The Canadian Journal.

TORONTO, OCTOBER, 1854.

Geology of Western Canada.—No. II.*

(From the Report of Alex. Murray, Esq., Assistant Provincial Geologist, dated Montreal, January 1849.)

WESTERN AND HURON DISTRICTS.

General Description of the Coast.

Of the east side of the promontory separating Georgian Bay from the main body of Lake Huron, a general description was given in the Report of last year. The west side is marked by characteristics similar to those which in the same Report were stated to belong to the south side of the great Manitoulin Island. At all parts from Cape Hurd to Rivière au Sable (north) the coast is low, rocky and rugged, and scantily clothed with a dwarfish growth of evergreen trees. It is deeply indented by numerous bays and creeks, and at intervals, bound by groups of small, low and usually barren islands of limestone. As is the case on the southern shores of the Manitoulins, these bays, though frequently capacious, rarely constitute good harbours, the approach to them being at times extremely dangerous, even for vessels of small draught, owing to the shallows which extend for a long distance out into the lake, consequent upon the low westerly dip of the calcareous strata composing the promontory. Safe and commodious places of resort, however, for vessels navigating the lake, are not altogether wanting, and among these probably the best is the harbour of Tobermory, near Cape Hurd, well known to most persons who have frequented this part of the coast. Boats can find shelter in many places, either in coves or creeks, or among the islands, and at the mouth of the Rivière au Sable (north), there is an excellent boat harbour, but a sand-bar at the entrance effectually prevents the admission of vessels drawing over three feet.

Losing its rocky nature, a decided change takes place in the character of the coast, at the Rivière au Sable (north), about the mouth of which, and for several miles south, sand dunes prevail; and farther on, a beach of sand, strewed over in parts with boulders, extends some distance beyond the Sauguine. Between the two rivers there is no harbour of any description, and with strong northerly or westerly winds, it is next to impossible to effect a landing, in consequence of the barriers of boulders which lie along the shore at considerable distances from the land, the shallowness of the approach, and a heavy surf which rolls in from the lake. Bordering the lake along the sandy tract there is no amelioration in the timber, which consists for the most part of a mixture of inferior evergreens, with small white birches and cedars, until approaching the Sauguine, where a gradual but evident improvement in the nature of the soil is indicated by the more frequently recurring presence of good sized pines, accompanied with maple, elm and birch. The mouth of the Sauguine affords a good harbour for boats and small craft, but as is the case with all the rivers of the coast, a bar is formed across its entrance, over which a heavy sea breaks when the wind is at all strong from any point between south west and north: its entrance, under such circumstances, is difficult, and attended with considerable danger. At a very short distance up from its junction with the lake, the river becomes rapid and is no farther navigable except for canoes or small boats, and rapids occur at intervals to the highest part we reached, which might be about five miles from the mouth. In these five miles the river flows between banks of clay, gravel and sand, frequently rising boldly to heights of between twenty and a hundred feet over the water; the surface of the country on both sides is flat or gently undulating, and while in many parts it bears a heavy growth of pine timber, in others it yields maple, elm, ash, and other hardwood trees of good size. About two miles from the mouth, on the right bank of the river, there is an Indian settlement, from which a portage has been cut across the peninsula to the Indian Village of Neewash, at the head of Owen's Sound. The territory to the North of the portage being exclusively an Indian Reserve, remains in its primeval state of wilderness; and with the exception of a building which was raised some years ago by a fishing company at Caheto, or Fishing Island, there is not a single dwelling house on any part of the coast all the way to Cape Hurd, a distance of nearly sixty miles.

Following the coast south from the Sauguine, the land is low, with a beach alternately of sand and boulders, for about six or seven miles, beyond which occasional ledges of rock appear, until reaching the Little Pine River, which enters the lake to the south of Point Douglas. Beyond the Little Pine River the land becomes more elevated, and the character of its forest proclaims a still further improvement in the soil. At the outlet of a stream, dignified, though a mere brook, with the name of the Big Pine River, in which the epithet Big, however, is probably intended to qualify the wood rather than the water, the surface is thickly grown over with pine of large size, and before reaching Point Clark, some nine miles farther, the interior consists chiefly of excellent hardwood land. A beach of fine sand skirts the shore for the whole distance. From Point Clark, the coast which, from the mouth of the Rivière au Sable (north), has a general bearing about S.W. by W., turns due south, and maintaining this course to Port Frank, in the Township of Stephen, a distance of fifty miles, presents to the lake, in almost all parts, steep and lofty cliffs of clay, the summit of which spreads back into an extensive level country, producing a luxuriant vegetation of the heaviest description of hardwood trees. At Port Frank the trend of the coast changes to south west, and again with the adjacent country becomes sandy, presenting innumerable sand dunes, which extend several miles back, and in many instances rise to the height of a hundred feet and more over the surface of the lake. This character prevails to the mouth the Rivière au Sable (south,) and beyond it to within a short distance of Cape Ipperwash or Kettle Point, which is about fifteen miles from Port Frank. Kettle Point displays a few flat rocks coming to the water's edge, but beyond it a fine sandy beach, with high cliffs of clay rising at a short distance back, hold the coast line to within two miles of the entrance of the St. Clair River, where the country again appears to assume an arenaceous character.

In the direction in which we proceeded along this coast,

* 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.

settlements first appear a short distance to the south of Point Clark, the forest being here and there indented with extensive clearings which increase in size and number, approaching Goderich. South from Goderich the principal settlement we observed was at Bayfield River, but the rest of the coast between that river and Port Sarnia, on the St. Clair, is as yet but thinly peopled. Kettle Point and the neighbourhood are still, I understand, in the possession of the Indians, and are in consequence but little cultivated.

With the exception of Goderich harbour, at the mouth of the Maitland River, and the basin at the exit of Rivière au Sable (south,) there is not a single place of security for any description of vessel between the River Sauguine and the St. Clair. Small boats, I was informed, could enter Big Pine Brook, but no craft of larger size. There are no islands, no coves, no accessible brooks or streams, and with strong winds from the south, west or north, it is difficult, if not impossible, to land boats with safety. At many points the water is very shallow and large boulders often lie at a long distance out in the lake, while a very heavy sea breaks every where along the coast.

Distribution of the Rock Formations.

The rocks exhibited upon that part of Lake Huron now under consideration, are portions of the whole suite of fossiliferous deposits between the Trenton Limestone (using the New York nomenclature,) at the base, and the Hamilton Group at the summit, both inclusive; the superposition, in ascending order, being as follows:

1. Trenton Limestone,
2. Utica Slate,
3. Loraine Shales,
4. Medina Sandstone and Marl,
5. Niagara Limestone,
6. Onondaga Salt Group, or Gypsiferous Limestone and Shale,
7. Corniferous Limestone,
8. Hamilton Group.

I. TRENTON LIMESTONE.

As already remarked in former Reports, the Trenton Limestone occupies the whole of the Peninsula between Matchedash and Nottawasaga Bays, and the group of islands lying off its extremity, consisting of the Giant's Tomb, Hope, Beckwith and Christian Islands. At the head of Matchedash Bay, near the entrance of the Cold Water River, the limestones are found with a narrow band of green sandstone below them, resting unconformably upon gneiss, and from that spot a nearly straight line drawn down the Bay to the Giant's Tomb, would mark the lower boundary of the formation, the limestone being seen outcropping at intervals on the south west shore, while the islands and mainland on the opposite side display nothing but the older rock in its various granitic and syenitic aspects. The upper members of the Trenton formation were found about eight miles west from Nottawasaga River at McGlashan's Mills, at Hurontario in the Township of Nottawasaga, at the little islands, called the Hen and Chickens, and on the coast in the N.W. corner of the Township of Nottawasaga, where they were seen to pass below the Utica slate. The tranverse breadth of the formation is thus about thirty miles, and its thickness, supposing the dip to be to the south-westward at the rate of thirty feet in a mile, would be 900 feet. But it is not unlikely that it may be affected by very gentle undulations and it would therefore be scarcely safe to state the probable amount at more than 600 to 700 feet. The arenaceous portion of the formation, distinguished by the New York geologists as the Calciferous sandrock, is usually found at the base, and beds more or less silicious occur at intervals throughout the whole thickness. Green calcareous and argillaceous shales are also frequently met with, usually holding numerous fossils, and alternating with beds of good limestone; the pure limestones are sometimes of a buff color and very fine texture, in which case fossils are scarce, those in such instances most prevalent, being small fucoids generally replaced by calcareous spar, running through the beds vertically to the plane of stratification. Other beds are gray in color, granular and crowded with fossils. Among these beds some hold the tail of a trilobite (*Isotelus gigas*) in great abundance, while others are almost exclusively composed of the remains of a species of *Leptena*. The fossils observed to prevail throughout the formation were several species of *Leptena*, *Cypricardia*, several spiral univalves, orthoceratites, trilobites, chiefly *Isotelus gigas*, encrinites, corals and fucoids.

In the variations in mineral quality in different parts of the formation, some beds are so very arenaceous and hard as to be altogether unfit for burning into lime, or where not too silicious for such a purpose, the lime assumes when slacked such a dark yellow color as to unfit it for white-washing, while it permits but a small admixture of sand in forming mortar. Other beds on the contrary are uncommonly free from silicious matter, and are then often bituminous, and sometimes have a slightly argillaceous aspect. The lime from these beds is of excellent quality.

II. UTICA SLATE.

Black bituminous shales come to the surface on the coast of Nottawasaga Bay, in the fourth concession of Collingwood, with beds of close-grained, dark-brown bituminous limestone interstratified. The limestones contain fossils, but by no means in such abundance as the shales, which are uncommonly productive, the prevailing fossil being the tail of the *Isotelus gigas*, which greatly predominates, but is accompanied by *Triarthus beckii, Orthis, Lingula, Orthoceras and Graptolithus.*

III. LORAINE SHALES.

The first exposure of the formation we met with on our route along the coast was near Cape Boucher, in Nottawasaga Bay, where cliffs rising abruptly to the height of 150 feet, present sections of buff or drab-colored argillaceous shales, interstratified with thin beds of gray yellow-weathering sandstone. It next makes its appearance at Point Rich, and continues exposed, in a high nearly vertical cliff, thence to Point William, where we found blue and drab-colored argillaceous shales, with thin alternations of calcareous sandstone and thin beds of limestone. The upper part of the formation was observed in a cliff about 100 feet high at the head of Owen's Sound, immediately over the steam-boat wharf, where the base of the precipice displayed shales of a similar character to those at Point William, which were overlaid by hard beds of gray or brownish yellow-weathering silicious limestone capping the summit. Portions of the formation are seen at Cape Commodore, on the islands opposite to Colpoy's Bay, at Cape Croker, and other parts of the coast, until reaching Cabot's Head, where they were observed to pass below the Medina rocks, as noticed in the Report of last year. If a straight line were drawn from Point Rich to Cape Croker, to represent the outcrop of the base, the formation would have a breadth of about twenty miles at Owen's Sound, which, at the supposed slope of thirty feet in a mile, would give a thickness of about 600 feet.

Fossils are found in vast abundance, but unequally distributed through the formation. In the section near Cape Boucher they consist chiefly of stems of encrinites and pentacrinites and also fucoids, shells of all kinds being very scarce. At Point

William shells are more plentiful, but not in great abundance, while at Cape Croker and Cape Montresor various species of shells occur in great numbers, in addition to encrinites, corals and fucoids. In the hard beds at the top of the formation, in Owen's Sound, we met with numerous fossils; they were principally small shells and corals, and the forms having been replaced by silica, while the imbedding matrix is calcareous, they were weathered out in relief on the exposed surfaces, being precisely in the condition in which similar remains were found in the upper beds of the same series last season, at Cabot's Head and in the Grand Manitoulin Island. The species of *Pterinea* (*P. carinata*) which appears to be peculiarly characteristic of this series of rocks, is found more or less abundantly in different parts throughout the whole vertical thickness, and in great numbers at Point William, Cape Croker and Cape Montresor.

Concretionary nodules of calcareous quality, usually assuming spheroidal or sub-spheroidal shapes, are thickly scattered through the shales in some parts of the formation, and were observed in particular among the rocks in the neighbourhood of Cape Boucher.

The materials of economic importance observed associated with the Loraine shales, were stones fit for building, for tiles and flagging, with limestone and clay. For building, the hard beds at the top of the series, are of tolerably good quality, when the layers are not too thin, which however they frequently are, and some of the calcareo-arenaceous bands might be used for a rough description of tiles and flagging; but the material is of an inferior quality for either purpose. There are very few beds fit for burning into lime; an occasional one, however, is met with among the blue and drab shales. When not too calcareous, the clays derived from the disintegration of the shales constitute material of good quality for brick making. Gypsum is reported to have been found in the formation near Cape Commodore, but the only specimens of it met with by me occurred in small isolated masses of no economical importance, being such as are known to exist in the formation elsewhere.

IV. V. MEDINA SANDSTONE AND NIAGARA LIMESTONE.

A bold precipitous escarpment marking the outcrop of the Niagara limestones, was traced along the coast during the season of 1847, from Cabot's Head to Colpoy's Bay. Southward from the bight of this bay, the escarpment leaves the coast, but maintaining some degree of parrallelism with it, sweeps round towards the heights over Cape Commodore, whence it runs nearly due south, keeping two or three miles distant from the west shore of Owen's Sound, until reaching the line between the Townships of Derby and Sydenham, about three miles south of the village of the latter name at the head of Owen's Sound, where it strikes to the south-eastward and crosses the Owen's Sound road. The subjacent formation was not exposed at any part that we visited south of Colpoy's Bay, being concealed by detritus and forest trees, but the soil at the base of the Niagara escarpment was frequently observed to be of a red color and marly quality, leaving little doubt that it was derived from the immediately proximity of the marls of the Medina group.

The upper part of the Niagara limestones, which constitutes the south shores of the Manitoulin Islands, strikes from Horse or Fitzwilliam Island across to the Isle of Coves, then to Cape Hurd, whence it holds the coast and adjacent islands to Chief's Point and the Rivière au Sable (north;) from this, striking into the interior, it is no more seen on the lake. Rocks belonging either to the summit of this or to the base of the succeeding superior formation were seen at Galt, on the Grand River, and beds belonging to the Niagara Group, were observed occasionally coming to the surface, on the road between Galt and Dundas, but the country north of Galt, and between it and the mouth of the Rivière au Sable (north,) has not yet been examined, and I am unacquainted with the details of the geographical boundary of the summit of the formation in the interval, which is nearly a hundred miles.

Numerous fossils were observed in the Niagara limestones, but the variety was not great except among the corals, which were of many different species. The most characteristic shell was a *Pentamerus*, which extended through the whole formation, but was most abundant near the top; *Euomphalus* and other spiral genera were met with; a large bivalve of a new genus occurred in great numbers at Galt, associated with *Pentamerus*.* Among the thin-bedded limestones at the base of the formation (corresponding probably with the Clinton group portion of it,) some surfaces were thickly covered with organic remains, an *Atrypa* and a small turbinated shell chiefly prevailing. Trilobites, orthoceratites, corals and fucoids also, though in less abundance, were observed in this portion, but principally in one place near Cape Chin, on the south side of Dyer's Bay.

The Niagara group is fruitful in excellent materials for building and lime burning. At Galt white limestone occurs of a beautiful and enduring quality for architectural purposes, for which it is extensively quarried from beds nearly horizontal, varying from one to three feet thick, and blocks may be obtained of almost any required size without much difficulty; the stone burns also to an excellent lime. At Owen's Sound, about two miles S. by E. from the village, there are unworked strata of white or pale grey limestone; the upper beds are from two to four feet thick, the lower ones occasionally over twelve feet, being all very massive; the upper beds could be quarried to an almost boundless extent, and would yield an excellent building material; the lower beds are likewise fit for building purposes, but being the base of an abrupt escarpment could not be extensively quarried; large loose masses, however, skirt the escarpment, and these might be made available for a great length of time. All the beds would stand the weather well; many of them have occasionally been burnt by the settlers, and are said to make an excellent quality of lime. Materials of much the same sort would be found all the way to Cabot's Head. On the Rivière au Sable (north,) about a mile and a half or two miles from its mouth, there are some pale greenish-blue limestone beds, one of them darker than the rest, which would all be fit for building purposes; the stone appears to resist the disintegrating influences of the weather well, but it turns under them to a blackish color. The beds are from eight to eighteen inches, and even two feet thick; they are divided by parallel joints into rhomboidal forms, and would afford blocks of any required size. At Chiefs' Point there is a limestone which presents a white or pale gray color on fracture; it has a rough pitted exterior surface, and weathers to a dark brown approaching to black; the beds are massive, ranging from two to four feet in thickness; parallel joints intersect them, and they could easily be quarried, and afford a very substantial building stone: most of the beds are supposed to be fit for burning into lime.

* Since Mr. Murray's examination of the rocks at Galt, Mr. Hall, of New York, has visited the spot, and in addition to the new bivalve, above mentioned, to which he proposes to give the name of *Megalamus Canadensis*, he has met with other shells, two of which he recognises as belonging to the Onondaga Salt Group, or Gypsiferous Limestone, and he is disposed to class the Galt rocks with that formation.—W. E. L.

Lyell Island and the Fishing Islands give a stone precisely similar to that of Chiefs' Point and under exactly similar circumstances; and so indeed does nearly the whole coast to Cape Hard, on which the rocks, running on the strike, are exposed nearly the whole way. Hitherto the only trial that has been made of this part of the formation is on one of the Fishing Islands, where a house, to which allusion has already been made, was constructed some years ago by a fishing company for the superintendent.

Biographical Notice of Sir Roderick Murchison.*

Sir Roderick Murchison was born on the 19th of February, 1792, at Taradale, a picturesque estate on the Beauly Loch, and was the eldest son of Kenneth Murchison, Esq., of Taradale, by the sister of General Sir Alexander Mackenzie, Bart., of Fairburn, in the same county, a distinguished officer, who was second in command at the capture of the Cape of Good Hope, in 1795, and subsequently served in the Mediterranean. The Murchisons derive their descent from Colma, (subsequently M'Colmans,) the son of Anselm, a son of Ryan, King of Ulster, who had been driven from his country by the Danes. One of the M'Colmans, called Murdo or Murcho-du, settled in Kintail, in Ross-shire; but the family fell into comparative poverty. One of his descendants, John Murchison, the great grandfather of our author, who held a Major's commission in King James's army, fell, at the age of thirty-five, in the battle of Sheriffmuir. His grandson Kenneth, our author's father, born in 1752, was educated for the medical profession, and held lucrative appointments in India. He was the friend of Hastings, Impey, and Sullivan; and after his return to Europe he purchased the estate of Taradale from his maternal uncle, Mr. Mackenzie of Lentron. It is a curious circumstance that he kept journals written in Gaelic and in the Greek character,—a fact which may probably have been known to Macpherson and John Home, who had at one time proposed to have the poems of Ossian printed in the same character. Having, on account of his health removed to England in 1794,—he died at Bathampton, near Bath, in 1796, in the forty-fourth year of his age. Inheriting the martial spirit of his uncle, young Murchison chose the profession of a soldier, and while imbibing the first elements of learning, at the school of Durham, under Dr. Britton, to which he went in 1799, he exhibited among his school-fellows that daring spirit and recklessness of danger which so well harmonizes with the ambition of military adventure. On one occasion he performed, to the wonder of his school-fellows, the hazardous feat of getting outside of the balustrade of the great tower of the cathedral, and seating himself on a corner spout projecting from a dragon; and at another time he began his career of subterranean exploration by crawling, as we have heard him say, in the society of rats not yet fossilized, along the conduit which begins at the Watergate and terminates at the river Wear, where he was received with open arms by his admiring school-fellows.

