house of this material was built at Northampton in 1807, and it is said to be still standing fresh and clear, to all appearance as if it had encountered only the rain of our last watery spring. The stone may be heated to a white heat, and then gradually cooled, or plunged into cold water at the option of the experimenter—and in either case it does not shell off nor crumble. Wet granite, as we all saw at the burning of the Custom-house, positively exploded in the heat—the flutings of the pillars, for instance, leaping off 2 or 3 ft. If therefore, soapstone should be employed for flooring as well as for walls (and there is no reason against it), a perfectly fire-proof building would be the result. So, if the assertions of all the chemists turn out to be correct, we have at last found out the very perfection of building materials. But they are testing the matter in New York, and we shall soon hear.—*Portland* (U.S.) *Advertiser.*

The Precious Metals in England.—At a time when the extraction of gold in England occupies so much attention, the following account of the presence of silver in England may prove interesting. An immense silver mine was worked in the vicinity of Aberystwith, in the reign of Elizabeth, by which a company of Germans enriched themselves; after whom Sir Hugh Middleton accumulated 2000*l*. a month out of one silver mine at Bwlch-yr-Eskir, by which produce he was enabled to defray the expense of bringing the New River to London. After him, Mr. Bushill, a servant of Sir. Francis Beacon, gained from the same mine such immense profits, as to be able to present Charles I. with a regiment of horse, and to provide clothes for his whole army. Besides this he advanced, as a loan to his Majesty, no less a sum than 40,000*l*., equal to at least four times the amount of the present currency; and he also raised a regiment amongst his miners at his own charge.

Lumbering on the Line of the Grand Trunk Railway.—The railway to Montreal has turned the forests along its line into gold. One of the leading and one of the earliest objections urged against the plan of the railway from Portland to Montreal, was the character of the country through which it was to pass. "The howling wilderness," so graphically depicted in the speeches of the friends of some of the rival lines, has been found, but instead of proving any discouragement to its friends, turns out a noble business for the railway. A timber township furnishes more business for the road than three ordinary farming townships of equal extent under good cultivation

Substitute for Gutta Percha, &c.—M. Sorel, C.E., of Paris has patented some improved compositions to be employed as substitutes for caoutchouc, gutta percha, and certain fatty bodies. The principal bases of these compositions are the following substances:—Colophony or common resin, bitumen or natural pitch, or the pitch obtained from gas-works, fixed resin oils, gutta percha, hydrated lime, and water. The above substances are employed (by weight) in about the following proportions:—Colophony, 2; pitch or bitumen, 2; resin oil, 8; hydrated lime, 6; gutta percha, 12; water, 3; pipeclay or other like argillaceous earths, 10.

Remarkable Temperature at Toronto during July.

This month has been not only the hottest July, but absolutely the hottest month recorded. The mean temperature has been 72°·5, which is 3°3 above that for August, 1848, the next highest of the whole record. By an inspection of the additional column in the Comparative Table, it will be seen that this July is no less than 6°·3 above the mean July temperature; an enormous excess, rendered more remarkable by the fact, that hitherto July has been the month of the whole least liable to extreme variations. The column containing the variations of the several days from the normal temperature for each day shows, that only four days have been below the normal, all the rest being above. The 3rd day is nearly the hottest that has ever been recorded, having reached 81°·3 which is 16°·2 above the mean of that day, and only 0°·7 below July 12th, 1845 (while it is 2°.5 above July 12th, 1849, the two highest previously). Notwithstanding this excessive temperature, the amount of rain fallen is above the average, and the number of times that thunder or lightning have occurred is also considerable.

