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THE

CANADIAN JOURNAL

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THE CANADIAN JOURNAL.

NEW SERIES.

No. VII.—JANUARY, 1857.

THE DECREASE, RESTORATION, AND PRESERVATION OF SALMON IN CANADA.

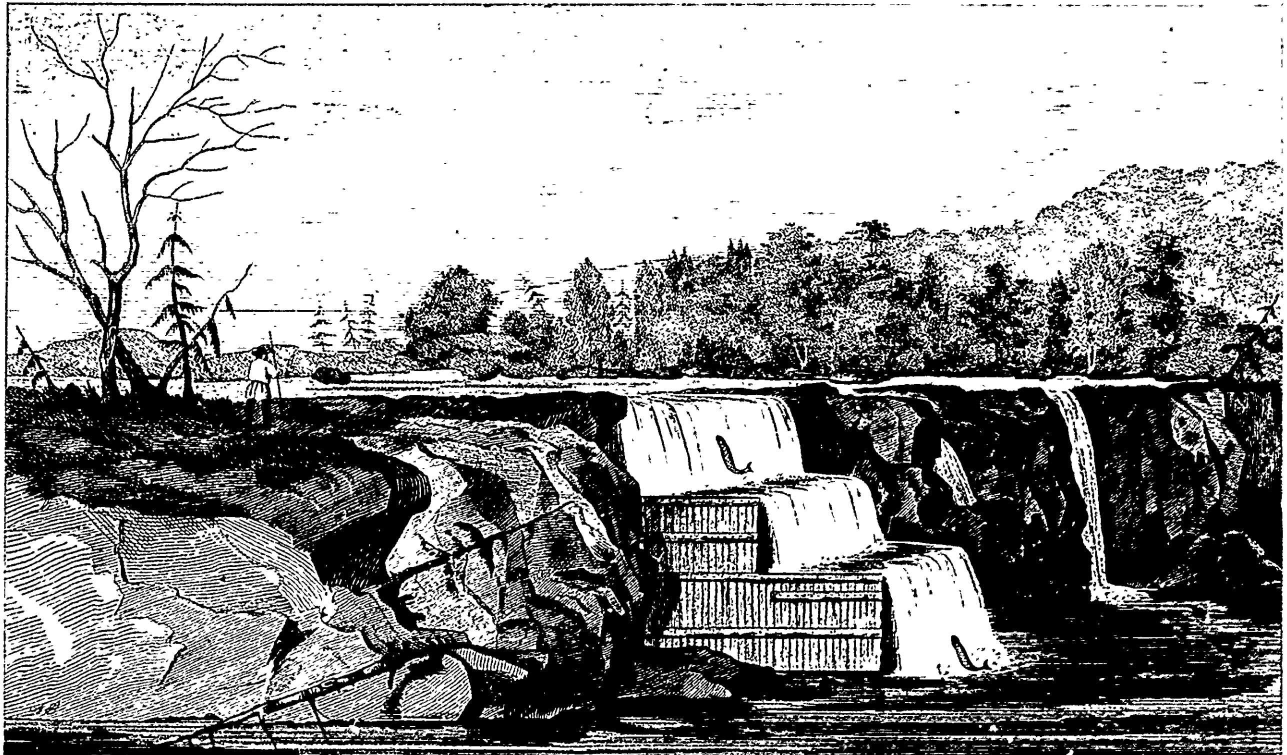
BY THE REV. WILLIAM AGAR ADAMSON, D.C.L.

Read before the Canadian Institute, December 6th, 1856.

Brillat Savarin, in his "Physiologie du Gout," asserts that the man who discovers a new dish does more for the happiness of the human race than he who discovered the Georgium Sidus. If this be true, then he who could devise means for the preservation and increase of an old, wholesome and highly coveted article of food would not labor in vain, nor would, I imagine, his endeavors be despised by the members of the Canadian Institute, however humble his abilities, and however unskilled he might be in scientific lore. Actuated by this belief, as well as desirous to respond to the demand for co-operation among the members of the Canadian Institute, I would venture to lay before you some notes upon the decrease, restoration, and preservation of the Salmon (*Salmo Salar*) in Canada.

It is unnecessary to magnify the importance of this fish as an economic production, or as an article of commerce. As food it is beyond comparison the most valuable of fresh water fish, both on account of the delicacy of its flavor, and the numbers in which it can be supplied. By prudence, a little exertion, and a very small expense now, it may not only be rendered cheap and accessible to almost every family in Canada, but also an article of no small commercial importance as an export to the United States, in which country, by pursuing the course which Canada has hitherto imitated, this noble fish has been almost exterminated. Twenty-five or thirty years ago every stream tributary to the St. Lawrence, from Niagara to Labrador on the north side, and to Gaspé basin on the south, abounded with salmon. At the present moment, with the exception of a few in the Jacques Cartier, there is not one to be found in any river between the Falls of Niagara and the city of Quebec. This deplorable decrease in a natural production of great value has arisen from two causes; 1st.—the natural disposition of uncivilized man to destroy at all times and at all seasons whatever has life and is fit for food; and 2nd.—the neglect of those persons who have constructed mill-dams, to attach to them slides, or chutes, by ascending which the fish could pass onwards to their spawning beds in the interior. It is supposed by many that the dust from the sawmills getting into the gills of the salmon prevents them from respirating freely, and so banishes them from the streams on which such mills are situated, but I am persuaded that this is a mistake, for salmon are found in considerable numbers at the mouths of many such streams, below the dams. In the Marguerite, in the Saguenay, at the Petit Saguenays, the Es-quemain, Port Neuf, Rimouski, Metis, and others that might be named, the real cause of the decrease is the insuperable obstacles presented by mill-dams, which prevent them from ascending to the ærated waters, *high up the* streams, which are essential for the fecundation of their ova, and so for the propagation of the species. Would you then—it may be asked, pull down our mills in order that we might have salmon in our rivers? most certainly not, I reply, for it is quite possible to maintain all our mills, with all their mill-dams, and yet afford to the fish an easy and inexpensive mode of passing upwards to their breeding places.