From the grammar-school of Durham he went, in 1805, to the Military College of Marlow, where he remained till 1807, when, at the age of fifteen, he got a commission in the 36th regiment of foot. By the interest of his uncle, Sir Alexander Mackenzie, he was transferred to the University of Edinburgh to pursue his studies, at a time when he had a recruiting party under his orders in the town. He was boarded in the house of Mr. Manners, then bookseller, and librarian to the Faculty of Advocates, where he had among his associates the late M. Schweitzkoff, who died when Russian Minister at Florence, and the present Sir Thomas Birch, M.P. for Liverpool, and private secretary to Lord Melbourne when his lordship was Chief Secretary in Ireland. Our young Ensign does not seem to have drawn much wisdom from the Modern Athens, or to have acquired, in his University studies, any knowledge in those branches of science to which he was afterwards devoted.

After he had joined his regiment at Cork, in the winter of 1808, it was moved to Fermoy, when it was suddenly ordered to embark for Portugal under Sir Arthur Wellesley. After the army landed at Lisbon and advanced into the interior, he was present at the battle of Roleia, where General Laborde was defeated on the 17th August; and he carried the colours of his regiment, the 36th, when it so nobly distinguished itself at the battle of Vimiera on the 21st of August. Sir Arthur's despatch specially recommended Colonel Burne, who commanded the 36th, and, what was unusual, he devoted a whole paragraph to the praise of the regiment. Having observed the brilliant charge executed by General (afterwards Sir Ronald) Ferguson's brigade, of which the 36th formed the right, and noticed the manner in which they captured the enemy's guns, and drove them across a moor away from their main body, Sir Arthur followed them at a gallop from the centre, where he had repulsed Junot in person, and reached them only at a hamlet where the French were rallying in their front. At this moment our author's brother Ensign was shot. In the confusion and din of the fight, a shrill voice was heard, "Where are the colours of the 36th?"—"Here, Sir!" replied the young Ensign. The regiment was immediately halted, and the welcome sound of "Very well, my boys," conveyed the satisfaction of their distinguished chief. Our limits will not permit us to follow our young soldier in his military career in the Peninsula. He accompanied the army in its advance to Madrid through cold and snow to meet Soult; and after its retreat, and junction with Sir John Moore, he was present at the battle of Corunna, and shared in all the dangers of that unfortunate event. He was subsequently removed to the staff of his uncle, General Sir Alexander Mackenzie, in Sicily, and afterwards served in the Mediterranean at the siege of Cadiz, and in Ireland as a captain in the Inniskilling or 9th dragoons. Amid the excitements and dangers of war, the germ of science which Nature had planted within him had not yet shown its peaceful foliage, and, though his eye dwelt on the fine gorges and rugged outlines of the mountain ranges between Spain and Portugal,—on the masses of granite in the famous pass of Guadaramma,—he was not aware that he was treading upon Silurian pavements, which, in other countries, it was to be the business of his life to explore.

In 1815 he married the only daughter of General Hugonin, a lady of congenial taste and great accomplishments; and, considering the married state as incompatible with the duties required from a soldier, he left the service, and sought for amusement and instruction in foreign travel, and, when at home, in the occupations of the sportsman and fox hunter. Destined, however, for higher objects, it required only the voice of affection and friendship to remove him to more rational and more congenial pursuits. Herself a good florist and botanist, Lady Murchison attracted him to scientific studies, and having thus been initiated into the temple of knowledge, it was not difficult to fix him at its shrine. When in company with Sir Humphry Davy, and engaged with him in field-sports at the hospitable

* Abstract of an article in the North British Review for August, 1854.

mansion of the late Mr. Morritt of Rokeby, he was encouraged by that eminent chemist to devote himself to science, and, at his advice, attended the Lectures at the Royal Institution. Here he acquired his first lessons in science between 1822 and 1824, and having been elected a member of the Geological Society in 1825, he at once entered upon the duties of a practical geologist. In the following year he was admitted a Fellow of the Royal Society, and thus took his place among the philosophers of England.

After examining the Brora coal in Sutherlandshire, and showing that it was a member of the Oolitic series, and equal only to the impure coal of the Oolite of Scarborough and Whitby, our author visited the Highlands in the following year with Professor Sedgwick, when they succeeded in showing that the primary sandstone of Macculloch was nothing more than the true old red sandstone.

Thus prepared by his geological studies at home, our author, accompanied by Lady Murchison, set out in 1828, along with his distinguished friend Mr. Lyell, to study the extinct volcanoes of Auvergne, and the geology of the north of Italy. In this tour they visited Paris, Avergne, the south of France, Nice, and Turin. The results of this diversified journey, which Mr. Lyell by himself extended to Rome, Naples, and Sicily, were partly published in his "Principles of Geology," and partly in three Memoirs, the joint production of the two geologists. These Memoirs were on the excavation of Valleys, as illustrated by the volcanic rocks of Central France, on the tertiary strata of the Cantal, and on the tertiary fresh water strata of Aix, in Provence.

After separating from his companion, who contiued his journey to the South, our author crossed the Alps from Venice and Bassano, and in the journey he discovered a key to establish the order of sequence of the Jurassic or Golitic and Cretaceous rocks, and the Tertiary strata which overlap them; and having in 1829 visited the same mountain chain in the following year, along with professor Sedgwick, and again in the year 1830 by himself, he was enabled with the assistance of his friend, to publish a Memoir in the Geological Transactions on the structure of the Eastern Alps, accompanied by a Geological Map of the chain.

After these explorations of the Alps, Sir Roderick directed his attention to the geology of his own country. He had been led by his friend and instructor Dr. Buckland to explore the banks of the Wye between Hay and Builth, in the hope of discovering evidences of order among those masses of rock to which the unmeaning term of grauwacke had been applied, and he was thus led to study those vast and regular deposits of a remote age, which are most clearly displayed in that part of Wales and England which was occupied by the Silures, and which he called the *Silurian System*. After having established the existence of the system in the counties of Shropshire, Hereford, Montgomery, and Radnor, he traced it to the southwest, through the counties of Brecknock and Caermarthen, and finally discovered the whole succession of the upper and lower Silurian rocks, in the sea cliffs to the west of Milford Haven,—the only place in the British Isles where the whole series, down to an unfossiliferous base is seen to be regularly surmounted by the Old Red Sandstone.

These views were first published in the proceedings of the Geological Society and in the Philosophical Magazine, between the years 1832 and 1835, both inclusive; the term *Silurian* having been applied to the series in the last mentioned year. At that time it was believed that the great slaty masses of North Wales, which had been under the survey of Professor Sedgwick, but whose fossils had not been made known, were inferior in position to the formations which had been classed, and whose fossils had been identified, as *Silurian*. This belief continued to be in force when the large work entitled the "Silurian System" was published, (1839,) the *supposed* lower rocks having been termed *Cambrian* in 1836, by their explorer, Professor Sedgwick; it being then presumed that this would prove to contain a distinct group of organic remains. When the masses, however, to which the name *Cambrian* had been given, were examined in detail by the numerous geologists of the Government Survey, and were thus for the first time, placed in correlation with the previously established Silurian strata, it was found that the great and apparently chaotic pile of Snowden, though full of porphyry and other igneous rocks, was nothing more than the absolute physical equivalent of the Llandeilo formation of the Lower Silurian, and hence these gentlemen, with the entire approval of Sir H. de la Beche, the founder of the great national Geological Museum in the Metropolis, restricted the term Cambrian to the underlying grauwacke without fossils. When we add to these considerations the fact that Silurian fossils are alone found in what were called Cambrian rocks, we cannot avoid adopting the opinion expressed fourteen years ago in one of his anniversary addresses by Sir R. Murchison on his return from Russia, and which has since been maintained by the great body of geologists,—Continental, American, and British,—that the so-called "Cambrian" rocks which contain fossils, are merely geographical extensions (under those different mineral characters so admirably described by Professor Sedgwick) of the lower Silurian deposits of the typical region of Sir R. Murchison in Shropshire and the adjacent counties. But passing by this subject of nomenclature, the difference about which is feelingly alluded to in his preface by our author, we cannot view the question as affecting the acknowledged merits of the distinguished Cambridge Professor, who, whatever be the names of the rocks, will ever occupy the same lofty place in the history of geology to which his labours have so justly entitled him, and whose praises are emphatically recorded in the volume under review by his associate in many a field of research.

Without particularly noticing the two journeys which were performed by our author and Professor Sedgwick in 1835 and 1839 into the Rhenish provinces, including the Hartz district and Franconia on the one side, and Belgium and the Boullonais on the other, in the last of which they were accompanied by M. de Verneuil, we must hasten to give a brief account* of the remarkable journeys which he made to Russia in 1840 and 1841, in company with M. Verneuil, whom he invited to accompany him. Our geologists reached St. Petersburg in the summer of 1840, and after visiting the banks of the rivers Volkof and Siass, and the shore of Lake Onega, they proceeded to Archangel, and the borders of the White Sea, and followed the River Dwina into the Government of Vologda. After traversing to the Volga they returned by Moscow to St. Petersburg, examining the Valdai Hills, Lake Ilmen, and the banks of the rivers which they passed. Mr. Murchison returned to England in 1840; but having, along with M. Verneuil, been invited by the Emperor to superintend a geological survey of Russia, our two geologists travelled overland to St. Petersburg in the spring of 1841, and being joined by Count Key-

* In the *North British Review*, Edinburgh edition, vol. v. p. 183 where is reviewed "The Geology of Russia in Europe," our readers will find a fuller account of these journeys, and their results.

serling and Lieutenant Kokšharof, they proceeded to explore the Ural Mountains, the southern provinces of the empire, and the coal districts between the Dnieper and the Don. In order to render his great work on Eastern Europe as perfect as possible, our author alone travelled, in 1842, through several parts of Germany, Poland, and the Carpathian Mountains; and with the same objects in view, he explored successfully, in the summer of 1844, the Palæozoic formations of Sweden and Norway. He afterwards re-visited St. Petersburg, and after communicating with Count Keyserling on the subject of the Petchora and Timan country, which had been explored by that geologist, and examining some newly-discovered natural relations of the strata, not very distant from the capital, he returned to England, and completed in 1845, in conjunction with M. de Verneuil, that magnificent work on the geology of Russia and the Ural Mountains, of which we have given a full account in a preceding article.

Before quitting our enumeration of the geological works of Sir Roderick Murchison which preceded the one now under review, we must notice his remarkable treatise on the Alps, Appennines, and Carpathians, published by the Geographical Society, in which, after visiting the Alps for the sixth time, he clearly separated the great Nummulite formation from the chalk and other cretaceous deposits with which it had been confounded. This treatise was translated and published in Professor Savi and Menegheiri's work entitled *Le Alpi et gli Apennini*, in which they adopt the general views of the English geologists, and append to it the details of their own observations on the geology of Tuscany. In addition to the works we have enumerated, Mr. Murchison has published upwards of a *hundred* memoirs, a list of which will be found in the *Bibliographia* of Agassiz, published by the late Mr. Hugh Strickland.

But it is not merely by his geological discoveries and writings that Sir Roderick Murchison has earned the gratitude of his country and his reputation in the world of science. After having for five years discharged the arduous duties of secretary to the Geological Society, he filled the office of president in the years 1831 and 1832, and 1842 and 1843. When the British Association assembled at York for the first time in 1831, he was one of the few geologists that responded to the invitation of its founder, and fully appreciating the value of such an institution, he discharged the arduous duties of general secretary for several years, and was president of the Southampton Meeting in 1846. In the important discussions which took place in the geological section he took an active part; he communicated many important papers to its different meetings, and at Ipswich in 1851 he succeeded in establishing the new section of physical geography, ethnology, and philology, thus removing geography from the geological section, in which it was overborne by more popular topics of discussion.

Not less important have been the services of Sir Roderick to the Royal Geographical Society, now one of the most popular and flourishing institutions in the kingdom. When the Society was not in its most active state, he was raised to its presidency in 1844, and was re-elected in 1845; and the energy and talent which he displayed in promoting the objects of the Society are sufficiently shewn in the two printed annual addresses which it is the duty of the president to deliver. At that time the Society had no house of their own, no suitable apartments for the reception of their numerous collections of maps and charts; and hence during the year of the Great Exhibition, in 1851, when the Emperor of Austria presented to it the valuable framed maps which were exhibited in the Crystal Palace, no other place could be found for them than the walls of the staircase which led to their small meeting room.—This was not the proper condition of a society which bore the name of *Royal*, and adjudged annually two royal medals; and the indifference of British Ministers to the interests of science, even when the nation derives from it the most palpable advantages, is well displayed in their treatment of this most useful institution. Sir Roderick Murchison had in 1844 and 1845, failed in obtaining from Sir Robert Peel any pecuniary aid, and when, during his second presidency in 1852, he made a new appeal to the nation, he might have equally failed, had he not proposed that the Society should repay any obligation conferred upon it by the Government, by "rendering one of its rooms a *map office* of the British nation, in which all persons might have access to maps, charts, and plans, many thousands in number." This appeal to the utilitarian conscience succeeded, and we believe that it was chiefly through the exertions of Mr. Joseph Hume that the sum of £500 was wrested from the national purse, never closed but against science, to enable the Geographical Society to receive presents from foreign sovereigns, and carry on researches honorable to the nation, and subservient to the highest interests of its trade and commerce. We have reason to believe that Sir Robert Peel was ashamed of his illiberality to the Geographical Society. We know at least that after he had associated, as he did in the latter part of his life, with many of our most distinguished men of science, he did more to promote its interests than all the ministers that preceded him, and all those, too, that have followed him as advisers of the Crown. Had his valuable life been spared, the science of England would have wanted neither money from the Treasury to advance its interests, nor honours from the Crown to reward and stimulate its cultivators. His successors have yet to learn as he did, the national value of education and knowledge, and require to be taught that if they have not the liberality to foster and extend the educational institutions of the country, it is at least their duty to maintain them, and especially those of Scotland, of which her Majesty is the visitor, in the possession of their original endowments.

Among the other services to his country, and one for which his native Scotland owes him peculiar obligations, we must not omit the great and successful exertions which he made to promote the Ordnance Survey of Scotland. While £850,000 was expended on the Ordnance Survey of Ireland, in procuring for that country a magnificent map on the scale of *six inches to a mile*, almost nothing was done for the map of Scotland, though the survey of the country commenced in the last century. Humiliated by the reflection that Scotland stands almost alone in Europe as a kingdom without a good general map, and experiencing how much geologists and engineers were perplexed by the want of such an auxiliary in their researches, Sir Roderick roused the public attention to the fact in 1834.—The British association in 1834 presented to Government a memorial on the subject, which was printed in 1835 by order of the House of Commons; and the Royal Highland Society and other public bodies, seconded their exertions. The apathy of the Government, however, to everything like science, and especially to Scottish interests, was not overcome even by their powerful influence; and a fresh agitation in 1850 was required to awaken the Scottish members to a due sense of the interests which they had unwarrantably neglect and obtained from a reluctant Legislature the necessary means for carrying on and completing the survey of Scotland.* A grant of £25,000, and

* See *North British Review*. Edinburgh edition, vol

subsequently of 35,000 per annum was made to this great work; but judging from the past, and knowing how little trust is to be placed in public men who have been driven to the discharge of a duty, not by the impulse of knowledge, but by an overwhelming pressure from without, we fear that the necessities of war will be employed as an excuse for neglecting this and all the other works of peace.

We have already had occasion, in a previous article, to mention the honours and rewards which were conferred upon Sir Roderick Murchison by the Emperor of Russia, in consideration of his services in investigating the geological structure of that vast empire. The scientific institutions of Europe have equally recognised his services to science, and we find his name in the list of members of the Imperial Academies of Science of St. Petersburg, Berlin, and Copenhagen, in that of the corresponding members of the Imperial Institute of France, of the Royal Society of Edinburgh, of the Royal Irish Academy, and of the Trustees of the British Museum. In enumerating these honours, we may add that he has long been an active member of the Royal Society of London, and that he has received the honorary degree of M.A. from the Universities of Cambridge and Durham, and of D.C.L. from that of Oxford. In 1846 he received the honour of British knighthood—the cheap reward which an ungrateful country offers in exchange, to-day, for professional sacrifices and national benefits; to-morrow, for political subserviency and corruption. The last service which Sir Roderick has performed to geological science is the publication of the work entitled *Siluria*.

Important Improvement in the Manufacture of Iron and other Metals by the Introduction of a Liquid Purifier.

The advantages derivable from this new principle (the liquid purifier) are being fast appreciated. Among other establishments where the indefatigable discoverer has been, may be noticed the paper-mills belonging to the highest civic authority of the borough of Birmingham, who received him with his usual kindness and urbanity; and having listened attentively to Mr. Phillips's statement of its effects on metals, and of what he proposed doing at the paper-mills, the Mayor at once went with him to the mills, and whilst the machine was in operation, Mr. Phillips's introduced a small quantity of the liquid: in about a minute a piece of paper was produced of decidedly different texture to the bulk then making. This is, of course, not to be considered a fair test or experiment, but merely as showing the extraordinary power of the liquid purifier, whether applied to hard or soft substances. Instances of its effect on other articles can be equally well authenticated; but enough is here shown to prove that various sources of our national prosperity are likely to derive advantage from its introduction into the factories at Manchester and elsewhere, and to which, we understand, it is Mr. Phillips's purpose to turn his attention as soon as he has firmly fixed the practical application of it in the metal trade generally.

As respects copper, brass, &c., we beg now to state that on the introduction of the liquid purifier into the crucible or melting pot (either in or out of the furnace), whilst the metal is in the proper melted state, it brings up almost immediately all the dross and impurities, which the present imperfect mode of fluxing is incapable of doing; this, of course, renders the metal better, and the castings made, whether into ingot or work, are superior, being stronger, tougher, and more solid, consequently better for boring and turning. Its practical working and economical properties have been fully proved, and it may be stated that lighter or thinner castings will be equally strong, and much neater than those in present use; that wire and other things requiring increased strength, in proportion to size, may be made and used thinner than at present; and that ingot metal, being more pure, will be increased in value, and, consequently, will go further in manufacture. This has been frequently tested, particularly as regards the commonest sort of stuff, such as brass filings, which by the new purifier is rendered a good metal, and fit for use again; and although it loses considerably in weight by the new process as compared with the old, yet, on being valued for its metallic properties, after being cast into ingots by the old and new process, the advantage is always found to be on the side of the later, besides having a good metal to work upon; so that if the manufacturer desires to lower in quality, he can do so to suit his purpose and work. This advantage alone, independent of every other, must be of great benefit to the manufacturer and to the public, producing profit to the one and economy to the other.—*Mining Journal.*

New Zealand Flax.

The open hostilities in which this country is at present engaged with Russia, have rendered it incumbent upon us to seek substitutes for articles, the produce of that empire, on which we have been dependent, amongst them for Russian hemp. The demand for paper in this country has also so outgrown our usual sources of supply, that we are forced to seek for new fibrous substance suited for its manufacture, and the New Zealand flax seems to be one well calculated to meet in a great measure these requirements. The *Phormium tenax*, or New Zealand flax grows in great luxuriance in every part of the islands of that vast district, the flax being contained in the leaf of the plant, covered with green cuticle, which requires to be peeled off, and a viscous, gummy substance removed, the precise nature of which is as yet unascertained, before the fibre can be obtained. This cleansing has been as yet but imperfectly accomplished, although the highly valuable qualities of the plant have been long known to the colonists, and it has been used immemorially by the natives, who have only as yet attempted the operation of hand-scraping the leaves in a green state. It has been for the last twenty years an article of limited commerce; but the difficulty of preparing it for use, from the want of proper means and machinery, had been so great, and the cost so considerable, as to have hitherto rendered it unsaleable at a remunerating price.