*** In the Register for June (see August Number), read Comparative Table for *June*, instead of May.

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

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

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	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.
					°	°	°	°	°													
1	29·773	29·800	29.776	29·782	63·4	79·7	59.9	69.50	+ 4.73	0·412	0·490	0.363	0·446	·72	·51	·73	·64	N	S S E	Calm	2·91	...
2	·810	·717	—	—	65·5	81·1	—	—	—	·446	·821	—	—	73	79	—	—	N E	E b S	—	2·68	...
3	·648	·569	·491	·555	71·5	93·0	78.1	81.32	+16.17	·525	·767	·543	·650	71	51	58	63	Calm	S	S W	2·59	...
4	·477	·341	·466	·424	74·3	93·6	69.6	78.60	+13.30	·575	·759	·616	·635	69	50	88	68	Calm	S S W	Calm	4·27	0·895
5	·554	·575	·608	·583	62·8	79·3	65.8	69.55	+ 4.17	·480	·633	·498	·509	77	65	80	72	N b W	S b W	N b E	3·96	...
6	·691	·696	·697	·699	64·4	82·2	65.3	71.83	+ 6.23	·459	·710	·495	·554	78	66	82	73	Calm	S b E	Calm	1·88	...
7	·713	·655	·610	·657	66·1	81·1	70.6	73.00	+ 7.30	·544	·509	·553	·531	87	49	76	69	N b E	E b N	Calm	3·42	...
8	·593	·467	·525	·522	69·8	91·0	74.3	79.23	+13.45	·519	·867	·751	·738	73	61	92	76	Calm	S b W	W	6·03	0·350
9	·616	·658	—	—	64·2	70·0	—	—	—	·518	·396	—	—	88	55	—	—	N N W	N W b N	—	7·28	...
10	·741	·715	·675	·709	58·5	76·8	63.2	67.28	+ 1.20	·370	·389	·464	·420	77	43	82	66	N b W	S b W	S W	3·63	...
11	·674	·607	·659	·653	67·1	73·3	62.5	67.87	+ 1.68	·474	·531	·480	·478	73	66	87	72	Calm	S	N N W	4·13	0·075
12	·749	·792	·838	·803	58·2	71·6	58.1	62.40	— 3.90	·336	·327	·299	·318	71	43	64	59	W N W	N W b N	N N W	8·05	...
13	·881	·836	·763	·818	56·3	73·1	54.2	61.98	— 4.40	·324	·457	·329	·386	74	55	80	71	N E	E	Calm	4·84	...
14	·727	·671	·675	·690	65·8	83·3	67.6	72.15	+ 5.73	·490	·526	·433	·504	79	48	67	67	N	S E	N	2·98	...
15	·753	·735	·698	·726	65·3	82 9	66.8	72.13	+ 5.65	·475	·557	·464	·498	78	50	72	66	N b W	S b E	Calm	2·67	...
16	·714	·683	—	—	71·1	77·0	—	—	—	·530	·523	—	—	72	58	—	—	N N E	E	—	3·73	Inap.
17	·757	·737	·740	·744	72·9	89·1	74.7	79.42	+12.75	·571	·472	·488	·515	73	36	58	54	N	S	N N W	5·01	...
18	·785	·690	·591	·683	74·0	83·3	69.3	74.93	+ 8.25	·603	·626	·576	·581	74	56	83	70	Calm	E S E	Calm	2·59	...
19	·576	·558	·511	·547	70·9	73·6	68.2	72.83	+ 6.05	·598	·715	·614	·671	82	89	92	86	Calm	E b N	W N W	3·09	1·135
20	·542	·455	·550	·521	72·6	92·1	74.3	79.95	+13.18	·781	·796	·756	·738	95	54	93	78	Calm	S	Calm	3·26	0·640
21	·630	·635	·626	·626	71·8	81·7	71.2	75.23	+ 8.47	·655	·716	·596	·666	86	68	80	78	N b W	E b S	N E b N	5·05	...
22	·596	·571	·615	.588	69·6	84·1	69.3	75.22	+ 8.35	·559	·787	·630	·666	80	69	90	79	N N E	E b S	N N W	3·19	0·565
23	·681	·658	—	—	67·5	81·7	—	—	—	·517	·639	—	—	79	60	—	—	N N W	S b E	—	2·34	Inap.
24	·675	·633	.579	·628	71·1	84·0	68.4	75.45	+ 8.58	·594	·618	·548	·606	80	54	81	72	Calm	E	Calm	3·02	...
25	·484	·351	·339	·387	68·4	88·8	75.4	78·98	+12.02	·600	·738	·655	·676	89	56	77	71	N E	S b E	S S W	7·44	...
26	·488	·533	·682	·563	73·6	78·1	57.4	69.72	+ 2.75	·620	·413	·308	·451	77	44	66	63	S W b W	W	W N W	12·84	...
27	.853	·823	·799	·813	61·9	74·2	56.5	64.52	— 2.47	·395	·404	·312	·397	74	49	70	68	N W b W	S	Calm	4·31	...
28	.822	·725	·686	·741	65·0	81·7	68.6	71.70	+ 4.73	·509	·500	·599	·543	85	48	88	74	Calm	S E	W S W	2·83	0·395
29	·451	·443	·513	·469	65.7	84.0	71.4	73.32	+ 6.37	·567	·772	·552	·614	92	68	74	77	S b W	S	S W b W	8·39	...
30	·713	·747	—	—	66·1	76·6	—	—	—	·497	·601	—	—	79	68	—	—	W	S	—	2·75	0·6,5
31	.807	·712	·651	·715	63·5	72·7	63.8	65.98	— 0.97	·522	·611	·466	·518	91	79	81	83	Calm	E b S	Calm	1·06	0·0 5
M	29·669	29·628	29·629	29·6403	67.09	81.86	67.10	72.47	+ 6.22	0.518	0.603	0·515	0·550	79	56	78	71	3·21	7·19	2·83	4.26	4·805