Aware of these difficulties, and of its increasing commercial value, the Society of Arts at Wellington, New Zealand, lately proposed a premium of fifty guineas to any person who should furnish them with modes of operation, models, and specifications of machinery, by which the flax might be dressed at a cost not exceeding £5 per ton, and the Council expressed their opinion, "that the time may not be very far distant when the navy and mercantile marine of Great Britain will be supplied with cordage and sails from the hitherto comparatively useless New Zealand flax." This announcement naturally attracted attention and accordingly a small hand-revolving machine has been constructed, making 60 revolutions per minute, at each of which revolutions two green leaves are passed through, completely macerated, and forced on to a second part of the machine, which frees the fibre from the gum-resinous substance with which it is coated. This gum has been considered the cause of its brittleness, and has hitherto been only removed by steeping in running water, and by stamping and beating, a very slow, imperfect, and expensive process. The second part of the machine then discharges the macerated leaves into a small stream of water, where the mucilage is washed off by women and children, who merely draw the fibre of each leaf through the hand, and wring it out, it is then hung up to dry under cover. It requires 8 tons of green leaves to produce 1 ton of fibre; but the inventor of the machine has had dried leaves from New Zealand ten feet in length, containing an exceedingly coarse but very strong fibre suitable for ropes and cordage. There are several varieties of the plant, the fibre in each varying in quality, applicable to the manufacture of fabrics for which silk, cotton, flax, wool, and hemp are used; the fine tow, we are assured, forms a beautiful yarn, and the flax takes colour as well as any textile fibre. Water-power abounds in the colony, and if applied to this machine on a large scale, a supply may be obtained sufficient for every purpose.

The flax has been grown in nurseries in Devonshire, and, we believe, in Wales; if so, we see no reason why its culture may not be extended in these islands. The Devon leaves, we are assured, average about 6 feet in length, and although worked by the machine in the dry and not in the green state, each leaf produced 3 ozs. of green fibre. Paper manufactured from this fibre possesses the singular quality of being impervious to water; a sheet of paper folded in the shape of a basin, and filled with water, has been kept suspended for 14 consecutive days, without any appearance of dampness on the exterior; for cartridge-paper, therefore, it would prove invaluable, as well as for preserving polished steel and iron goods. It takes tar as well as European hemp; the relative strength of rope made from the New Zealand fibre and Russian hemp has been tested at the Royal Dockyard, Woolwich, when it was found that a 4½-inch made of the former was 60 per cent. stronger than 4½-inch made of the latter. Running gear and ship tackling of cordage made of this invaluable substance has been used in ships trading between London and New Zealand, and highly approved of; and flat-ropes have been made from it for use in the deep coal-pits of Lancashire, where they are preferred to those of Russian hemp, when supplies can be obtained.

We have thus produced in one of our new colonies, in an unlimited quantity, an article calculated to supersede the hemp of Manilla, America, and above all, of Russia. This invaluable production of the earth covers many thousand acres of the soil to which it is indigenous; and it is remarkable, that the higher the altitude at which it grows, the shorter the leaf and the finer the fabric it produces. The want of proper machinery for its production has hitherto prevented the shipment of it in quantity to Europe; the proposed plan will probably remedy that evil, and in time ensure an ample supply. We have thought it right to direct the attention of commercial men to this very interesting and important national object: the drain for European labour in Australia renders it desirable that the natives should be employed extensively in this manufacture, the simplicity of the new machinery suits it for being worked by them, and we hope to see the Zealand flax properly and extensively prepared by the improved process, attain the position in the European markets which its valuable qualities appear so fully to merit.—*Mining Journal*

Incrustation in Boilers.

Mr. Washington Jones exhibited to the meeting of the Franklin Institute, July 20, some specimens of scale, or incrustation, taken from the boiler of a coasting steamer. One piece about twelve inches long, by eight wide, and about three-eights thick, was formed on the outer portion of the furnace crown, and distinctly showed the form of that part of the boiler, with each rivet head and the joinings of the sheets. The scale had been deposited in layers that were of various tints, derived from the colouring matter extracted from the substances (such as saw-dust of mahogany, &c.), that had, from time to time, been put into the boiler to prevent the deposit of scale. Another piece of irregular shape, had been taken from the steam chimney. It is well known that scale is a non-conductor of heat. It forms most rapidly, as a necessary consequence, upon those parts of the boiler where the heat and the evaporation is the greatest, and thus increases the liability these parts have to become overheated or burned.

Mr. Jones also presented a stay bolt taken from the smoke-pipe, where its head had been for over two years exposed to jets of exhaust steam. The part of the head against which the steam impinged, had been cut or worn away by its action; the texture of the iron was close, and the wasted part was as smooth as if cut with a keen tool.

Mr. Jones remarked that the proper construction and maintenance of steam boilers in a safe condition, should be of special importance not only to engineers, but to the whole community. No part of the apparatus requires closer attention. As a class, our steamboat engineers are fully competent to discharge the duties belonging to their post; but, occasionally, the desire to make a quick run, induces them to carry a little higher steam, and to "blow out" less frequently, a practice to be deprecated, as it is almost sure to bring upon them the labour of "scaling", as well as risking the efficiency of the boilers.—*Journal Franklin Institute.*

Lighting by Electricity.

Letter of MM. Deleuil & Son, to M. Elie de Beaumont.

We communicated to the Academy, some time ago, a note in reference to the electro-lighting of the Napoleon Docks. M. Regnault, the director of the telegraph of the Rouen Railroad, who took charge of this lighting, has communicated to us the statement of the expense, of which we herewith send you the details. We thought everything connected with this lighting would be favorably received by the Academy. The apparatus which worked for four consecutive months with great regularity, were composed each of a battery of fifty Bunsen elements of large size.

The expense per day apparatus, was as follows:

Wages of the workmen, ...	4·50	francs.
Mercury, ...	5·	"
Zinc, ...	4·50	"
Charcoal points, ...	1·40	"
Nitric Acid, ...	1·80	"
Sulphuric Acid, ...	1·84	"
	19·04	" ($3·80)

The expense of lighting 400 workmen was, then, 38·08 francs

(87·62) per evening, or 1·9 cents per man. The economy is considerable, and the work can be done without danger and with a regularity which cannot be obtained by any other means.

The Perpetual Secretary remarked, that electro-lighting which could be very cheaply established on ship-board, and which is not, like other systems of lighting, liable to be extinguished during a storm, would be very advantageous for preventing those collisions by night which are so frequent, and generally so disastrous, and to which attention has been called by a recent event.—*Comptes Rendus.*

On Changes of the Sea-Level effected by existing Physical Causes during stated periods of time.

BY ALFRED TYLOR, F.G.S.*

Introduction.

The First Part of the ensuing paper is occupied with the details of the probable amount of the solid matter annually brought into the ocean by rivers and other agents, in suspension and solution; and the conclusion is arrived at, that the quantity of detritus thus distributed on the sea-bottom would displace enough water to cause an elevation of the ocean-level to the extent of at least 3 inches in 10,000 years.

In the Second Part an endeavour is made to compute the number of such periods of 10,000 years that must have elapsed during the accumulation of the immense mass of recent freshwater strata said to exist in the valley of the Mississippi.

The calculation as to the latter is made from the *data* collected by observers in America, of the extent of the deposit in question; and it is here supposed, first, that in former periods the *same* quantity of mud as at present has been annually carried into the Gulf of Mexico; and secondly, that the amount of sediment deposited on the delta and plains of the Mississippi does not exceed *one-tenth part* of the solid material which has been carried out (suspended in the water of the river) into distant parts of the Gulf of Mexico, or into the Atlantic Ocean itself.

From recent accounts by Mr. C. Ellet, of the United States, it appears that a column of fresh water, 1¼ mile wide and about 7 feet deep, is constantly entering the Gulf of Mexico at a speed of 2 to 2½ miles per hour, and floats on the surface of a stratum of salt water, to which it partially communicates its own velocity. And below this a stratum of sea-water is found to be flowing in an opposite direction to that of the two strata of fresh and salt water above it.

From the data submitted, it would appear that the accumulation of the alluvial deposit of the Mississippi must have occupied a great number of periods, during each of which an elevation of the sea-level of 3 inches may have occurred.

The general conclusion arrived at is, that the sea-level cannot be considered as stationary for practical geological purposes, since the operation of present physical causes would produce a considerable change in its height, even during the construction of a recent deposit like that in the valley of the Mississippi, which may be called small and local compared with those older formations familiar to geological observers.

But the subsidence and elevation of the crust of the earth would be accompanied by alterations of the area of the sea-bed; and the frequency of such movements would therefore furnish additional reasons for not considering the sea-level permanent for the lengthened periods requisite for the accumulation of sedimentary deposits of any magnitude.

In the Third Part of this paper an attempt is made to direct attention to the difficulty of finding any test by which to distinguish strata gradually accumulated during a long-continued upward movement of the sea-level, from those strata formed on a sea-bottom slowly subsiding while the ocean-level was stationary. In either case no change of depth of water may have occurred of sufficient importance to cause the removal of the Mollusca inhabiting the locality, and therefore the discovery of *the same species of organic remains from top to bottom of a thick deposit* is not an absolute proof (as has been supposed†) that gradual subsidence has occurred during that particular formation; because the condition of equal depth of water during any deposit might be produced either by subsidence of the sea-bottom or elevation of the sea-level, or by both conjointly.

In discussing these questions, the writer has not assumed that during gradual subsidences or gradual elevations, greater denudations or depositions would occur than when the level of the land and sea-bottom was stationary; because it is not certain, either that during such gentle oscillations the forces that would produce denudation are sensibly diminished or increased, or that the rocks which are brought within the reach of denuding forces are necessarily more easily worn away than those which were previously exposed to the same influences.

PART I.

It has long been acknowledged that the quantity of detritus annually carried into the ocean from various sources must displace an equal volume of water, and thus tend to raise the level of the sea. Many years since it was estimated by an Italian that this change might amount to one foot in a thousand years. The general opinion on this subject has been, that the effects produced by the present supplies of detritus would be too minute to be perceptible, and on geological enquiries the ocean-level has been considered as permanent for all practical purposes.‡ I here propose to offer the evidence of present denudation in certain countries where careful observations have been made, in order to show, that if such rapid destruction of land occurs in most localities, then the operation of present physical causes must be amply sufficient to effect a

---

* From the Philosophical Magazine for April, 1853.

† "In formations from a few hundred to a thousand feet and upwards in thickness, the whole of which does actually belong to the same geological age and is therefore characterized by the same fossils, most curious and important results may be sometimes deduced if the position or relative heights at which the groups of fossils are imbedded be noted; and this is a point usually neglected. For, thanks to the researches of Professor E. Forbes, the depth of water under which a collection of shells lived can now be approximately told; and thus the movement of the crust of the earth, while the strata including the shells were accumulating, can be inferred.

"For instance, if the bottom of a cliff, say 800 feet in height, a set of shells are buried which must have lived under water only 50 or 100 feet in depth, it is clear that the bottom of the sea must have sunk to have allowed of the deposition of the 700 feet of superincumbent submarine strata; subsequently the whole 800 feet must have been upraised." (Darwin.)

‡ Manfredi. See Lyell's Principles, edit. 1850, p. 270 and 542.

perceptible alteration in the sea-level in a moderate space of time.

The mere consideration of the number of cubic feet of detritus annually removed from any tract of land by its rivers, does not produce so striking an impression upon the mind as the statement of how much the *mean surface level* of the district in question would be reduced by such a removal. This information may be obtained by calculation from the published accounts of the quantity of mud annually abstracted from districts of known dimensions by their rivers. In this manner it is found that the Ganges would in about 1751 years, at its present annual rate, carry away from the land it drains (which is supposed to be about 400,000 square miles) as much detritus as would cover that area to the depth of one foot, as the following calculation will show:—

Thus, 27,870,400 (superficial feet in a mile) × 400,000 = 11,151,360,000,000, the number of superficial feet in the area of 400,000 square miles drained by the Ganges. The number of cubic feet of detritus discharged annually by that river is 6,368,677,400. (See Lyell's Principles.)

$\frac{6,368,677,400}{11,151,360,000,000} = \frac{1}{1751}$; consequently the reduction of the mean level of the Ganges district is $\frac{1}{1751}$ of a foot annually, or 1 foot in 1751 years.

6,368,677,400 cubic feet of mud discharged × 856 water to mud = 5,444,074,288,640 = the number of cubic feet of water annually discharged by the Ganges.

$\frac{5,444,074,288,640}{11,151,360,000,000}$ = about ½ a foot, so that the mean annual discharge of water is equal to about 6 inches of rain on the whole area of 400,000 square miles.

The Mississippi, on the other hand, would occupy 9000 years at its present annual rate in reducing to the amount of one foot the mean surface-level of the district it drains, which is computed at eleven hundred thousand square miles. The result is obtained as follows:

If 3,702,758,400 cubic feet of mud are annually carried down by the Mississippi (since the mud is to the water as 1 to 3000), 3,702,758,400 × 3000 = 11,108,275,200,000 = the number of cubic feet of water annually carried by the river into the Gulf of Mexico. The area of district drained by this river is stated at 1,100,000 square miles = 5280 × 5280 = 27,878,400 = the number of superficial feet in a mile—27,878,400 × 1,100,000 = 30,666,240,000,000 = the number of superficial feet contained in the area of 1,100,000 square miles drained solely by the Mississippi.

$\frac{11,108,275,200,000}{30,666,240,000,000}$ foot = ⅓ foot nearly. Consequently the water carried down by the river is equal to about 4 inches of rain over the surface of land drained.

If it be assumed that the levels of the rivers, lakes and springs are the same in this district at the same period of two consecutive years, the water sufficient to produce the above-mentioned 4 inches of the total of rain-fall upon the whole of this district must have been annually derived from clouds which have been charged with vapor in parts of the earth beyond the confines of the tract of country under consideration; since if the 4 inches of rain annually carried into the Gulf of Mexico were not replaced from foreign sources, the levels of the rivers, lakes, and springs must rapidly fall.

The estimate of denudation obtained from these countries may be incorrect when applied to other lands differing in altitude and receipt of rain. Besides, many rivers empty themselves into lakes and inland seas, and other extensive tracts are entirely without rain. Since there must be extensive districts which contribute no detritus whatever to rivers, I propose to *assume* that one half the earth's surface only is drained by rivers flowing directly into the sea,* and that the average supply of detritus does not exceed that afforded by the district through which the Mississippi flows (a country where there are no very high mountains, and only a moderate quantity of rain).

The quantity of soluble salts annually carried into the ocean must amount to a very large volume, particularly as river-water always contains matter in solution, while it is only during two or three months of the year that alluvium in suspension is carried down in large quantities. The proportion of soluble salts in the water of the Thames is 17 to 70,000, or 1 to 4117; while the proportion of alluvium suspended in the water of the Mississippi is as 1 to 3000.†

The level of the land is as much reduced by what is carried away in solution, as if this were mud and sand removed in suspension; and a submarine deposit formed from materials brought into the sea in solution will displace a volume of water equal to their former bulk; and therefore, when the annual supply of soluble salts to the ocean does not exceed the quantity separated from solution, the same effect will be produced upon the sea-level by matter introduced, whether it be in solution or suspension. While the proportion of the land to the ocean remains as 1 to 3,‡ it is evident that a reduction of 3 feet in the mean surface-level of the land must take place by denudation before a volume of detritus would be conveyed into the sea sufficient to displace enough water to occasion an elevation of one foot on the ocean-level.

There is great need of further information respecting the amount of sediment carried down by other rivers besides those mentioned; yet if the rate of denudation obtained from the statistics of the Ganges and Mississippi be any guide to what is occurring on the remainder of the globe, we cannot suppose that an indefinite time would be required for the performance of a denudation, which should reduce the mean surface-level of the land 3 feet and raise that of the ocean 1 foot. It was during the contemplation of the changes of level that might have been produced by the operations of ordinary physical agents upon the surface of the earth, that Hutton was led to remark that it was not necessary to suppose the area of the land always maintained the same extent, but that from time to time new land would be formed by the elevatory movements of the sea-bottom to compensate for what had been carried into

* By reference to Johnston's Physical Atlas, the calculated proportion of land drained by rivers running into European lakes and inland seas may be seen.

† For the statistics of the Mississippi River, see Sir Charles Lyell's Second Visit to the United States, edit. 1847, vol. ii, p. 249 to 253 and other places.

‡ M. Balbi shows (Atlas, Soc. Diff. Useful Knowledge, 1844) that the land on the globe equals 37,647,000 square geographical miles, the sea equals 110,875,000 square geographical miles.

the ocean by the continued operations of rivers and breakers * In speaking of the elevation of the sea-level, I only refer to the intervals between those movements of the land which might neutralize in an instant all that had been effected by the operation of rivers for immense periods of time.

It would add very much to the interest of this inquiry if any proof could be brought forward of a recent gradual upward movement of the sea-level. This would, however, be difficult to observe,† on account of the rise in the water concealing the evidence of its former level, except just at the mouths of rivers, where the deposits of fluviatile alluvium might raise the land from time to time and keep it always above the rising waters.

The deposits situated at a few such localities have been described by the best observers, and I hope to show that in several cases there are appearances which might be partly explained by changes of the sea-level, but that a much greater number of cases and more certain evidence would be needed before such an event could be satisfactorily proved. I propose to make some remarks upon this point, after having submitted the evidence which has induced me to believe that the supply of detritus under present physical conditions is sufficient to raise the ocean level 3 or 4 inches in 10,000 years, provided no subsidence or elevation disturbed the result.

To this subject I now proceed. Sir Charles Lyell's published statements of the quantity of mud annually carried down by the Mississippi and Ganges appear to have been made with so much care, that they may be a better guide to the general rate of removal of soil by rivers than information obtained from a greater number of smaller rivers, which of course are more likely to be influenced by local circumstances. Eleven hundred thousand square miles of land are drained by the Mississippi,‡ which annually discharges a quantity of water equal in volume to 4 inches of rain or about one tenth of the total rain-fall over this entire surface, which forms one-fifth part of North America.§ From the mean of a great number of observations, the average quantity of alluvium suspended in the water appears to be 1 part in 3000. Consequently, as the water annually drawn off would cover an area of eleven hundred thousand square miles to the depth of four inches, the quantity of mud removed in the water, as measured at or near the mouth of the river) would cover the same extensive surface to the depth of 1-3000th part of four inches, or to the depth of 1-9000th part of a foot. Or, in other words, the Mississippi at its present rate would occupy 9000 years in carrying away detritus before the mean surface level of one-fifth part of North America would be reduced one foot.

The Ganges discharges into the Indian Ocean a supply of water equal to about six inches of rain on 400,000 square miles, or a much greater volume of water than the Mississippi pours into the Gulf of Mexico, taking into consideration the difference in size of the countries they drain.

The alluvium suspended in the waters of the Ganges is as 1 to 858 by weight; consequently the detrital matter removed in suspension by the water in one year would cover the land from which it is derived to the depth of 1-1751 of a foot; that is to say, the Ganges might pour out muddy water at its present rate for 1751 years before the mean level of 400,000 square miles would be reduced one foot in height. The great elevation of the Himalaya range, or possibly a greater rain-fall, may probably occasion the difference between the rates of denudation indicated by the Ganges and the Mississippi. As there are also parts of the earth's surface drained by rivers flowing into lakes and inland seas, and other tracts are entirely without rain, I propose to estimate (as before mentioned) that only half the land contributes detritus in suspension to rivers flowing directly into the sea.|| If this area be annually reduced in level at the same rate as the district through which the Mississippi flows, then the mean level of the land on the globe, would be reduced 3 feet in 54,000 years, and consequently the level of the ocean raised 1 foot in the same period by means of the detritus suspended in river-water poured into the ocean.¶

But in addition to the sediment carried down by means of rivers, we have also to take into consideration the amount of debris washed into the sea from cliffs during so long a period as that mentioned. It is difficult, however, to form any estimate of what this would annually amount to, for old maps and charts are hardly accurate enough to represent the waste of cliffs by breaker-action even within the last 100 years. Capt. Washington has, however, published a report** which gives an account of the encroachment of the sea at intervals on one part of the Suffolk coast. This will give a general idea of the contribution of detritus that may be obtained from some points of a coast-line. The following statements are collected from Capt. Washington's Report on Harwich Harbor in 1844.

The cliff on the western side of the harbor is about 1 mile long and 40 feet high, and the encroachment of the sea appears to have been at the rate of 1 foot per annum between the years 1709 and 1756, so that the annual supply of detritus was equal to 40 cubic feet for each foot of frontage. Between 1756 and 1804 the advance increased to nearly 2 feet per annum; so that the annual removal of cliff amounted to nearly 80 cubic feet for each foot of frontage.

Between 1804 and 1844 the encroachment of the sea averaged 10 feet per annum, and the annual removal of detritus must have amounted to 400 cubic feet for each foot of frontage. It was during this latter period that extensive dredging for cement stone took place at the base of the cliff.

On the eastern side of the harbor events of an opposite character have occurred, for Landguard Point has gained 50 feet per annum in length during the last 30 years. The addition thus made to the land, and to the "littoral zone," presents an interesting example of the rapid accumulation of a local deposit under favourable circumstances. From the appearance

* "It is not necessary that the present land should be worn away and wasted exactly in proportion as new land shall appear; or conversely, that an equal production of new land should be produced as the old is made to disappear." (Hutton's Theory of the Earth, 1795, vol. i, p. 196.)

† See Darwin, Coral Reefs, &c. edit. 1851, p. 95.

‡ See art. Mississippi, Penny Cyclopædia, vol. xxv, p. 277.

§ The total rain-fall of the United States is 39 inches between 24½° and 45° N. lat. (Berghaus and Johnston.)

|| The proportion of land without rain is about 1-1200th of the whole. Keith and Johnston say that nearly one-half the drainage-water of Europe and Asia falls into the Black and Caspian Seas. The proportion for Africa and America is not known.

¶ It is not improbable that the *solvent* powers of rain and river-water are as important agents in the removal of land as the agency above mentioned. Definite calculations on this subject remain to be made.

** Tidal Harbors' Commission, First Report of 1845.

of the beach, it would appear that the shingle and sand of which it is formed have been brought from the north, in which direction there are recorded instances of great destruction of land by storms during the last 300 years. The aspect, however, of much of the coast-line appears as if it had remained unaltered for a very long period, except in the manner Mr. R. A. C. Austen* alludes to when he remarks "that although the sea for months together, and in places even for whole years, may not acquire any fresh spoil, yet there are few hours when its waters are unemployed in fashioning and abraiding the materials already acquired." In considering the effect upon the sea-level caused by sand, mud, and pebbles washed in by the breakers, it is only necessary to regard those materials that may be brought in from cliffs above high-water mark; for the movement of sand and mud below high-water mark can produce no effect upon the sea-level, because the abstraction of these materials from one part of the shore is exactly balanced by their addition to some other part. For instance, some of the flint-pebbles which have contributed to the recent deposit at Landguard Point have been brought along shore a great distance from their original position on the cliff. These flints formed an addition to the sea-bed, and tended to raise its general level by displacing an amount of water equal to their bulk the moment they fell on the shore below high-water mark; and it is quite clear their subsequent movements, either beneath the wave or on the beach, could produce no further effect upon the sea-level, the spaces they occupied on one part of the coast being balanced by the vacancy left at some other. It is also evident that the beach at Landguard Point will go on extending so long as the fresh supplies of shingle and sand from the north exceed the removals southward.

In the same manner the continued supplies of pebbles from the westward enables the Chesil Bank to preserve its position. As soon, however, as any disturbing causes interrupt the supplies of new material, the sand and shingle beaches dependent upon them must soon disappear; and in fact the termination of every beach will be at that point where the waste and abrasion by breaker-action are balanced by the supply of pebbles and sand drifted from other places. Although it appears clear that only the detritus obtained from cliffs above high-water mark need be taken into calculation, yet I regret to find that scarcely any data of this kind exist, and therefore it is not possible to ascertain the probable effect upon the sea-level that is being produced by the detritus so derived. In the same manner the per-centage of soluble salts in the water of the few large rivers of which notes have been published has not been given separately from the per-centage of matter in suspension, and therefore we are in ignorance of the supplies that are annually introduced into the ocean from the formation of submarine deposits from materials dissolved in the sea-water. When the rise in the sea-level from the effect of alluvium brought in suspension by rivers was being considered, I supposed that that cause alone might produce an elevation of one foot in 54,000 years; but in order to make some allowance for the similar effects that must be produced by the introduction into the ocean of materials from above high-water mark on coast lines† by breaker-action, and also by the formation of submarine deposits from materials which were brought into the ocean in solution, I now propose to consider that all these causes together might produce an elevation of the sea-level equal to one foot in 40,000 years, or three inches in 10,000 years.

Mr. Darwin has remarked, that "the knowledge of any result, which, with sufficient time allowed, can be produced by causes, though appearing infinitely improbable, is valuable to the geologist, for he by his creed deals with centuries and thousands of years as others do with minutes." For these reasons even if, upon further investigation, it should be found that the true rise in the sea-level is much less than three inches in 10,000 years (in periods undisturbed by subsidences and elevation,) yet it may still be an important element in accounting for those changes which we are now about to consider.

* Austen, Quart. Jour. Geol. Soc. vol. vi. 71-73. and De la Beche, Geol. Observer, 1851, p. 65.

† The rough estimation of the extent of coast-line, kindly supplied by Mr. A. K. Johnston, (Nov. 1852,) is as follows:—

	Nautical miles (60 to a degree.)	English statute miles (69½ to a degree.)
Europe, - -	17,200	20,425
Asia, - - -	30,800	34,825
Africa, - -	14,000	16,625
America, - -	37,600	44,656
	99,600	116,531

(*To be continued.*)

New York Industrial Exhibition.

SPECIAL REPORT OF MR. DILKE, PRESENTED TO THE HOUSE OF COMMONS BY COMMAND OF HER MAJESTY, IN PURSUANCE OF THEIR ADDRESS OF FEBRUARY 6, 1854.

Mr. Dilke's sudden recall to England while collecting information connected with the New York Industrial Exhibition, prevented him from giving more than a passing attention to the details of the subject. To Mr. Antrobus Holwell, the Commissioner from Canada, the public are indebted for the Reports on the Classes which comprehended Naval Architecture, Military Engineering, Ordnance, Armour and Accoutrements, Philosophical Instruments and products resulting from their use. (e. g. Daguerreotypes, &c.,) Maps and Charts, Horology, Surgical Instruments and Appliances. Indeed we may justly say that Mr. Dilke's report is not a report of the Exhibition, it is merely a collection of official details and notices of facts, without any special bearing upon the subject he was sent to investigate. The supply of water to towns,—Limited Partnerships—Industrial Educational Establishments—the Smithsonian Institution—and Fire Establishments—are briefly alluded to, and some interesting, although to a Canadian scarcely novel, descriptions are given and facts recorded. The readers of the *Canadian Journal* are already familiar with the description of the building in which the American Exhibition was held (see *Canadian Journal*, Vol. I., page 69). The same description together with a similar plate of the building is given in Mr. Dilke's Report. The objects exhibited were divided into thirty-one classes; Mr. Dilke furnishes a report on two of these classes only—class 8, and 10. The report on these classes was written by the Canadian Commissioner, and it bears the title of—"Notes on some of the Contributions to the Exhibition of the Industry of all nations at New York, in 1853 by W. Antrobus Holwell, Ordnance Store Keeper, Quebec, and Commissioner from Canada"—we proceed to extract a few interesting items.

Breech-loading and Self-cleaning Rifles; Shot-Guns, and Pistols.

Marston Fire Arms Manufacturing Company, New York.—That this is a favourite description of rifle with the Americans may be inferred from the fact, that the number of men employed in January 1853 in the manufacture of these and other similar arms and cartridges of Mr. Marston's invention was but ninety, and has been increased to upwards of a hundred and forty; the average sale being at the present date (December 1853) about forty a week. The breech-loading part of the invention consists in a sliding breech pin, which is drawn back in a line with the bore by means of a lever, the handle of which is below the butt; thus exposing a longitudinal opening in the right side of the piece immediately behind the breech end of the barrel: into this opening the cartridge is placed, when by drawing back the handle of the lever the breech pin is thrust forward, pushing before it the cartridge, which is thus lodged within the barrel; the interior and shorter end of the lever is of solid metal, and is so placed with respect to the breech pin as that when the latter is pushed wholly forward it forms with the solid end of the lever a substantial joint, the longitudinal axes of the two pieces lying at an angle of about 135° to each other. Great strength in resisting the force of the discharge is claimed for this arrangement, in consequence of the combination of these two pieces of metal being *somewhat* similar to the "key-stone of an arch;" it must, however, be rememembered that the whole force of the recoil is borne by the pivot on which the lever (representing the "key-stone") *turns*, there being little or no provision (in the arms examined) for relieving this pivot from the whole of this strain (though it is conceived that an arrangement for that purpose might easily be effected by strengthening the lower part of the recess in which the lever moves and causing the lever to bear against it). A small hole is bored through the sliding pin in such direction as to effect the necessary communication between the vent and the cartridge when the breech pin is pushed forward; the cartridge consists of a paper cylindrical shell cemented or tied to a small cylindrical projection at the base of the bullet, which is conical; the shell being filled with powder is closed by a disc of leather cut to fit *tightly* the bore of the piece, and greased round its edge. A small hole is bored in the centre of this disc to admit of the necessary communication between the priming and the powder in the cartridge. At each discharge the last disc of leather *remains in the barrel* and is forced forward by the introduction of the next cartridge, and subsequently blown out by its discharge: it thus *cleans out* the barrel, which *it is said* will in consequence be left "perfectly *bright* after a *thousand* discharges." Their price varies from $25 to $100.

New Revolving Guns and Pistols.

P. W. Porter, Inventor, Memphis, Tennessee.—A solid steel cylinder or disc (2½ inches in diameter, and about ¾ths of an inch thick) has its periphery bored with eight or nine cylindrical chambers radiating towards the centre; each chamber being of just sufficient depth to receive a small cartridge with its ball. As this cylinder is made to revolve in a recess immediately behind the breech, each chamber in the cylindrical disc corresponds with the bore of the barrel, and each chamber has a perforation or channel leading from its inner or rear end to the exterior (right) face of the revolving disc, where it is covered by the cap or primer *only* when the chamber with which it communicates is in a line with and opens into the bore of the barrel; the lock moves backward on a hinge which allows it to close upon the side of the cylinder when in use, or to be opened out whenever it might be necessary to charge or exchange the cylinder; the hammer is in the *interior* of the lock which is of simple yet effective construction; the cylinder is turned round (so as to bring each chamber successively in position) by the motion of a lever (which forms also the trigger guard) downwards and forwards with the left hand; the hammer is cocked by the same movement, so that in firing all that is necessary is for the left hand to move the lever, and the right to pull the trigger. A very rapid succession of discharges may be thus obtained (as many, it is *said*, as forty in a minute, including the exchange of cylinders), an advantage which this rifle probably possesses in a higher degree than any other known contrivance.

Sharp's Patent Primer attached to a Shot-Gun.

C. Sharp, inventor, and manufacturer, Hartford, Connecticut.—This is an ingenious invention, and promises to become a favourite, although from its recent origin it has not yet had the advantage of extensive trial. The percussion primers consist of very small discs or "pellets" of copper (probably not more than three-sixteenths of an inch in diameter), fifty of which are contained in a small receptacle in front of the lock and beneath the head of the hammer. These "pellets" are said to be "*air and waterproof.*" The piece being cocked, the trigger is pulled, and although no indication whatever of any cap or other priming is visible, an explosion is heard each time the hammer descends; but by slowly letting down the hammer, one of these minute discs containing the priming is seen to emerge from a scarcely perceptible hole in the lock, immediately beneath the head of the hammer, being thrust out with a sort of jerk by means of a slender bolt or sliding piece, which exactly fits the slit, and which having ejected the disc immediately returns to be ready to force out another at the moment of the hammer's descent. The little disc is thus deposited, *as if by magic*, immediately over the nipple, where it is *immediately* struck by the hammer, the end of which has a slightly conical cavity for its reception, and so unerring and certain is this jerking of the disc into its proper position, that whether the piece be held with the hammer uppermost, as in the ordinary way of firing, or reversed, or with the muzzle pointing upwards or downwards, or in short, in any conceivable position, the effect is always equally satisfactory.

Mr. Sharp also exhibits his *Breech-loading Rifle* (patented in 1850). By some accident or oversight it is not mentioned in the catalogue, This rifle may probably with safety be pronounced as, all things considered, the best breech-loading *single charge* fire-arm yet invented; and in proof that it is generally so esteemed, it may be mentioned that, since it was patented in 1850, upwards of 40,000 have been manufactured and sold; and further, that the United States Government, have, upon the recommendation of a Board of Ordnance Officers, held in November, 1850, ordered a trial of them to be made by the army on active service. The Board in question, after a severe trial of this rifle, report that "it was fired several hundred times without cleaning, during which the movements of its machinery were not obstructed:" and also that "the penetration, range, and accuracy of its fire with the cartridges and conical ball prepared for it, were superior to those of any other breech-loading piece offered to the Board.

Its construction is simple. A solid breech-piece of about three-quarters of an inch in thickness, is inserted in a recess immediately behind the chamber of the barrel, so as that the faces of such breech piece shall slide against and completely close the same. This piece is drawn downwards by moving forward a jointed lever, which forms also the trigger guard; the bore of the barrel is thereby completely exposed, and may be *looked through*, thus affording great facility for observing whether it is clean or foul. The cartridge with its ball attached is then inserted by hand into the bore, and pressed home with the thumb. The lever, or trigger guard, is then brought back, which raises the breech piece, the front upper edge of which being *sharp*, cuts off the end of the cartridge so as to completely expose the powder within it to the action of the priming, which may either be the common percussion cap, "Maynard's" primer, or Mr. Sharp's own ingenious "pellet," above mentioned. The cartridge prepared expressly for this gun is provided with a conical bullet, but any description of cartridge may be used, or even loose powder, by first forcing forward the ball to the proper depth by means of a suitable rammer, and then carefully pouring over it the requisite charge of powder, any excess of which will be removed by the return of the breech piece. For safety and precision of firing and for simplicity of construction, this appears undoubtedly superior to all other breech loading single charge guns.

The prices of Mr. Sharp's Rifles are as follow:

Carbine, Plain Octagon	$35
Do. with Globe Sight	[illegible]
Do. Ornamented from	$60 to 100

J. H. Fitzgibbon, of St. Louis, Missouri, exhibits a large miscellaneous collection of Daguerreotypes. Many of the pictures are well executed. He also exhibits four *Electrotype Copper Copies* of *Daguerreotypes*, together with the originals from which they were taken. The appearance of the copper duplicates is decidedly superior, in tone and general effect, to that of the original pictures; they have also the advantage of not being reversed: it is much to be regretted that this simple and very successful process is not more generally adopted by Daguerreotypists. These are the only specimens in the Exhibition.

Miscellaneous Philosophical Processes or Products.

Specimens of Electrotype Copperplates, produced at the United States Coast Survey Office.—These plates are three in number, and consist of,—1st. The original engraved plate; 2nd. A reverse or Matrix obtained therefrom by electro deposit; and 3rd. A "Duplicate" or fac-simile of the first or original plate, this last being also obtained by electro deposit upon the reverse or matrix No. 2; a printed proof or impression on paper from this latter completes the collection, and affords satisfactory evidence of the perfect manner of conducting the whole operation, all the most minute points and delicate lines being brought out beautifully sharp and distinct. As the several processes adopted in the production of these plates appear to be all of the most improved description founded on sound philosophical principles, whilst some of them are claimed as the invention of Mr. Mathiot, of the Coast Survey Electrotype Laboratory, under whose able direction the whole work is conducted, a brief description of those processes may not be unacceptable.*

The original plate as received from the engraver, is immediately electro-silvered, and then washed with an alcoholic solution of iodine and exposed to sunshine or bright light. This is found effectually to prevent the adhesion of the electro deposit to the original plate (probably by the interposition of an infinitesimal film of the *vapor* of iodine), without in the slightest degree impairing the sharpness of the impression, the thickness of the coating of iodine vapour being estimated by Mr. Mathiot at *one forty-four millionth* part of an inch: or, upon the supposition that the iodine remains upon the plate in its elementary state then the thickness of the deposit is estimated at the "*one eighteen thousand millionth* part of an inch!"

The plate thus idoized is placed in the vat or decomposition trough in a *vertical* position (the necessary connections with the battery and other arrangements being effected, as usual), and as soon as a sufficient surface layer is produced which usually takes about twelve hours), the plate with its surface layer is removed to another vat, in which it is placed horizontally with its face upwards, and the positive pole or plate of copper immediately over it, at a distance of about an inch, —the temperature of the copper solution in this horizontal bath being maintained uniformly day and night at about 180°. This is effected by means of a simple furnace with self-regulating damper and an internal coil or helix of pipe, with an upper and a lower tube leading to the corresponding parts of the vat or bath, in which the required temperature is thus maintained by the circulation of the fluid in the ordinary manner; it being found that a peck of charcoal will maintain 100 gallons of the copper solution at any required point between 100° and 200° for twelve hours; the result of such increase of temperature being that a plate of copper one-eighth of an inch thick, and containing 10 square feet of surface, can be produced in forty-eight hours, or at the rate of 3 lbs. to the square foot in twenty-four hours. The quality of the metal produced under such increased temperature being moreover found to be of a very superior description, rivalling in hardness ductility, and elasticity the best rolled or hammered copperplate. This is satisfactorily exemplified in a couple of broad strips of copper, one-eighth of an inch thick, which are exhibited near these plates. One of the strips is flat, and found to be exceedingly hard and sonorous; the other is twisted up into a sort of open single knot, to prove the perfect ductility and tenacity of the metal. It may also be mentioned that about 2,000 impressions were printed from the first electrotype duplicate taken from the original plate in the Exhibition without its showing any appearance of deterioration, although the lines are many of them exceedingly light and delicate,—so much so, that it is said by competent judges that the original *engraved* plate would probably have failed in producing *one* thousand equally good impressions.