Highest Barometer...... 29·885, at 8 a.m. on 13th } Monthly range:
Lowest Barometer....... 29·308, at 4 p.m. on 4th } 0·577 inches.

Highest registered temperature 98°·0, at p.m. on 19th } Monthly range:
Lowest registered temperature 42°·5, at a.m. on 12th } 55°·5.

Mean Maximum Thermometer............. 84°·79 } Mean daily range:
Mean Minimum Thermometer............. 58°·46 } 26°·33.

Greatest daily range.........44°·5, from p.m. of 4th to a.m. of 5th.
Warmest day....... 3rd. Mean temperature...... 81°·32 } Difference,
Coldest day......... 13th. Mean temperature....... 61°·98 } 19°·34.
Greatest intensity of Solar Radiation, 106°·4 on 3rd, p.m. } Range,
Lowest point of Terrestrial Radiation, 38°·2 on 12th, a.m. } 68°·2.

Aurora observed on 4 nights: viz. on 3rd, 10th, 22nd, and 24th.
Possible to see Aurora on 26 nights.
Impossible to see Aurora 5 nights.
Raining on 9 days. Raining 28·7 hours: depth, 4·805 inches.
Thunder Storms occurred on the 4th, 8th, 11th, 19th, 20th, 22nd, 29th, and 31st.
Sheet Lightning, not accompanied by thunder or rain, observed on the 14th, 15th, 16th, 18th, 21st and 25th.
Hailstones and irregular pieces of ice fell during the thunderstorm on the 4th, at 4.30 p.m.

		H. M.			
Heavy Rain	on the 4th,	in 2.30	there fell 0.895	inches	on the surface.
	" 19th,	" 8.30	" 1.135	"	"
	" 20th,	" 0.20	" 0.640	"	"
	" 22nd,	" 0.22	" 0.565	"	"

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

North.	West.	South.	East.
976·23	1010·80	1110·08	823·43

Mean direction of the Wind, W 32° S.
Mean velocity of the Wind, 4·26 miles per hour.
Maximum velocity, 26.4 miles per hour, from 10 to 11 a. m. on 26th.
Most windy day, the 26th; mean velocity, 12·84 miles per hour.
Least windy day, the 31st; mean velocity, 1·06 " "
The velocity of the wind from 4h. 35m. to 4h 41 p. m., during the thunder storm on the 4th, equalled 6.8 miles, being at the rate of 68.0 miles per hour, and on the 8th from 5h. 26m. to 5h. 43m. p. m. it attained the rate of 33.9 miles per hour.
10th. Beautiful band of Auroral light from 9.20 to 10.50 p. m., rising from W horizon, passing through β Leonis in the West, α Coronæ Borealis in zenith, and bounded on its northern edge towards the east by α Hercules. This band was very remarkable from its fixity of position.