Mr. Mathiot manufactures or produces the negative silver plates of his batteries by electro deposition, and in order to remove from their platinized surfaces the impurities of the zinc plates, which are invariably found to attach themselves thereto, he immerses them *daily* in a solution of per-chloride of iron, which is found to immediately restore the action of the plate, and thus constantly maintain the "*tone*" of the battery.

Mr. Dilke's account of the Smithsonian Institution contains much interesting information which will be read with pleasure by all, although it may not possess the charm of novelty to many of our readers, who are familiar with the progress of this valuable Institution, through its published records and the frequent references made to it in American Scientific and Literary Periodicals. We subjoin a few extracts.

The Smithsonian Institution.

This magnificent establishment, founded at Washington out of funds bequeathed for that purpose by an English gentleman, is exercising so much influence throughout the United States, and I may also say throughout the world, that I feel bound to give some account of it, and also of its course of action. Mr. Hugh Smithson, one of the family of the present Duke of Northumberland, died at Genoa, on the 27th of June, 1829, leaving a fortune of about £120,000. By his will he desired that the income arising therefrom should be paid to his nephew, H. G. Hungerford, during his life, and that the property itself should descend to his children, if he had any, absolutely; but the will went on to say—

"In case of the death of my said nephew without leaving a child, or children, or of the death of the child or children he may have had, under the age of 21 years, or intestate, I then bequeath the whole of my property (subject to an annuity of 100 pounds to John Fitall, and for the security and payment of which, I mean stock to remain in this country) to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

The circumstances of this bequest are somewhat remarkable. Nothing is known of the reasons which induced the testator to select a city in the United States for the site of the proposed Institution. He had never been, it is believed, in America, and is supposed to have had no predilection for republican forms of Government; nor does it appear, from anything found among his book and papers, or from the recollections of his associates, that he had ever taken a special interest in the people of the United States. In June, 1835, Mr. Hungerford died without issue, and in July, 1836, a bill was passed by Congress to empower the President of the United States to appoint a special Agent who should act in England, and receive the amount thus become due to the United States' Government.

In September 1838 the money, $515,169, was paid over by the English Court of Chancery to the Hon. Richard Rush, the agent appointed by the Government of the United States; and eight years after, on the 10th of August, 1846, an Act was passed for the purpose of establishing the Smithsonian Institution.

"This Act creates an establishment to be called the Smithsonian Institution, composed of the President and Vice-President of the United States, the Secretaries of State, of the Treasury of War, and the Navy, the Postmaster-General, Attorney-General, and Mayor of Washington, with such others as they may elect Honorary Members. It devolves the immediate government of the Institution upon a Board of Regents, of fifteen members; namely, the Vice-President of the United States, the Chief Justice of the Supreme Court, and the Mayor of the city of Washington, *ex officio*, three members of the Senate to be appointed by the President thereof, three members of the House to be appointed by the Speaker, and six persons to be chosen from the citizens at large, by joint resolution of the Senate and House, two of whom shall be members of the National Institute, and the other four inhabitants of States, and no two from the same state.

"The Act also establishes a permanent loan of the original fund ($515,169) to the United States at six per cent. interest; appropriated the accumulated interest, then amounting to $242,129, or so much as might be needed, together with so much of the accruing income as might be unexpended in any year, for the erection of a building; provided for the establishment of a Library, Museum, Chemical Laboratory, &c., and left most of the details of the organization to the Board of Regents."

The very general terms of the bequest gave rise to difficulties as to the best mode of carrying the wishes of the testator into effect; but the Board of Regents having in the outset been fortunate enough to secure the services of Joseph Henry, L.L.D., of Princeton College as Secretary and Chief Executive Officer of the Institution, they empowered him to draw up a programme of organization, which was adopted by the Regents in 1847, and as the principal points in this programme are given in Professor Henry's Report to the Board, dated 1st of January, 1851, I have thought it better to quote a few passages.

"Smithson left his property, in case of the death of his nephew, to whom it was first bequeathed, 'to found at Washington under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men.' These are the only words of the testator to serve as a guide to the adoption of a plan for the execution of his benevolent design. They are found, however, when attentively considered, to admit of legitimate deductions sufficiently definite and comprehensive.

"1. The bequest is made to the United States, in trust for the good of *mankind*.

---

* See *Canadian Journal*, Vol. I., p 226, for a full report of this process.

"2. The objects of the Institution are two-fold: first, to increase, second, to diffuse knowledge; objects which, though often confounded with each other, are logically distinct, and ought to be separately regarded. The first is the enlargement of the existing stock of knowledge by the discovery of new truths, and the second is the dissemination of these and other truths among men.

"3. No particular kind of knowledge is designated, hence a liberal interpretation of the bequest will exclude no part of the great domain of science and literature from the degree of attention its importance may demand.

"4. Since mankind are to be benefited by the bequest, any unnecessary expenditure on merely local objects would not be in accordance with the proper administration of the trust.

"5. Though the funds are generally considered large, and much is expected of them, they are really small in proportion to the demands made upon them. The annual income of the bequest is less than half the cost of the publication of a single yearly report of the Patent Office.

"6. In order, therefore, that the limited income may effect the greatest amount of good, it should be expended in doing that which cannot be done as well by other means.

This sum of 150,000 dollars having been subsequently added to the original 515,169 dollars, the Smithsonian Institution has now a permanent fund of 665,169 dollars, which, at the rate of interest allowed by the Government, yields an annual income of about £8,000.

The rules now adopted in reference to the distribution of the Publications issued by the Institution, are very liberal.

"1. They are to be presented to all learned Societies which publish transactions and give copies of these in exchange to the Institution.

"2. Also, to all Foreign Libraries of the first class, provided they give in exchange their catalogues, or other publications, or an equivalent from their duplicate volumes.

"3. To all Colleges in actual operation in this country; provided they furnish in return, meteorological observations, catalogues of their Libraries and of their students, and all other publications issued by them, relative to their organization and history.

"4. To all States and Territories; provided they give in return copies of all documents published under their authority.

"5. To all incorporated Public Libraries in this country, not included in either of the foregoing classes, now containing more than seven thousand volumes, and to smaller Libraries, where a whole State or large district would be otherwise left unsupplied.

"The author of each memoir receives, as his only compensation, a certain number of copies of it, to distribute among his friends, or to present to individuals who may be occupied in the same line of research. In this way single memoirs are distributed to individuals, and especially to those who are most actively engaged in promoting discoveries. Copies of the reports, and also in some cases, of particular memoirs, are sent to all meteorological observers. Besides these, we have placed on the list the more prominent Academies and Lyceums, as recipients of the minor publications. It is also intended, in order to benefit the public more generally, to place on sale copies of memoirs and reports, though on account of the number required for the supply of Institutions, we have not as yet been able to carry this plan into effect.

"No copyright has been taken for the Smithsonian publications; they are therefore free to be used by the compilers of books, and in this way they are beginning to reach the general reader and to produce a beneficial effect on the public mind."

It is mentioned in Professor Henry's Report for 1852, that the number of copies of the "Smithsonian Contributions" distributed is greater than that of the transactions of any other Scientific or Literary Society.

The Regents of the Institution being of opinion that the rapid interchange of literary and scientific publications is of the utmost importance for the developement of knowledge, have constituted themselves the medium for such intercommunications between all Public Scientific and Literary Societies of the Old and New World. For this purpose all important scientific documents issued by the Governments, by the Public Learned and Scientific bodies in the United States, are collected at Washington, and then dispatched to their agents in London, Paris, and Leipsic for distribution; and the agents at the above named places forward to the United States all documents received in exchange; the Smithsonian Institution taking upon itself all cost of transport, so that no delay may be experienced in the receipt of the communications in America. The extent to which this system has been carried, is, I suspect, little known in this country, but may be inferred from the following abstract of the number of Societies in communication with the Institution, and for which parcels are collected.

3	Public Bodies in	Africa	9	Public Bodies in	America (South)
10	" "	Asia	7	" "	Belgium
4	" "	Denmark	84	" "	Great Britain & Ireland
54	" "	France	69	" "	Germany
1	" "	Greece	10	" "	Holland
1	" "	Iceland	25	" "	Italy
4	" "	Norway	1	" "	Portugal
12	" "	Russia	5	" "	Sweden
4	" "	Spain	9	" "	Switzerland
1	" "	Turkey			

We conclude our Extracts from Mr. Dilke's Report with an account of a Steam Fire Engine lately built at Cincinnati:

Cincinnati Steam Fire-Engine.

This engine, which cost rather more than two thousand pounds, and weighs between five and six tons, throws eighty-four thousand gallons in an hour. Five horses are required, four to draw the engine, and one the fuel and reel cart. Mr. Dilke and Professor Wilson went to see the engine. Mr. Dilke says—"On reaching the station we satisfied ourselves that there was no fire in the engine, and that the water in the boiler was cold. On the order being given to proceed to a particular point, the light was applied to the grate, always kept ready filled with very combustible materials, the horses were harnessed, and the engine left the house in 3½ minutes after the supposed fire was announced. It reached the spot indicated, 1,450 feet distant from the engine-house, in 2¾ minutes, and in 6½ minutes from the first announcement the horses were uncoupled and the engine placed over the supply cistern. In 8½ minutes the steam-guage was at 35°, and the pumps self-feeding. In 9 minutes a hose was affixed, and the reel despatched in 9½ minutes to about 100 feet distant from the engine, during which time a second hose was being fixed and laid out. In 12 minutes water was issuing from one hose, and in 12¼ minutes from both. In 13 minutes the jet of water reached 100 feet from the nozzle first applied, one of an inch diameter, and from that time a large body of water was pouring forth. In 17 minutes the supply was strong enough to rise about 60 feet in height. In 28 minutes it was playing over a moderate-sized house. In 33 minutes all six nozzles were in use. In 38 minutes the issue of water was stopped, that the capability of supplying steam jets might be shown. In 39½ minutes a very powerful blast of steam was issuing. We were informed that the engine had on two or three occasions played six hours continuously, and once 12 hours, and we were given to understand that it had thrown water 230 feet—a statement we could believe from the power exhibited, and which was shown by directing the stream against a heavy cart standing empty in the street, and which was driven by it nearly 100 feet."

Statistics of Fibrous Materials.

The quantity of fibrous substances of all kinds imported into the United Kingdom last year was 614,000 tons; and deducting 72,000 tons exported, there remained for home consumption 542,000 tons. Of this quantity 94,000 tons were flax, and 63,000 tons hemp; and of these two articles 64,000 tons of flax and 42,000 tons of hemp, together 106,000 tons, came from Russia. The amount of paper manufactured in the five years from 1830 to 1834, both inclusive, was 354,940,658lbs., or an average of 70,988,131lbs.; and in the five years from 1849 to 1853 the manufacture increased to 756,170,193lbs., being an average of 151,234,178lbs. per annum. Last year the amount manufactured, in round numbers, was 177,000,000lbs., against 154,000,000lbs. in the previous year, showing an increase of above 23,000,000lbs. in one year.

The total quantity of flax imported in the whole term of fifty-three years, was 2,252,422 tons; of which Russia furnished 1,587,395 tons, and the rest of the world (all foreign) 665,027 tons. Of hemp, the total importation was 1,829,291 tons; of which Russia furnished 1,505,189 tons; and the rest of the world, including India, 324,102 tons.

We have received from Russia, in the last 53 years, the following quantities and value of flax and hemp; the valuation being made, for the whole term of years, at the moderate rate of £40 per ton for flax, and £35 per ton for hemp;—

Of flax	1,587,395	tons	worth	£63,495,800
Of hemp	1,505,189	,,	,,	52,681,615
Together	3,092,584	,,	,,	£116,177,415

The importation of rags of every description, in the last 53 years was 346,554 tons, or an average for the whole term of 6,539 tons per annum. We exported in the same period, 12,296 tons, of which 10,-146 tons were British and Irish rags; and only 2,150 tons foreign rags re-exported; and of the quantities so exported, 4,206 tons, or about 35 per cent. of the whole quantity in 53 years, was exported in the last two years, almost wholly to the United States.—J. B. Sharp, *Jour. Soc. Arts.*

Collossal Monument to Shakspere.

It is a subject of frequent remark by foreigners that there is in this country no monument to Shakspere. Signor Chardigni has conceived the idea of erecting a gigantic statue of the great dramatist. Russia, he says, boasts her colossal statue of Peter the Great; Italy of Charles Borromeo; Bavaria its gigantic statue, the head of which forms a conspicuous ornament at the Crystal Palace. Why should not England have her great statue, Signor Chardigni proposes that the statue should be a hundred feet high, of cast-iron, formed by a new process which he has invented.

In the statue it is proposed to have three floors, with a staircase for ascending to the top or head of the monument. These three floors will divide the statue into three rooms, of about 80 feet in circumference and 15 feet each in height, the sides of which the artist proposes should be adorned with bassi-relievi, in cast-iron, representing all the chief scenes of Shakspere's plays. In the middle of the first floor are to be statues, in cast-iron, of the Queen and Prince Albert.

The third floor of the statue reaching to the head, will afford a most splendid panoramic view of London, through the apertures for the eyes, which,following the proportions of the rest of the statue, will be more than two feet wide. In addition to the light which will come from the apertures of the eyes, a large quantity of light will be admitted by the top of the head, which is for this purpose intended to be made of glass. In addition to this, the folds of the drapery of the statue will admit a variety of openings, not visible from below, through which light and air may be introduced. It is also proposed it should contain a library of the best editions of Shakspere's works.

Busts, in cast-iron, of contemporaries of Shakspere, and of those whose names have been worthily associated with his, would be fitting ornaments of the interior.

The statue would stand on a pedestal of stone, in which should be the entrance, through doors of cast-iron, whose panels might be adorned with appropriate bassi-relievi.

It has been suggested that the Regent's-park, or the top of Primrose-hill, are fitting spots for its erection,

On Modern Discoveries by the Microscope.

By T. Rymer Jones, F. R. S., Professor of Comparative Anatomy, King's College, London.

It is easy for any one to expatiate generally concerning the extent of the animal creation, and the limitless beneficence of Providence, but it is the microscopist only, who, reversing the Galilean tube, explores for himself the deep abysses of a drop of water, and finds therein a world invisible to the unassisted sense, feelingly can appreciate the works of the Almighty.

Not many years ago it was related that the inhabitants of a certain district in Sweden, possessing but a scanty stock of corn, were in the habit of mixing with their meal a portion of the earth of the country to supply the deficiency, and that this earth was found to be nutritious. Now it had long been an acknowledged fact that animal life cannot be sustained by inorganic matter; but how, then, in this case, could such be employed as nutriment? Many microscopes were speedily directed to this inquiry, and on examination, to the astonishment of an admiring world, this earth was found to consist of shells of microscopic creatures, shells as perfect in their construction as they were varied in their beauty. Such a circumstance as this was eminently calculated to attract the attention of the curious, and subsequent investigations were not long in proving the startling fact that whole tracts of country in different parts of the world—nay, solid rocks are altogether formed of similar materials. A coin shows by the impress upon it the name and date of the sovereign in whose reign it was issued, so do these "medals of creation" bear testimony to the eternal power and sovereignty of the Great Ruler of the world. Nearly 5000 years passed away before the invention of the microscope. Poetry had sought to pourtray the "flammantia mœnia mundi,"—it remained for the microscope to bring them before our view. Looking with the ordinary powers of the microscope into a drop of water, we perceive minute globes rolling round and round, having within them smaller globules revolving like satellites, not around, but within their parent planet. Multitudes of various forms have been found; and Ehrenberg, who had given much time and profound attention to the examination of these forms of being, has supposed them to be possessed of numerous stomachs, an eye, and a system of blood-vessels; but sober reflection and more recent investigation have assured us that these do not exist. The interior globules, supposed by him to be stomachs, at the touch of the magic wand of a sister science, have revealed their real nature; tested by iodine, they have shown themselves to be starch granules; and these infusoria, so long claimed as part of the animal creation, are now given up to the botanist as belonging to the vegetable world.

In his younger days he was told of a mill to grind old people young again, and laughed heartily at so absurd a story, little thinking that a greater number of years, more knowledge and mature reflection, would convince him of the truth of the tale as regards these infusoria, in whom division is multiplication; looking at one of these you will perceive a transparent line crossing it; sometimes longitudinally, sometimes transversely, sometimes obliquely, according to the different species.—At each extremity of the line an indentation may next be observed, which gradually lengthens till the two halves resemble the two continents of America connected by a slender isthmus; by the continued efforts of both portions they become finally divided, and each swims off to find for itself a separate maintenance. In 24 hours a transparent line appears across each of these divided beings, and a similar division again takes place. We have heard of the calculation of the nail in a horseshoe, and the squares on a chess-board, but these are trifles compared with the computation of the descendants of a single monad, which in one month would equal the number of the human inhabitants of this globe. A grain of sand appears of little importance, but the shores which say to the ocean "hither shalt thou go and no further, here shall thy proud waves be stayed,'" are but composed of multitudes of these grains; so these myriads of simple forms oppose a barrier to chaos and to death, and retain within appointed bounds all that may contribute to organic existence. These infusoria form, the base of that pyramid of animal life at the apex of which man has proudly stood for 6000 years without discerning that foundation to which it owed its strength and its security. The microscope is a most valuable instrument for education and for amusement; costly apparatus is not needful, nor is great advance in science necessary to the person who uses it; the most important observations have been made by the most simple means. Many of the discoveries of Ehrenberg himself were made by means of a simple pocket instrument. The microscope is available at every leisure hour; it affords quiet and never-ending amusement, and not amusement only, but the most important of all instruction, for it affords us visible proof that God not only clothes the "lilies of the field," and the grass which to-day is, and to-morrow is cast into the oven, but that He perpetually cares for those myriads of creatures, so small that they are invisible to the unaided sight; and how, then, shall we, so much more highly favoured, ever fail to rely upon His fatherly Providence and His unwearying care?

The Rev. W. Whewell, D. D., Master of Trinity College, Cambridge, "On the Material Helps of Education."

The lecturer said, that as he had not yet had the opportunity of examining the collection of the means and helps to education which the scheme of the Educational Exhibition had brought together, he must regard the subject in its general aspect, as it offers itself to our thoughts. We suppose education to be understood, not in any new or peculiar signification, but in the ordinary and familiar sense in which it is commonly spoken of among intelligent persons. We consider *general* education as opposed to special, technical or *professional* education; and we speak especially of intentional or *formal* education, as distinguished from the *spontaneous* education which precedes such formal education, and takes the place of it in some cases; and as distinguished, on the other hand, from the *ripening post education* which follows formal education.

Education, in this sense, may be defined as the process by which the individual is made a participator in the best attainments of the human mind in general, namely, with what is *rational*, *true*, *beautiful*, and *good*.

The individual participates in the *rational* attainments of man by becoming acquainted with language, which is the instrument of reason. Education begins with our own language: and none of the means of education is so universal, necessary, powerful, and extensive, as this most cheap and common one. A special point to attend to in using language for the purpose of education, is to teach the history of the language—the way in which words came to mean what they do mean. This inquiry, in the case of modern languages, contains elements additional to what it had in the case of Greek, in consequence of the influence of the subsequent history of nations and of thought upon languages. In English there are additional peculiarities in the history of the language, in consequence of its containing two main component parts—the Saxon part and the Latin (and Greek) part. The result of this history is that, at present, *the only living part of the English language is the dead languages*. The material means of education in regard to language, are school-books—as grammars and vocabularies. And it is a great improvement, recently introduced into English education in this branch, that school-books have been published in which these two elements of the language—the Tuetonic and the Latin part—are distinguished and separated.