Comparative Table for July.*

Year.	Temperature. Mean.	Dif. f'm Avr'ge.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Wind. Mean Vel'y.	
	°	°	°	°	°				
1840...	66·0	—0·2	79·4	48·2	31·2	6	5·270	...	
1841...	65·0	—1·2	86·3	43·2	43·1	10	8·150	0·27	lb.
1842...	64·7	—1·5	90·5	42·0	48·5	4	3·050	0·33	lb.
1843...	64·5	—1·7	86·1	40·2	45·9	8	4·605	0·44	lb.
1844...	66·0	—0·2	86·1	40·5	45·6	12	2·815	0·19	lb.
1845...	66·2	0·0	94·6	45·6	49·0	7	2·195	0·30	lb.
1846...	68·0	+1·8	94·0	44·9	49·1	9	2·895	0·29	lb.
1847...	68·0	+1·8	87·5	43·8	43·7	8	3·355	0·19	lb.
1848...	65·5	—0·7	82·7.	46·7	36·0	10	1·890	4·94	Miles.
1849...	68·4	+2·2	89·1	51·0	38·1	4	3·415	3·52	Miles.
1850...	68·9	+2·7	84·9	52·8	32·1	12	5·270	4·56	Miles.
1851...	65·0	—1·2	82·7	52·1	30·6	12	3·625	4·13	Miles.
1852...	66·8	+0·6	90·1	49·5	40·6	8	4·025	3·33	Miles.
1853...	65·6	—0·6	85·4	49·4	36·0	10	0·915	3·70	Miles.
1854...	72·5	+6·3	93·6	53·0	40·6	9	4·805	4·26	Miles.
								0·29	lb.
M'n.	66·74		87·53	46·86	40·67	8.6	3·752	4·06	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—July, 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. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10. P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	30.020	30.017	30.058	62.1	80.6	65.0	.379	.681	.483	.71	.68	.78	W N W	S W	S S E	2.36	3.40	1.22	...	Clear.	Clear.	Str. 1.
2	30.123	30.003	29.900	65.6	82.1	65.0	473	618	555	76	57	89	S W b S	S b E	S	Calm	2.50	0.75	...	Light Cirrs. 4.	Cir. Cum. Str. 6.	Clear.
3	29.810	29.762	29.751	68.6	85.6	78.2	523	763	776	76	65	82	S S W	W S W	S b W	0.16	1.56	6.25	...	Cir. Str. 3.	Str. 2.	Do. Aur. Bor.
4	.660	.552	.664	80.0	95.4	77.8	762	986	827	73	57	90	S S W	S S W	S S W	2.60	6.37	5.51	0.076	Clear.	Str. S. Thunder	Str. 10.
5	.798	.814	.891	71.0	76.2	61.6	588	515	407	78	58	75	W b N	W b N	W b N	4.33	6.46	7.05	...	Do.	Clear. [& Light.	Do. 2. Aur. Bor.
6	.933	.989	30.060	66.0	82.0	68.4	474	550	582	74	52	85	W b N	W b S	N W	Calm	1.26	2.01	...	Do.	Clear.	Do. 4.
7	30.070	30.007	29.979	69.5	89.1	70.0	570	681	541	81	51	74	N W	S W b W	S b W	Calm	Inap.	Calm	...	Do.	Do.	Clear.
8	29.897	29.800	.896	77.1	94.3	86.7	648	940	681	71	50	66	E	S	N E	Calm	0.62	6.66	...	Hazy.	Do.	Cum. Str. 2.
9	29.731	.912	.921	77.8	84.6	64.5	787	806	450	86	78	75	S b W	W b S	N	1.50	4.00	10.00	...	Cum. Str. 4.	Cum. Str. 8.	Do. 9.
10	30.026	.964	.955	66.2	89.0	64.0	425	888	476	71	44	79	N E b E	S b W	S W b S	Inap.	Inap.	0.38	...	Clear.	Clear.	Clear.
11	29.968	.924	.907	70.0	86.5	64.0	499	617	482	69	50	80	W b S	S S W	S W b S	0.51	0.50	Calm	...	Do.	Do.	Str. 2.
12	.947	30.001	30.055	66.2	83.1	57.1	464	588	335	72	53	70	W	W	N W b W	1.05	4.37	7.50	...	Str. 2.	Str. 4.	Clear Aur. Bor.
13	30.210	30.164	30.111	60.0	83.9	66.0	393	588	416	75	53	65	W N W	S S W	S b E	3.66	1.42	0.13	...	Clear.	Clear.	Do.
14	30.066	29.961	29.943	64.3	90.2	69.2	504	638	570	84	46	81	N E b E	S W b S	S b W	0.49	Calm	Calm	...	Do.	Do.	Do. Faint A. B.
15	29.990	29.986	30.011	63.6	91.3	71.3	565	814	617	91	59	82	N E b E	E N E	S W	6.34	0.92	0.82	...	Do.	Do.	Str. 2.
16	30.000	30.003	29.990	70.7	93.6	77.8	550	638	715	76	47	78	E b S	W	S W b S	Calm	0.92	2.12	...	Do.	Do.	Cir. Str. 9.
17	29.943	30.009	30.007	76.8	92.6	72.3	659	607	638	74	44	82	W b S	W b S	N W	2.13	4.27	8.70	...	Do.	Do.	Clear.
18	30.070	29.922	29.880	68.0	85.4	74.0	512	628	643	73	53	78	N W	W b N	W S W	1.25	1.47	0.83	...	Do.	Do.	Cir. Str. 2.
19	29.803	.740	.764	74.6	98.0	76.2	617	550	801	74	40	90	S W b W	W S W	W	1.92	2.00	7.66	...	Do.	Do.	Clear.
20	.787	.783	.754	80.1	98.0	74.1	751	578	751	75	42	84	S W b W	S S W	W b S	0.47	9.00	5.50	0.104	Do.	Do.	Do. Thunder at
21	.945	.973	30.018	72.6	85.1	66.0	578	840	489	74	71	76	N b E	N N E	N E b E	4.28	4.30	7.62	...	Do.	Do.	Do. [5.30
22	.974	.933	.913	70.0	84.0	73.9	541	739	751	74	64	90	N E	N E	E b N	7.00	1.02	2.00	...	Do.	Hazy.	Str. 10.
23	.943	.926	.960	74.1	80.7	72.0	681	910	670	82	75	86	W S W	W	W	1.62	2.60	0.48	Inap.	Str. 4. Slight	Cum. Str. 4.	Clear.
24	.985	.976	.994	75.0	94.2	72.0	670	814	704	78	59	90	S W b W	S W b W	S W b W	Inap.	Calm	1.32	...	Clear. [rain	Str. 2.	Str. 2
25	.905	.684	.673	76.2	90.1	80.1	692	814	827	78	59	82	S S E	S S E	S	Inap.	Calm	7.60	...	Do.	Cum. Str. 2.	Do. 4. Dist. th.
26	.665	.656	.800	76.0	91.0	70.6	623	739	568	71	53	78	S S W	W b S	W b N	8.75	9.50	8.77	Inap.	Cum. Str. 5.	Do. 5.	Str. 2. Slight sh.
27	30.028	30.044	30.055	64.8	78.1	68.7	504	450	523	84	47	76	N W b N	N W b N	S W b W	3.38	4.25	Calm	...	Clear.	Do. 2.	Clear. Faint A.
28	30.103	30.019	29.982	66.7	87.1	71.0	506	638	617	76	51	82	W	S W b W	S W	2.43	3.84	1.00	...	Do.	Clear.	Cir. Str. 8. [Bor.
29	29.823	29.645	.677	65.0	77.0	69.3	555	648	668	89	71	95	S W b S	S W	S W	0.99	4.25	7.00	Inap.	Slight Rain.	Do.	Clear Aur. Bor.
30	29.784	29.921	.992	65.5	84.4	61.5	527	814	483	85	71	89	W N W	W N W	W N W	4.21	3.21	8.14	...	Clear.	Clear.	Do.
31	30.082	30.021	.992	67.7	91.6	69.0	455	814	541	69	59	76	W N W	S W	S W	Inap.	Inap.	Calm	...	Do.	Do.	Do.

Barometer	Highest, the 13th day	....	30·210
	Lowest, the 29th day	....	29·645
	Monthly Mean	....	29·916
	" Range	....	·565
Thermometer.	Highest, the 20th day	....	100°·1
	Lowest, the 10th day	....	51°·6
	Monthly Mean	....	76°·2
	" Range	....	48°·5
	Mean Humidity	....	·709
Greatest Intensity of the Sun's Rays		....	141°·2

Rain fell on 5 days, amounting to 0·174 inches, and was accompanied by thunder and lightning on 2 days. Raining 1 hour, 50 minutes. Amount of evaporation, 5·12 in.

Most prevalent Wind, S W by W. Least prevalent Wind, N.

Most Windy Day, the 5th day; mean miles per hour, 5·91.

Least Windy Day, the 7th day; mean miles per hour, Inap.

Aurora Borealis visible on 7 nights. Might have been seen on 14 nights.

The electrical state of the atmosphere was marked by feeble intensity until the 20th day, when the electric pole was blown down during a high wind. No observation since.

The month was remarkable for great heat and dryness being 8°2 above the temperature of last July. The amount of evaporation was the most observed here. Small birds quite deserted the fields and villages and retired to the rivers.