The individual participates in the knowledge which man has attained of what is *true* by becoming acquainted with collections of truths, such as geometry, arithmetic, mechanics and astronomy. Arithmetic and geometry ought to be taught by being reduced to *intuition*. In the case of geometry there are some difficulties in this reduction, which may be illustrated, and, in fact, removed, by folding a leaf of paper. In this way we may define a straight line and a right angle, and prove that the three angles of a triangle are equal to two right angles. We may also construct a pentagon, which may be shown (though not without some geometrical skill) to be equilateral and equiangular. Also, in mechanics the relation of the weights on inclined planes may be reduced to intuition, by an ingenious illustration, devised by Stevinus, of Bruges. In astronomy, the helps of education are ancillary spheres, orreries, and the like.

It is a part of education to make the individual a participator in what is *beautiful*, even of common education, for we wish our pupils to admire what is beautiful in the thoughts, expressions, or melody of what they read, and talk of the beauties of Milton and of Shakespere. Again, musical melody has its beauty, as well as the melody of verse; and it is a great improvement in modern education that music has been made a more prominent part of it. Also an acquaintance with what is beautiful in the combination of forms and of colours, has a beneficial influence upon young persons in the way of general education, besides being important in many kinds of technical education. The collections of the Educational Exhibition will doubtless illustrate this branch.

To make man a participator in what is *good* is to teach him morality and religion; and the best mode of doing this is a matter of controversy on which we do not enter. Nevertheless, all parts of human culture are enriched, and to teach men what is true and beautiful helps the teaching of what is right and good.—*Journal of Society of Arts.*

Artificial Breeding of Fish.

A paper has lately been read before the French Academy by M. Millet, on the natural and artificial hatching of fish-spawn. M. Millet says, "in all the operations connected with the rearing of fish, in order to obtain success, much attention must be paid to the teachings of nature. It is by conforming to these principles, after studying for many years the habits and manners of fish, that I have sought to ascertain the best means of stocking the waters with this valuable description of food. For five successive years, from 1848 to 1854, I have made and caused to be made a variety of experiments in relation to artificial spawning applied to the breeding of fish. At the same time I have endeavoured to ascertain if it were possible to obtain results sufficiently satisfactory by following closer and closer the natural conditions of the spawning, so as to render the operations more simple, more economical, and more certain. I have since renewed my experiments on natural spawning, and have compared the results with those of the artificial method.

Among the different species of fish we may divide them into those which spawn in quick running streams, and those which spawn in still waters. In the first category will be found salmon, trout, grayling, &c.; in the second, carp, tench, &c. The trout makes an actual nest at the time of depositing her roe; she looks out for a bed of large gravel, or flint stones washed by running waters; these she turns over, and cleanses from all matter adhering to them, and foreign substances deposited by the water. She then hollows out cavities among the stones, into which she deposits the roe, so placing herself as for the current to carry it into the places prepared for its reception. While this process is going on, the roe is impregnated from time to time by the discharge of milt from the male, who hovers near. The female then covers up her nest with the stones which had been previously removed. Spawning beds may be established in water-courses. If the bed of the river is furnished with large gravel, or flint stones, these materials may be at once made use of for the purpose. It is only necessary to turn them over with a shovel or a rake, to form them into heaps, mounds, and small cavities. There is no difficulty in forming these spawning beds, and the expense is trifling. When the bottom does not naturally afford the proper material, gravel, flint-stones, or pieces of rock must be supplied. The formation of these artificial spawning beds, among other advantages, is attended with this, that the trout are retained in the stream thus stocked. Their efficacy is such, that I have caused trout to spawn in holes, and old ditches where I have thrown, before the regular time for spawning, several barrowsful of stone broken for mending the roads.

The grayling spawns frequently at a considerable depth. I have caused many cubic yards of rock and stone to be thrown into ditches, from ten to twelve yards in depth, and these have served as spawning beds for grayling.

For barbel, gudgeon, &c., I make in shallow running streams a sandy bottom with a slight declivity, with heaps of small stones and washed gravel, taking care to turn over and clean the materials with a shovel or rake.

The miller's thumb, the bullhead, and the minnow, breed readily in the same waters as the trout, more especially in springs and brooks.—The fry of the miller's thumb and the bullhead are hatched at a time when the young salmon, trout, and grayling are sufficiently advanced to feed on very small tender fish.

The miller's thumb looks out for stones under which cavities are found, in which she glues or sticks her eggs. But there is in this instance a previous proceeding, which consists in taking possession of a place, and *making the nest*. This fish hollows out a gallery or tunnel, with an entrance and an exit. The female glides under the stone, and then turning on her back rubs her belly forcibly against the face of the stone, depositing a portion of her roe, which immediately adheres. The male then follows into the nest, and by a similar movement to that of the female, while turning on his back, impregnates the eggs which are just laid. The miller's thumb keeps watch over her nest, and keeps at the entrance of the tunnel to drive away all injurious animals.

For carp, bream, tench, &c., the spawning beds are formed in still fresh water, which are kept by the sun's rays at a moderate temperature. The carp more particularly spawns most abundantly in ponds where the water is perfectly stagnant. Moveable spawning beds may be formed by means of fagots or hurdles placed near the edges as inclined planes, covered with pieces of turf or rushes.

The perch spawns in a manner altogether peculiar. Its eggs are fixed to each other in small groups forming a broad ribbon, which has the appearance of beautiful lace work. This fish has but one ovary, which is completely emptied at one time. In a large number of ponds and lakes the perch roe is hatched by means of faggots thrown into the water. At spawning time the perch quits the running water, and seeks still pools. In preparing the spawning beds for this fish, masses of rushes or grass, faggots or branches, are thrown into the water; or, what is better still, boughs of trees with small branches attached (such as willow boughs) are stuck into the banks at a depth of from half-a-yard to a yard. It is very easy to gather the spawn, for all that is necessary is to raise the ribbons with a stick or a small fork.

Artificial spawning beds, applied to the hatching of certain *cyprinidæ* particularly of the bream and the roach, and of the perch, have been employed as a means of stocking waters in very many places. Since the year 1761, Lund obtained successful results by this means; he produced upwards of ten millions of young fish."

Ascent of Mont Blanc by a Lady.

A correspondent of the London *Times* says:—The ascent of Mont Blanc has just been accomplished by an English Lady. It appears that Mr. and Mrs. Hamilton, a gentleman and lady who reside near London, accompanied by nine guides, and by a boy of the village 16 years old, started from Chamouni to make the ascent on Sunday morning last, about 8 o'clock. They arrived at the Grands Mulets at 4 o'clock in the afternoon, and passed the night in the hut the guides have recently erected there; at half-past 3 the next morning they continued their journey, and after meeting with difficulties of no ordinary character succeeded in reaching the summit at about half-past 2 P.M. They rested there about 10 minutes, when the anxiety of the guides respecting the weather induced them to commence the descent, and they got back to the Grands Mulets at 5 o'clock, and passed another night in the hut. On Wednesday morning they returned thence to Chamouni, and they found this to be the most difficult part of their journey, in consequence of the descent of avalanches. They succeeded, however, in surmounting every obstacle, and were welcomed on their arrival at the village by the firing of cannon, the forming of a triumphal procession, and every other demonstration of enthusiastic applause.

A fête was given the next evening in the court-yard of the Hotel de Londres, which probably surpassed anything of the kind ever seen in Chamouni, not excepting that which took place after Mr. Albert Smith's ascent. Mrs. Hamilton had so far recovered from her fatigue as to be able to join the dancers, and she did so with much spirit. From a conversation I had with her on this occasion, I found that neither she nor her husband suffered from the rarefaction of the air at the summit, although several of the guides were so utterly prostrated that they fell upon their faces as soon as they reached the top. She spoke in the warmest terms of her two guides, Jean and Victor Tairray, who paid her the utmost attention during the whole route. An avalanche of immense size fell as they were passing the Grand Plateau, and in its course went over part of the track they had crossed but a few minutes before, and completely filled a *crevasse* beneath, said by the guides to be 25 feet wide and 40 deep.

This is the first time the top of Mont Blanc has ever been reached by an English lady, although two women have before made the attempt successfully, one being a French lady of Geneva, Mdlle. D'Angeville, and the other a peasant in the neighbourhood of Chamouni.

Two other ascents have been made this season, both during the present month; one by a Mr. Birkbeck, and the other by a Mr. Blackwell. Dr. Talbot an American gentleman has commenced the ascent to-day, and is now at the Grands Mulets, where he will pass the night, and, if the weather permit him, will continue his journey to-morrow. It has been so unfavourable during the latter part of the day that it is doubtful whether he will accomplish his wishes so soon, but he has expressed his intention to remain upon the rocks for a week rather than return unsuccessful.

Products of Coal—Paraffine.

The case in which JAMES YOUNG and others were plaintiffs, and STEPHEN WHITE and others were defendants, tried before Lord CAMPBELL and a special jury on the 28th of June last, involved questions so interesting to those who are concerned in the products of bituminous coal, and in the recognition of patent rights, that a condensed notice of it must be acceptable to our readers. It was an action brought by the plaintiffs for an alleged infringement of a patent obtained by Mr. JAMES YOUNG, on the 17th of October, 1850, as the inventor of "improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom." The defendants, while denying the infringement, pleaded that the plaintiff was not the true and first inventor; that the manufacture was not, at the time of obtaining the patent, a new invention within this realm; and further, that the patent did not sufficiently particularise the nature of it. The defendants are chemists and gas manufacturers, in and near Manchester under two patents for making gas by what is called the "hydro-carbon process."

It appeared that, in 1847, Mr. YOUNG, as a scientific man, was requested, by Dr. LYON PLAYFAIR, to analyse a mineral oil, which exuded in a coal pit at Riddings, near Alfreton, in Derbyshire of a very remarkable character, and which then excited attention. On the analysis, he was unable to procure naptha from it in sufficient quantity; but, by a further process, he was enabled to purify the oil, so as to obtain from it considerable illuminating power, and he found that it had the remarkable quality of being unaffected by the action of the atmosphere. After a while, the oil could not be procured, and Mr. YOUNG turned his attention to the discovery of some means of artificially producing this particular fluid: and he subsequently succeeded, by distilling highly bituminous coal at a low red heat, in obtaining this same oil. He found that it consisted of a substance, in a liquid state, known under the name of "paraffine," so called from the words *parum* and *affinis*, having little affinity to any other; that it was compounded of hydrogen and carbon in almost equal parts; and that it is not decomposed by the action of the oxygen in the atmosphere. Paraffine oil is procured by distillation, but, when afterwards condensed by cold, it assumes a peculiarly fine, waxy appearance, called "paraffine," which, on the application of heat, again becomes dissolved. The oil possesses this peculiarity—that it will keep for an indefinite time; and, as it is said to be the most oleaginous or slippery oil that has been discovered, it was found useful as a lubricant for machinery. The defendants, in January, 1853, as the Hydro-Carbon Gas Company, Manchester, advertised paraffine oil, which was found of the same description and quality as that which Mr. YOUNG was selling under his patent; and on a representation to them, they acknowledged that what they were making was paraffine oil, but stated that they obtained it by a different process. The defendants had two patents for making illuminating gas: in their process by the first patent, they used two retorts, in one of which water is dropped on coal, and partially decomposed, steam, hydrogen gas and carbonic oxide arising from it. In the other retort is an apparatus of iron, upon which oil or tar is dropped, which produces a highly carburetted hydrogen gas, emitting so much smoke, when subjected to the action of fire, that it is necessary to dilute it. This is done by applying a mixture of hydrogen gas and carbonic oxide, the products of the first retort, and the mixture produces a gas, not only very inflammable, but possessing high illuminating powers. As paraffine oil could only be procured from bituminous coal, or waxy petroleum, it was insisted, on the part of the plaintiffs as clear, that the oil could not be obtained from any form of the process specified in the defendants' first patent. Their second patent proposed to use coal, for the purpose of generating this illuminating gas at a white heat; while the subject of the plaintiffs' patent, paraffine oil, was evolved from coal only at a low red heat. It was observed that if the heat was raised above the low red heat at which paraffine was obtained from the same bituminous coal, not paraffine oil, but a totally different liquid, was produced, possessing wholly distinct chemical qualities—namely, naphthaline, with a visible trace of paraffine, which is justly considered a curious and striking phenomenon. It was alleged, that since the second patent was obtained, the object of which was to improve the mode of procuring illuminating gas, the defendants had been using their retorts at a low red heat, thereby obtaining paraffine oil, instead of illuminating gas. The plaintiffs further asserted, that if the defendants should attempt to show that they still used a white heat, it would be proved that they had recourse to the action of water, internally applied, for the purpose of reducing the temperature within: while, in order to keep up appearances, they maintained the white heat without. The plaintiffs claimed for Mr. YOUNG the merit of the discovery; the production of paraffine oil from coal was not known before his invention; that it was an article of great practical value could not be controverted by the defendants, who professed to sell it themselves; and it was insisted that they produced it by a process which if not identical with, was at all events equivalent to that employed by him.

On the part of the plaintiffs, a number of eminent professors of chemistry, and manufacturing chemists, were examined, whose evidence went strongly to sustain the plaintiffs' case—namely, that the production of paraffine by the distillation of bituminous coal at a low heat was a novelty, and that it had not been obtained prior to the date of the plaintiffs' patent. They were cross-examined on the part of the defendants, with the view of showing that the existence of paraffine in bituminous coal was well known to scientific men, and described by chemical writers, particularly on the Continent, before the plaintiff's discovery; and the Boghead Cannel or mineral was repeatedly referred to, but it did not appear that any attempt had been made, on the part of the plaintiffs to analyse the coal gas produced from it. It having been shown that the per centage of paraffine in Mr. YOUNG's oil was from 12 to 13 lbs. in the 40 gallons, or from 3 to 4 per cent., and that Mr. WHITE's contained only half the quantity, it was endeavored to be established that they could not be the same but it was proved that the latter oil also froze solid on applying cold.

The exclusive claim of the plaintiffs was strongly resisted, on the part of the defendants, by reference to a number of scientific and chemical works, English, American, French, and German, proved to have been in circulation in this country prior to 1850, all treating of paraffine as a substance well known to chemists, the product of the distillation of bituminous coal at a low temperature. It was also proved to have been procured from Wigan Cannel coal tar, obtained from the Salford Gas-works by the process recommended by Baron REICHENBACK in a work published in Germany, in 1833. It was insisted that he was the original discoverer, and that he had also pointed out the commercial application of this product, one of the purposes for which he states it will be useful, being the lubrication of the wheels of carriages. A specification for the manufacture of a nearly similar substance had been lodged by M. DU BUYSON, 1845, and it was admitted that he had produced it, but not commercially. It was then shown that the Boghead mineral was first introduced to notice in the year 1850, and that paraffine had been extracted from the dead oil, of the residum tar produced by it in the ordinary practice of gas manufacture. It was stated that, from a ton of that coal, nearly 700 lbs. of tar can be procured, and from 140 to 150 lbs. of paraffine oil (about 15 gallons), and that from 13 to 20 per cent. of the paraffine oil so produced is pure paraffine. It was then proved that the heat best suited to the process of making hydro-carbon gas was a white heat; and that there was not a very great distance between that and red heat, was shown by the facts that the melting point of silver, 1280°. is a bright red—that of copper, 1570°, almost a white heat. In addition to the numerous publications relied on, several scientific witnesses were examined, on the part of the defendants, to displace the claim of originality asserted by the patentee, and the specification was strongly objected to. It was urged that, although the plaintiffs' patent was for "improvements in the treatment of certain bituminous substances, and in obtaining products therefrom," the only bituminous substance specified was coal. Distillation of coal was not new: the only novelty was a low heat, and it was contended that the patent was defective in not specifying what was new and what was old. It was understood that the legal objections, which were overruled, were to be made the subject of a bill of exceptions for final adjudication by the highest courts.

The Chief Justice Lord CAMPBELL, for the purpose of taking the opinion of the jury, gave them a direction that the specification of the plaintiffs' patent was sufficient, and he then left to them two questions—first, whether that of the plaintiff was a new invention at the time his patent was taken out, or whether his process was not at that time, and previous to that time, known in England. Secondly, whether the defendants had infringed that patent. The jury retired for some time, and after, on their return, sating that, in their opinion, the specification was sufficient, they answered the question in the affirmative—that the invention was a novelty, and that there was an infringement. A verdict was accordingly entered for the plaintiffs.—*Mining Journal.*

British Exports for 1853.

A return has just been issued by the Board of Trade of the declared values of British and Irish produce and manufactures exported from the united kingdom in the year 1853, specifying the amount to each country and colony. From this document the following list has been compiled, showing the order in which the various communities of the world rank as our customers; and one of the most remarkable facts it presents is, that, owing to the extraordinary increase of more than 10,000,000 in our consignments to Australia, our own possessions now take above one-third of the entire amount, although the total has reached £98,933,781, against £78,076,854 in 1852. The United States, including California, likewise figure for a great increase—namely, from £16,567,737 in 1852 to £23,658,427, at which they now stand. It is the augmentation in this case, indeed, coupled with that to our own colonies, by which the comparison of the exports of the two years exhibits so striking an improvement, since the aggregate of shipments to all other countries has remained almost stationary, such slight alteration as has taken place being in the direction of a decline. Among the British possessions which, next to Australia, continue to show an enlargement of trade, are India, Canada, the settlements of South Africa, and Mauritius. The West Indies remain stationary, and Hongkong, owing to the Chinese insurrection, exhibits a considerable falling off. Among the foreign countries our exports to which have declined, are China, Brazil, France, Egypt, Tuscany, Naples, the republics of the River Plate, New Granada, Venezuela, Hayti, and Greece. Turkey also shows a slight reduction, but she remains far beyond Russia, although in the insignificant total to that country there has been an increase, caused, probably, by extended purchases towards the end of the year under the apprehension of a blockade. With regard to other countries, those which present the most prominent improvement—although, with the exception of Mexico, which has advanced from £366,020 to £791,940, the variations generally have not been of much magnitude—are Holland, Belgium, Spain, Portugal, Chili, Peru, Denmark, and Sweden and Norway:—

"1.	British possessions—		
	Australia	£14,513,700	
	India	8,185,695	
	North America	4,898,544	
	West Indies	1,906,639	
	South Africa	1,122,680	
	Gibraltar	670,840	
	Channel Islands	470,107	
	Mauritius	385,879	
	Hongkong	375,908	
	Malta	297,906	
	Ionian Islands	116,567	
	Other possessions	347,787	
			£33,382,202
2.	United States		23,658,472
3.	Germany—		
	Hanseatic Towns	£7,093,314	
	Prussia	579,588	
	Hanover	472,179	
			£8,145,081
4.	Holland		4,452,955
5.	Brazil		3,186,407
6.	France		2,636,330
7.	Turkey—		
	Turkey	£2,029,305	
	Wallachia and Moldavia	179,510	
			£2,208,815
8.	China		1,373,689
9.	Spain		1,468,357
10.	Belgium		1,371,817
11.	Portugal		1,335,382
12.	Chili		1,264,942
13.	Peru		1,246,730
14.	Russia		1,228,404
15.	Cuba		1,124,864
16.	Sardinia		1,112,447
17.	Mexico		791,940
18.	Egypt		787,111
19.	Tuscany		639,794
10.	Naples and Sicily		639,544
21.	Austria in Italy		637,353
22.	West coast of Africa		617,764
23.	Denmark		569,733
24.	Java and Sumatra		558,212
25.	Sweden and Norway		556,183
26.	Buenos Ayres		551,035
27.	Uruguay		529,883
28.	New Granada		450,804
29.	Philippine Islands		386,552
30.	Syria and Palestine		306,580
31.	Venezuela		248,190
32.	Papal territories		207,491

33.	Greece	135,315
34.	Hayti	133,801
35.	Morocco	75,257
36.	Senegambia	1,527
	Other countries	912,662
		£98,933,781"

Toronto Harbour.

In our last issue, we stated that it was the intention of the Harbour Commissioners to strengthen the peninsula boundary of the Bay at the narrows near the Hotel. We have since had an opportunity of inspecting the plans of Mr. Kivas Tully, for the accomplishment of this work. Mr. Tully proposes to construct an embankment at the narrows, sustained by planking secured to posts sunk in the sand beach to the level of the Lake. The posts are to be about eight feet long, and the parallel walls of the embankment separated by an interval of twenty feet. This space is to be filled with sand and capped with road metal, with a view to form a permanent carriage road. On each side of this artificial roadway the sand of the peninsula is to be thrown in the form of an inclined plane, the sloping surface of which will be about fifteen feet in breadth. The entire embankment will thus have a breadth of about fifty feet.

It is proposed to continue this embankment along the peninsula boundary of the Bay to a certain distance, in the direction of the light-house, and then to connect it with the city by means of its continuation along the narrow strip of land which separates Ashbridge's from Toronto Bay. The Harbour Commissioners, we are informed, have determined to limit the construction of this embankment to the extent of about 150 yards, during the present year; preferring, before authorizing its continuation beyond that point, to satisfy themselves as to its capabilities to withstand the effects of the waves of the Lake under the influence of those prolonged easterly storms which invariably visit us in the spring of the year. We are not aware with whom this method of defending the narrows against the encroachments of the Lake originates, nor do we know whether Mr. Tully is acting in accordance with his own convictions, or under the particular directions of the Harbour Commissioners, in thus preparing for the construction of the works we have briefly described. We are, however, glad to find that the operations are viewed rather in the light of an experiment than as a permanent defence for the Harbour against the inroads of the surges of the Lake at the narrows. We have no hesitation in expressing a conviction that, *if the Lake maintains its present level during the winter, the establishment* of a roadway in the manner described is perfectly hopeless. That the embankment, or rather its ruins, will serve the purpose of arresting the encroachment of the Lake, is more than probable, but the waves will model it after their own fashion, and eventually form a safe natural bank, in which it will be difficult to trace the outline of Mr. Tully's roadway. If the Lake falls fifteen or eighteen inches during the present year, the roadway will be protected by a new beach formed, or, we may say, now forming, some thirty or forty yards from the present shore, and its purpose as a barrier will be neutralized. If the waters of the Lake do not fall during the autumn more than a few inches, the artificial sloping boundary of the roadway will be swept away, and the roadway itself undermined, until the planking assumes that inclination which will enable it to receive with the least resistance the force of a breaking wave—then the natural process of repair will commence and go on uninterruptedly.

We submit, with due respect to the experience and judgment of the Harbour Commissioners, that in devising means to give permanence to that narrow crest of sand shoal which separates Toronto Harbour from the Lake, the natural formative process by which the peninsula has increased and been maintained, should be narrowly watched and closely imitated. It has been, we believe, satisfactorily demonstrated that the materials which form the peninsula have been derived from the eastward. It should be borne in mind, however, that these materials do not "travel" uniformly. Their path of progress, if traced out, would not be parallel to the coast line, nor would they be found to pass over "equal spaces in equal times." Every gale of wind from the east or south-east pushes forward a certain quantity of the loose drifting materials of which the peninsula is composed, and forms here and there upon the coast bays and promontories which are continually changing their relative dimensions and positions. These bays and promontories are not necessarily bounded by the sand crest of the peninsula shoals. They may be, and indeed are, to a great extent subaqueous, and are then occasionally distinctly visible under certain conditions of sunshine and shade. It is altogether fortuitous whether a subaqueous bay or a promontory be formed on any part of the peninsula coast line after an easterly storm. During comparatively calm weather a bay may subsequently be enlarged or filled up, and its neighbouring promontory increased in dimensions or altogether swept away. A subaqueous promontory has been for some time forming near the spot where the breach existed at the narrows, a bay is rapidly forming at the Hotel, and the fence is being undermined. These conditions may be reversed during the first prolonged easterly storms, and under such circumstances what would become of Mr. Tully's roadway?

But is there no method of ensuring the existence of a promontory at the narrows? No contrivance can be more simple or more certain of ultimate success at the immediate point of its application. *Compel* the formation of a promontory at the narrows by the introduction of three or four groynes of small dimensions—say forty to fifty feet long, and four or five in height—projecting into the Lake. Arrest by this artifice the progress of the materials in their westerly course, until they accumulate so as to pass round or over the groynes, and a firm and stable barrier will be established, containing within itself the warrant of its durability.

Miscellanea.

Chevreul on the Harmony and Contrast of Colours—Mr. Sheriff Ruttan's Ventilating Car—Production of Cotton in the Southern States—The Victoria Bridge—The Harvest in 40 English Counties—Progress of Development in Organic Life.

M. E. Chevreul, in his new work on the Principles of Harmony and Contrast of Colours, deduces many curious analogies from the following well known fact:—

"That every colour, when placed beside another colour is changed, appearing different from what it really is, and moreover equally modifies the colour with which it is in proximity."

It thus appears that, every colour has a certain orbit of coloured atmosphere which modifies the neighbouring colours, so that red fills its vicinity with its complementary green; green, red; orange, blue; blue, orange; greenish yellow, violet; violet, greenish yellow; indigo, orange yellow; orange yellow, indigo.

M. Chevreul applies these principles to a great variety of Arts, Manufactures and devices, such as Painting, Interior Decoration, Tapestries, Carpets, Mosaics, Coloured Glazing, Paper-Staining, Calico-Printing, Letter-press Printing, Map-Colouring, Dress, Landscape and Flower Gardening, &c.

The *Athenæum* quotes the following subtleties as illustrative and curious:—

"*First Fact.* When a purchaser has for a considerable time looked at a yellow fabric, and he is then shown orange, or scarlet stuffs, it is found that he takes them to be amaranth-red or crimson, for there is a tendency in the retina, excited by yellow, to acquire an aptitude to see violet, whence all the red of the scarlet or orange stuff disappears, and the eye sees red, or a red tinged with violet. *Second Fact.* If there is presented to a buyer, one after another, fourteen pieces of red stuff, he will consider the last six or seven less beautiful than those first seen, although the pieces be identically the same.

What is the cause of this error of judgment? It is that the eyes having seen seven or eight red pieces in succession, are in the same condition as if they had regarded fixedly during the same period of time a single piece of red stuff; they have then a tendency to see the complementary of Red, that is to say, Green. This tendency goes of necessity to enfeeble the brilliancy of the red of the pieces seen later. In order that the merchant may not be the sufferer by this fatigue of the eyes of his customer, he must take care, after having shown the latter seven pieces of red, to present to him some pieces of green stuff, to restore the eyes to their normal state. If the sight of the green be sufficiently prolonged to exceed the normal state, the eyes will acquire a tendency to see red: then the last seven red pieces will appear more beautiful than the others."

Mr. Sheriff Ruttan's ventilating Car is acquiring favorable notice in the States. At the request of the passengers in the ventilated car on the New York end Erie Railroad, the subjoined expression of their approval was drawn up, and unanimously signed:

"We, the undersigned, now riding in one of the cars of the New York and Erie Railroad, ventilated by Henry Ruttan, Esq., of Cobourg, Canada, are highly delighted with the results of the experiment, and have never before travelled so comfortably and pleasantly, at this season of the year, upon this, or any other Railroad. This day, August 24th, is excessively hot and dusty, the entire train being enveloped in one continuous cloud of dust; and yet, in this car, so admirably does the ventilator perform its work, that the atmosphere about us is entirely free from dust and oppression, while we are continually breathing a pure and invigorating air. We unite, most heartily in urging upon Railroad Companies everywhere to adopt in their cars this method of ventilation, which is superior in every respect to any other mode which we ever experienced or heard of."

The production of Cotton in Southern States of the American Union, has wonderfully increased during the last few years: we take from a Philadelphia paper, the following notice of this remarkable progress:—

The earliest record of an export of cotton from the country (U.S) is dated 1747, when seven bags were shipped from Charleston. Thus then, in less than one hundred years the trade has increased to millions of bales per annum. A curious feature in the history of this fabric is, that in 1784, or little more than half a century ago, a shipment of 71 bags of cotton was made from the country to England, and on its arrival it was seized by the authorities, on the ground that America could not produce a quantity so great.—The average annual yield for the last five years ending 1835, was estimated at 1,000,055, bales. The average yield for the same period ending in 1840, was 1,440,000 bales; and the average annual yield for the like period, which terminated in 1850, was 2,270,000 bales. The total product of 1853, was 3,263,882 bales. In this connection the following comparative statement of the growth will be regarded with interest:—

1824,	569,249	bales.
1834,	1,254,328	"
1844,	2,394,503	"
1853,	3,262,882	"

The consumption for the last year named may be thus divided:

Export to Great Britain,	1,736,860	bales.
" France,	426,728	"
" North of Europe,	171,176	"
" Other foreign ports,	193,636	"
Retained for home use	671,009	"

The Montreal *Pilot* says,—" On the 24th July last we received an invitation to the laying of the first stone in the bed of the river, for the construction of the first pier of the bridge, and now, on the 14th September, when we write, pier No. 1 has arisen several feet above the level of the river, and the process of binding the blocks may be seen and understood. Each stone of the structure is clamped to its fellow by bands of iron, and the interstices are filled with molten lead and the strongest Roman cement. The result will be the construction of masonry as durable as that of the Collisseum or the Appian Ways, which have stood the wear and tear of time and of traffic for more than 2,000 years, and which still continue to exist as monuments of the skill and industry of man. It is a thing worthy of note, that in a new and rising country, only known to civilized men for two or three hundred years, monuments should arise to mark the progress of the age, and to compete in the world's esteem, with similar works constructed two or three thousand years ago; and if the rapid and mighty St. Lawrence is mastered by such works, then indeed is the achievement one worthy to be chronicled."

The State of Maine in an article on the same structure informs us, that: "Each of the tubes will be 19 feet in height at the end, whence they will gradually increase to 22 feet 6 inches in the centre. The width of each tube will be 15 feet, or 9 feet 6 inches wider than the rail track. The total weight of iron in the tubes will be 10,400 tons, and they will be bound and riveted together precisely in the same manner and with similar machinery, to that employed in the Britannia Bridge. The principal part of the stone used in the construction of the piers and abutments is a dense, blue lime stone found at *Point Claire*, on the Ottawa river about 18 miles above Montreal, about 8 above the confluence of that river with the St. Lawrence. A large village has suddenly sprung up at the place, for during the last twelve months, upwards of 500 quarrymen, stone masons, and laborers, have been employed there. Every contrivance that could be adopted to save manual labor, has been applied, and its extent will be judged from the fact that the machinery at the Quarry and at the adjacent jetty has (including the cost of the jetty) involved an outlay of £150,000. Three powerful steam Tugs and 35 barges capable of carrying 200 tons of stone, have been specially built for the work, at a cost of about $120,000. There are used for the conveyance of the stone to the piers, and by the end of September next, a Railway on the permanent line of the Grand Trunk track, will be laid down from the quarry (close to which the permanent line will pass,) to the north shore of the St. Lawrence, so as to convey along it, the stone required for the North embankment and for the northern abutment.

"The piers close to the abutments will each contain about 6,000 tons of masonry. Scarcely a block used in the construction of the piers will be less than 7 tons of weight, and many of them, especially those exposed to the force of the current, and to the breaking up of the ice in spring, will weigh fully 10 tons each. As the construction of "Pier No 1" is already several feet above the bed of the river, the process of binding the blocks together can now be seen and appreciated. In addition to the abundant use of the best water cement, each stone is clamped to its neighbors in several places by iron rivets, and the interstices between the rivets and the blocks are filled up with molten lead. If the mighty St. Lawrence conquers these combined appliances, then indeed is there an end to all mechanical resistances.

"In consequence of the increased height and width of the piers converging towards the centre, the weight of stone in those that will bear the centre tube will be about 8,000 tons each. The total amount of masonry in the piers will be 27,500,000 cubic feet, which at 13½ feet to the ton, gives a total weight of about 205,000 tons."

The London *Daily News* publishes the following result of the analysis of reports from 134 correspondents, spread over the 40 English counties: "Wheat—Very good, excellent, average, 31; good, full average, full crop, &c., 49; average, pretty good, &c., 32; near average, 4; under average, thin, &c., 12: middling, doubtful, or various 6. Totals—Favourable, 112: unfavourable, 12; neuter, 10. Barley—127 reports resolved themselves into: Very good, over average, abundant, &c., 33; good, full average, full crop, &c., 40; average, pretty good, &c., 20; short, light, indifferent, &c., 12; various, irregular, &c., 12. Totals—Favourable, 103; unfavourable, 12; neuter, 12. Oats—128 reports given; Excellent, over average, very good, &c., 25; good, full average, &c., 46; average, fair, pretty good, &c., 33; near average, tolerable, middling, various, &c., 11; under average, short, light &c., 13. Totals—Favourable, 104; unfavourable, 13; neuter, 11." Partial inquiries made in the Irish, Scotch and Welsh counties give similar favourable results.

In Dr. Carpenter's new edition of his Comparative Physiology many generalizations possessing peculiar interest are to be met with. Chapter I. is 'On the general plan of organic structure and development.' After a survey of the Vegetable and Animal kingdom, it illustrates the progress from *General* to *Special* in development, and closes with a notice of the 'Geological succession of Organic Life,' of which we present a short extract exemplifying the reasoning of the author. "Thus the earliest species of Palæotherium (a herbivorous quadruped having some affinity with the Tapir, but more with the Horse of the present epoch,) had the complete typical dentition, with three well developed toes on each foot; but a later species approached the horse more closely, in the reduction of the outer and inner toes, leaving the central one much larger in proportion; and in a still later species, the outer and inner toes are much more reduced, and the form and proportions of the rest of the skeleton and teeth are brought much nearer those of the horse, which, in the full development of only a single digit of each member as well as in the suppression of some of the teeth and the remarkable development of others, must be considered one of the most specialized forms of order."

A notice, *in extenso*, of this valuable work may form the occupation and study of some future hour.

A Storm in India.—The following report from a correspondent, on whom we can rely, of an awful phenomenon, happily unknown in temperate climates, will be read with astonishment.—"At 3 p.m. of the 10th of April, while we were measuring the circumference of large hailstones that fell lightly about us, a terrific storm passed to the south-west of the station, about seven miles off. The accounts brought by natives next morning were so strange that I did not believe them, but, after some gentlemen had visited the spot and confirmed all. I, too, went to see the wreck left by the hurricane. As some days had elapsed since the occurrence, I found it impossible to approach the chaos from the putrefaction of numbers of dead bodies. An eye-witness told me that, while it was blowing pretty stiff from the south-west, a jet black mass of cloud, towering high aloft, and almost touching the ground, was seen to approach; another similar mass advancing rapidly from the opposite direction. They whirled around each other, the heat became intense, and, enveloped in the greatest darkness, houses, bamboos, trees, men, women, and cattle were hurled in the whirlwind, dashed in all directions against trees, impaled on bamboos, or buried in the ruins. On the sides of the track of the storm huge hailstones fell of the size of bricks. The track was about 800 yards broad; its length is not known, nor the extent of the devastation ascertained; 60 dead bodies were counted by gentlemen who went there; 15 persons with limbs torn and mangled, with broken arms and legs, are in hospital. Report says that 300 have been killed, besides no end of cattle. I think it very probable. As the natives build their houses, each family in little separate farms hid in clumps of bamboos with intermediate fields, the scene presented is that of numbers of undistinguishable masses of clumps of bamboos and trees torn up, crossing each other in every direction and blocked up with earth and materials that had formed houses so entirely broken up that nothing could be recognized as having formed roof or sides. In fact, boxes, beds, and things made of planks were so broken into pieces of a foot or two, and thrown about, that it was not always easy to imagine what they had belonged to. From under the masses of rubbish jackalls and vultures were pulling out the remains of human beings and cattle, in small puddles dogs, goats, &c., were drowned and rotting. The fields were covered with the skeletons of human beings, while the short thick branches of trees that stood leafless and barkless supported numbers of vultures. Vultures covered the plain, too gorged to fly at our approach, and hundreds were soaring in circles high overhead in the clear sky, marking in the heavens the course of the storm. One poor famished distracted being, with head bandaged and body scratched all over, bruised and cut, limped up to me, he had lost all his relations—father, mother, wife, and children—all had been destroyed, and he could not find where they had been carried away. It would require hundreds of men to remove the piles of uprooted bamboos, &c., that mark the homesteads of the missing; under them will probably be found those that were killed, while some, probably, had a living grave, hoping alas! in vain—that rescue would come at last, or imagining, possibly, that the whole world had been destroyed. A bungalow of a zemindar, at Dunduma, on the river, Ghoghut, was blown in smithers across the river—300 yards; in the roof two men found a flying passage, and, strange to say, survived."—*Calcutta Englishman.*

Submarine Telegraph Without Wires.—The possibility of sending electric telegraph messages across, or through a body of water, without the aid of the submarine wires, has been satisfactorily tested at Portsmouth. The place selected for the experiment was the Mill-dam, at it its widest part, and where it is some 500 feet across. Two portions of the apparatus were placed on the opposite sides of the water, and terminating in a plate constructed for the purpose, and several messages were actually conveyed across, or rather through, the entire width of the Mill-dam with accuracy and instantaneous rapidity. There appeared every possibility that this could be done as easily with regard to the British Channel as the Mill-dam at Portsmouth. The inventor is a gentlemen of scientific attainments, residing at Edinburgh, and who has been described as the original inventor of the electric telegraph, but, who, from circumstances, was unable to turn the invention to his own advantage.

Stability of Iron Ships.—The recent history of the iron screw-steamer *Sarah Sands* affords an excellent illustration of the stability of iron ships, if well and substantially built. Previously to her last sailing from the Mersey she grounded on the Woodside bank, and remained high and dry during one tide, having in her 1000 tons dead weight, until the tide flowed again, during which time she did not sustain the slightest damage. On her return passage from the St. Lawrence to Liverpool she got a-ground on the rocks of Bell Isle, where she remained four days and four nights. On her arrival in Liverpool, it was found that she was perfectly sound not even a rivet having started, nor was there the slightest bulge or unevenness perceptible. On leaving the graving-dock, the other day, she capized, owing to her ballast having been removed, but she sustained no injury. These mishaps prove not only the superior manner in which she was built, but also proves the superiority of iron ships over wooden ones; for it is difficult to suppose that a wooden vessel would have withstood all these casualties without sustaining damage. The *Sarah Sands* was built in Liverpool, by Mr. James Hodson, consulting engineer, more than eight years ago.

A New Substitute for the Potato.—In the garden of the Horticultural Society at Chiswick are growing two plants of a Chinese yam, which is expected to prove an excellent substitute for the potato They have been obtained from the Jardin des Plantes at Paris, where they have been made the subjects of experiments that leave no doubt that it will become a plant of real importance in cultivation.

"If," says M. Decaisne, who has paid much attention to matters of this kind, "a new plant has a chance of becoming useful in rural economy, it must fulfil certain conditions, in the absence of which its cultivation cannot be profitable. In the first place, it must have been domesticated in some measure, and must suit the climate; moreover, it must in a few months go through all the stages of development, so as not to interfere with the ordinary and regular course of cropping; and, finally, its produce must have a market value in one form or another. If the plant is intended for the food of man, it is also indispensable that it shall not offend the tastes or the culinary habits of the persons among whom it is introduced. To this may be added that almost all the old perennial plants of the kitchen garden have been abandoned in favour of annuals, wherever the latter could be found with similar properties. Thus, *lathyrus tuberosus, sedum telephium*, &c., have given way before potatoes, spinach, and the like. Now, the Chinese yam satisfies every one of these conditions. It has been domesticated from time immemorial, it is perfectly hardy in this climate (Paris), its root is bulky, rich in nutritive matter, eatable when raw, easily cooked, either by boiling or roasting, and then having no other taste than that of flour (*fecule*). It is as much a ready-made bread as the potato, and it is better than the *batatas*, or sweet potato. Horticulturists should, therefore, provide themselves with the new arrival, and try experiments with it in the different climates and soils of France. If they bring to their task, which is a great public importance, the requisite amount of perseverance and intelligence, I have a firm belief that the potato yam (*igname batatas*) will, like its predecessor the potato, make many a fortune, and more especially alleviate the distress of the lower classes of the people." Such is M. Decaisne's account of this new food-plant, which is now in actual cultivation at Chiswick; and, judging from the size of the set from which one of the plants had sprung, it is evident that the tubers have all the requisites for profitable cultivation. One has been planted under glass, the other in the open air, and at present both appear to be thriving equally well. The species has been called *dioscorea batatas*, or the potato yam. It is a climbing plant, bearing considerable resemblance to our common black bryony, and, when it is considered how nearly that plant is related to the yams, the probability of our new comer becoming naturalized among us receives support. Whether, however, it realizes all that the French say of it or not, the trial of it in this country cannot prove otherwise than interesting and worthy of the society which has had the honor of introducing it. Let us hope, however, that it may indeed prove what it is professed to be—"a good substitute for the potato," and in all repects equal to that valuable esculent.—*Evening Mail.*

Artesian Well.—The deepest Artesian well in the world is at St. Louis, where, to furnish water to a sugar refiners, a shaft has been sunk to the depth of 2200 ft., through the rock foundations on which the city rests.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—August, 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	29·594	29·486	29.487	29·510	68·6	87·5	74·5	77·12	+10.15	0·575	0·899	0·762	0·733	·85	·71	·93	·81	Calm	S S W	W b S	4·02	0·025
2	·580	·585	·647	·606	66·6	79·0	62·8	70·10	+ 3.25	·467	·415	·441	·448	74	[illegible]	79	65	W N W	N W	N N W	6·75	...
3	·661	·577	·463	·559	56·1	75·2	63·2	65·45	— 1.40	·366	·507	·476	·470	83	60	84	77	Calm	Calm	Calm	0·10	...
4	·438	·436	·517	·475	65·8	73·3	65·7	67·85	+ 1·05	·486	·742	·515	·551	78	94	84	83	Calm	S W b S	N N W	2·58	0·210
5	·581	·578	·525	·557	59·9	77·9	63·2	67·23	+ 0.43	·421	·563	·454	·504	84	61	80	78	N W b W	S b W	Calm	2·18	...
6	·458	·441	—	—	59·9	78·1	—	—	—	·440	·393	—	—	87	42	—	—	Calm	W b N	—	10·75	...
7	·697	·697	·762	·721	56·0	70·5	52·8	59·95	— 6.73	·307	·195	·257	·255	70	27	65	54	Calm	N W b W	Calm	9·51	...
8	·832	·845	·838	·836	58·2	72·6	57·7	63·48	— 3.18	·365	·555	·304	·412	77	72	65	70	N W b N	S S E	N b W	4·00	...
9	·831	·786	·717	·773	52·4	72·9	62·2	64·22	— 2.33	·280	·440	·428	·392	73	56	78	67	N	E b N	Calm	4·60	...
10	·702	·646	·607	·645	62·5	76·2	61.6	67·92	+ 1.40	·423	·455	·522	·462	76	52	88	71	N E b N	E b N	N N E	4·54	Inap.
11	·599	·599	·595	·596	64·3	76·5	64·6	69·07	+ 2.63	·483	·687	·503	·550	82	72	85	80	N E b E	E	Calm	2·17	...
12	·595	·545	·467	·526	64·4	80·1	68·1	71·65	+ 5.32	·532	·639	·538	·582	90	65	80	78	Calm	S E	W N W	1·52	Inap.
13	·470	·508	—	—	67·6	80·8	—	—	—	·480	·494	—	—	73	48	—	—	S S W	W b N	—	9·54	...
14	·788	·751	·702	·739	56.7	71·1	59·2	62·45	— 3.78	·353	·337	·311	·344	78	45	63	63	N W	S S E	Calm	3·23	...
15	·409	·516	·576	·496	59·2	75·6	53·1	62·98	— 3.17	·435	·373	·319	·380	88	43	81	70	Calm	N W	Calm	8·08	...
16	·624	·610	·652	·630	57·8	77·2	59·1	64·45	— 1.58	·321	·267	·429	·354	69	29	89	63	W N W	W b S	N W	9·05	...
17	·665	·677	·719	·689	55·3	71·6	51·3	58·60	— 7.37	·347	·372	·275	·331	81	49	74	69	N W b W	S b E	Calm	4·71	...
18	·777	·738	·826	·779	52·6	78·0	58·2	64·83	— 1.00	·315	·382	·365	·368	81	41	77	64	Calm	S E b S	Calm	2·80	...
19	·715	·623	·579	·633	55·9	81·7	59·6	66·28	+ 0.52	·362	·454	·399	·423	83	43	81	70	Calm	S	Calm	2·27	...
20	·557	·599	—	—	63·9	86·2	—	—	—	·462	·533	—	—	80	44	—	—	Calm	N	—	7·50	...
21	·742	·627	·543	·635	56·7	86·4	76·1	74·87	+ 9.43	·359	·596	·646	·550	80	49	74	66	Calm	S b E	S W b W	4·63	...
22	·579	·635	·727	·658	76·8	87·4	66·6	77·67	+12.28	·542	·615	·466	·561	60	49	74	62	W b N	N W b N	E	7·05	0·105
23	·823	·762	·678	·748	63·2	68·2	58·6	62·40	— 2.73	·466	·520	·370	·444	82	77	77	81	E N E	E b N	Calm	2·56	...
24	·571	·536	·609	·572	63·0	98·1	75·4	80·43	+15.48	·501	·570	·655	·590	89	32	77	64	Calm	W	N W b W	8·62	...
25	·678	·673	·598	·646	66·7	75·9	66·4	69·22	+ 4.48	·435	·393	·522	·463	68	45	83	68	N N W	E b N	Calm	2·99	0·040
26	·583	·486	·583	·547	60·3	87·0	69·1	73·45	+ 8.92	·447	·673	·566	·583	88	54	82	73	Calm	S b W	W b N	4·85	...
27	·662	·717	—	—	64·9	70·9	—	—	—	·510	·496	—	—	86	68	—	—	W S W	E b N	—	2·12	...
28	·781	·792	·787	·786	56·4	78·5	59·5	65·65	+ 1.52	·403	·425	·391	·413	91	45	79	70	Calm	E b S	Calm	1·87	...
29	·776	·715	·659	·713	61·1	78·4	64·0	67·42	+ 3.60	·427	·628	·540	·530	81	67	93	81	Calm	E b S	Calm	3·03	...
30	·638	·516	·653	·620	68·3	86·9	72·9	74·87	+11.25	.609	·693	·655	·649	91	56	83	78	S	S b E	Calm	4·43	0·075
31	·795	·819	·807	·795	68·7	68·7	65·0	67·20	+ 3.88	·603	·557	·531	[illegible]	88	82	[illegible]	87	E N E	E	Calm	4 88	Inap.
M	29·669	29·639	29·642	29·6477	61.24	78.24	63.46	68.03	+ 2.27	0.431	0.516	0·469	0·478	80	55	80	79	2·86	8·33	1·64	4.74	0·455

Highest Barometer...... 29·845, at 2 p.m. on 8th } Monthly range:
Lowest Barometer....... 29·384, at 8 a.m. on 15th } 0·461 inches.

Highest registered temperature 99°·2, at p.m. on 24th } Monthly range:
Lowest registered temperature 45°·6, at a.m. on 18th } 53°·6.

Mean Maximum Thermometer.............. 80°·72 } Mean daily range:
Mean Minimum Thermometer............. 55°·26 } 25°·46.

Greatest daily range.........38°·4, from p.m. of 24th to a.m. of 25th.
Warmest day....... 24th. Mean temperature..... 80°·43 } Difference,
Coldest day........ 17th. Mean temperature...... 58°·60 } 21°·83.
Greatest intensity of Solar Radiation, 107°·6 on 24th, p.m. } Range,
Lowest point of Terrestrial Radiation, 35°·8 on 18th, a.m. } 71°·8.

Aurora observed on 1 night: viz. on 20th.

Possible to see Aurora on 21 nights.

Impossible to see Aurora 10 nights.

Raining on 5 days. Raining 5·3 hours; depth, 0·455 inches, which was the least quantity recorded for any August during the series.

Thunder Storms occurred on the 1st, 13th, 25th, and 30th.

Sheet Lightning, not accompanied by thunder or rain, observed on the 22nd, 26th, 29th, and 31st.

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

North.	West.	South.	East.
1230·21	1864·29	612·00	724·09

Mean direction of the Wind, W 28° N.

Mean velocity of the Wind, 4·74 miles per hour.

Maximum velocity, 26.6 miles per hour, from 4 to 5 p. m. on 6th.

Most windy day, the 6th; mean velocity, 10·75 miles per hour.

Least windy day, the 3rd; mean velocity, 0·10 " "

During the thunder storm and heavy squall on the 30th, the velocity of the wind from 2h. 26m. to 2. 45m. p.m., averaged 31 miles per hour.

The observed Temperature on the 24th, at 2 p.m., was +25°·7, and at 4 p.m., +23°·8 above the mean mormal Temperature of those hours respectively.

The observed Maximum on the 24th at 2 p.m. (98°·1), and the registered Maximum on the same day (99°·2), were the highest entries ever made at this Observatory.

Very few shooting stars were observed from the 9th to the 13th of this month, which is one of the periods usually given for the annual return of those Meteors.

Comparative Table for August.

Year.	Temperature. Mean.	Dif. f'm Avr'ge.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Wind. Mean Vel'y.	
	°	°	°	°	°				
1840...	64·6	—1·7	80.1	47·4	32·7	12	2·905	...	
1841...	64·4	—1·9	83·5	46·7	36·8	9	6·170	0·19	lb.
1842...	65.7	—0·6	80·7	45·3	35·4	6	2·500	0·30	lb.
1843...	66.4	+0·1	85·5	44·4	41·1	4	4·850	0·12	lb.
1844...	64·3	—2·0	82·5	44·3	38·2	17	Impt.	0·16	lb.
1845...	67·9	+1·6	82·5	44·4	38·1	9	1·725	0·19	lb.
1846...	68·4	+2.1	86·3	50·4	35·9	9	1·770	0·17	lb.
1847...	65·1	—1·2	83·1	44·9	38·2	10	2·140	0·19	lb.
1848...	69·2	+2·9	87·5	49·3	38·2	8	0·855	4·55	Miles.
1849...	66·3	0·0	79·5	51·4	28·1	10	4·970	3·76	Miles.
1850...	66·8	+0·5	84·2	43·0	41·2	13	4·355	4·46	Miles.
1851...	63·6	—2·7	79·8	43·6	36·2	10	1·360	4·62	Miles.
1852...	65·9	—0 4	81·2	46·7	34·5	9	2·695	3·30	Miles.
1853...	68·6	+2·3	91·6	47·6	44·0	11	2·575	4·23	Miles.
1854...	68·0	+1·7	98·1	47·0	51·1	5	0·455	4·74	Miles.
								0·19	lb.
M'n.	66·35		84·41	46·43	37.98	9·5	2·809	4·26	Miles.

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

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29.863	29.814	29.704	72.0	88.0	75.0	·550	·515	·776	·71	·44	·90	S W b S	S W b S	S S W	0.41	0.91	1.31	0.101	Clear.	Clear.	Str. Dis. Thun.
2	.662	.695	.872	73.5	78.1	56.2	597	607	408	74	64	89	W N W	N W	W	12.00	14.60	27.14	...	Do.	Cum. Str. 4.	Clear.
3	.876	.789	.733	65.0	83.9	69.9	449	715	486	72	61	69	W	W	W	0.81	1.42	2.41	...	Do.	Cir. Str. 2.	Cir. Str. 8.
4	.686	.650	.726	75.1	87.8	69.8	670	670	486	78	53	69	W	W b N	W b N	0.14	1.48	0.98	...	Cir. Str. 4.	Do. 2.	Do. 4.
5	.826	.819	.788	70.4	88.1	70.1	597	568	511	82	44	74	N W b N	N W b N	S W b S	Calm	Inap.	Inap.	...	Clear.	Cum. Str. 4.	Hazy.
6	.735	.619	.682	70.5	61.0	61.0	641	531	520	74	98	95	W S W	S W b W	W N W	Inap.	1.34	3.28	1.483	Cum. Str. 8.	Thun. and Rain.	Cum. Str. 8.
7	.837	.818	.900	56.1	59.1	58.4	363	338	412	79	66	81	W N W	W N W	W N W	16.30	15.31	11.66	...	Do. 4.	Cum. Str. 8.	Clear.
8	30.050	30.068	30.198	60.4	75.7	61.4	393	407	362	75	47	66	N W b N	N W b N	N N W	3.38	Inap.	2.93	...	Clear.	Clear.	Do.
9	30.216	30.201	30.184	60.7	85.7	60.1	330	515	441	63	43	84	N N W	S S W	E b N	Calm	Calm	Calm	...	Do.	Do.	Do.
10	30.121	30.101	30.009	52.0	81.8	69.8	349	473	486	87	45	69	E b N	N W	S S W	Calm	0.36	Calm	...	Str. 10.	Do.	Do.
11	29.998	29.970	29.954	60.5	87.2	69.6	467	523	570	89	41	81	S E b E	E	E N E	Inap.	Inap.	Calm	...	Clear.	Do.	Cir. Str. 9.
12	.924	.856	.894	68.5	91.1	74.6	523	550	681	76	40	82	N	S	S S W	Inap.	Inap.	Calm	...	Do.	Do.	Do. 8.
13	.661	.649	.811	70.1	85.0	61.8	572	618	445	79	52	79	W b N	W b N	W N W	1.42	9.98	11.16	0.266	Cir. Str. 4.	Cir. Str. 6.	Rain at 4 p. m.
14	.998	.963	30.014	57.1	74.0	57.0	335	414	335	70	50	70	N W b N	W N W	N W b W	8.66	13.14	2.21	...	Clear.	Clear.	Clear. [dis. th.
15	.712	.624	29.752	54.1	59.3	56.0	400	478	436	93	94	96	S W	N	W b S	Calm	Inap.	11.43	0.136	Do.	Rain at 1 p.m.	Cir. Str. 9.
16	.824	.815	.886	60.6	69.4	58.1	393	371	367	75	52	75	N W b W	W	N W	12.13	23.66	1.14	...	Do.	Cir. Str. 8.	Do. 4.
17	.937	.882	.932	60.4	77.1	54.2	393	414	326	75	45	76	S S W	W N W	N b W	Inap.	Inap.	6.66	...	Do.	Clear.	Clear, Au.Bor.
18	30.042	30.004	.939	58.6	75.6	60.5	389	428	416	79	50	79	E N E	W N W	S W b W	Inap.	Inap.	Inap.	...	Do.	Cum. 2.	Do.
19	30.013	29.883	.798	64.0	88.1	70.1	357	465	465	89	35	64	W	W	W b N	Calm	6.83	1.71	...	Do.	Clear.	Do.
20	29.799	.874	.920	70.0	77.1	58.0	442	435	389	60	47	79	W b N	W b N	N E	5.56	15.80	2.83	...	Do.	Cir. Str. 8.	Do. Aur. Bor.
21	30.069	.752	.699	56.6	77.2	76.0	305	588	515	66	61	58	E N E	S S W	W b N	Inap.	2.38	6.00	...	Do.	Do. 4.	Do.
22	29.838	.856	.999	69.0	74.2	55.6	551	659	351	77	67	79	N N W	N N W	N E	28.03	10.66	12.71	...	Str. 4.	Cum. 2.	Cum. 8.
23	30.183	30.108	.987	53.7	78.0	65.1	337	498	516	81	52	89	E N E	S S W	S S E	Inap.	Calm	Inap.	0.113	Clear.	Cir. Str. 4.	Cir. Str. 8.
24	29.776	29.639	.725	64.0	87.0	70.6	534	670	541	89	53	74	N W b N	N W b N	N	Calm	14.07	13.00	...	Str. 10, Thunder	Clear.	Clear.
25	.945	.958	.962	60.5	73.9	57.8	441	659	398	84	82	84	N W b N	N W b W	N E	10.71	10.00	3.33	...	Clear.	Do.	Str.2, Aur. Bor
26	.935	.889	.922	54.0	58.0	55.2	373	389	418	88	79	94	E N E	E S E	N E b E	12.28	16.33	3.80	Inap.	Str. Rain.	Rain at 2. p.m.	R'n at 8.30 p.m
27	30.030	30.002	30.095	60.4	78.0	53.0	350	523	397	86	55	81	E b N	E N E	E N E	10.73	13.13	8.98	...	Cir. Str. 4.	Clear.	Clear.
28	30.156	30.134	30.135	53.1	79.9	61.8	337	568	483	81	58	89	E N E	N W	S W b S	5.88	1.04	Inap.	...	Cum. Str. 10.	Cum. Str. 5.	Cum. Str. 10.
29	30.150	30.066	30.098	62.5	80.1	71.0	445	592	532	79	53	70	S W b S	S W b S	S W b S	Inap.	Calm	21.00	...	Clear.	Hazy.	Hazy.
30	29.821	29.814	29.944	66.0	87.2	71.0	464	854	715	72	68	95	S W b S	W N W	N W	14.10	2.14	1.46	0.166	Cir. Str. 4.	Cum. Str. 4.	Shower at 6, 20.
31	30.131	30.112	30.168	60.8	72.0	67.3	441	550	534	84	71	81	N E	E b N	E b N	2.48	3.41	1.48	...	Do. 7.	Do. 8.	Clear. [p.m.

Barometer	Highest, the 9th day	30·201
	Lowest, the 6th day	29·619
	Monthly Mean	29·910
	" Range	·582
Thermometer.	Highest, the 19th day	96°·0
	Lowest, the 16th day	47°·8
	Monthly Mean	68°·31
	" Range	48°·2
	Mean Humidity	·714
Greatest Intensity of the Sun's Rays		138°·1

Amount of Evaporation, 4·70 inches.

Rain fell on 7 days, amounting to 2·265 inches, and was accompanied by thunder and lightning on 3 days. Raining 7 hours, 45 minutes.

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

Most Windy Day, the 2nd day; mean miles per hour, 17·58.

Least Windy Day, the 9th day; mean miles per hour, 0.

Aurora Borealis visible on 3 nights. Might have been seen on 14 nights.

Electrical Apparatus out of order.