Marvellous stories are told of the great heights which salmon will leap in order to surmount the obstacles which nature or art may have erected between the lower parts of a stream and the upper waters which are suited to breeding purposes. Natural historians used gravely to tell us that salmon, in order to jump high, were in the habit of placing their tails in their mouths, and then, bending themselves like a bow, bound out of the water to a considerable distance, from twelve to twenty feet. The late Mr. Scrope, in his beautiful book "Days and Nights of Salmon Fishing," calculates that six feet in height is more than the average spring of salmon, though he conceives that very large fish in deep water, could leap much higher. He says, "Large fish can leap much higher than small ones; but their powers are limited or augmented according to the depth of water they spring from; in shallow water they have little power of ascension, in deep they have the most considerable. They rise very rapidly from the very bottom to the surface of the water by means of rowing and sculling as it were, with their fins and tail, and this powerful impetus bears them upwards in the air, on the same principle that a few tugs of the oar make a boat shoot onwards after one has ceased to row." However this may be, we know that salmon use almost incredible efforts to ascend their native rivers. Modes have recently been adopted in France, in England, Scotland and Ireland, by which they can do so with ease, and which can be much more cheaply applied to Mill-dams in Canada, than in any of the countries above mentioned. This is simply by constructing below each mill-dam a congeries of wooden boxes proportioned to the height of the dam—which could be done, in any weirs I have seen requiring them, for a sum not exceeding twenty dollars. We will suppose that the mill-dam to be passed over is fifteen feet high from the surface of the water, and that the salmon can surmount the height of five feet at a single bound, then it would be only necessary to erect two boxes, each five feet high, one over the other (as in the illustration) to enable the salmon, in three leaps, to reach the waters which nature prompts him to seek for the propagation of his species. In many Canadian rivers—such as Metis, Matane, Rimouski, Trois Saumons, etc.—this simple apparatus might be put in operation for one half the sum I have mentioned, and I trust it has only to be suggested to the gentlemen residing on their banks to arouse their patriotism and excite them to activity in the matter. There can be no doubt that were the mill-dams removed, or boxes constructed adjacent to them, and protection afforded to the spawning fish, many of the rivers in *Upper Canada* would again abound with Salmon. I have myself, within a few years, taken the true Salmo Salar in Lake Ontario, near Kingston, and many persons in Toronto know that they are taken annually at the mouths of the Credit, the Humber and at Bond Head, in the months of May and June, which is earlier than they are generally killed below Quebec. Whether these fish come up the St. Lawrence in the early spring, under the pavement of ice which then rests upon its surface, or whether they have spent the winter in Lake Ontario, is a question which I must leave to naturalists; merely mentioning that there is some foundation for believing that salmon will not only live, but breed, in fresh water, without visiting the sea. Mr. Lloyd, in his interesting work on the field sports of the North of Europe, says,



CANADIAN SALMON LEAPS.

"Near Katrineberg, there is a valuable fishery for salmon, ten or twelve thousand of these fish being taken annually. These salmon are bred in a lake, and, in consequence of cataracts, cannot have access to the sea. They are small in size and inferior in flavor," which may also be asserted of salmon taken in the neighborhood of Toronto. Mr. Scrope, in his work previously quoted, states that Mr. George Dormer, of Stone Mills, in the Parish of Bridport, put a female of the salmon tribe, which measured twenty inches in length, and was caught by him at his mill-dam, into a small well, where it remained twelve years, became quite tame and familiar, so as to feed from the hand, and was visited by many persons of respectability from Exeter and its neighborhood.

But the fact that salmon are annually taken near the Credit, the Humber and Bond Head is sufficient ground on which to base my argument for the probability that were the tributary streams of the St. Lawrence accessible to them they would ascend and again stock them with a numerous progeny. Even were this found not to be the case,—then we have the system of artificial propagation to fall back upon—a system which according to the Parliamentary Reports of the Fishery Commissioners has been practised with immense success in different parts of Ireland—according to M. Coste, Member of the Institute, and professor of the college of France, in his reports to the French Academy and the French Government, has answered admirably in France, and according to Mr. W. H. Fry and others, quoted by him in his treatise on artificial fish-breeding, has been generally effective in Scotland. This system, as is well known, consists simply of transporting from one river to another the impregnated eggs of the salmon, and placing them in shallow waters with a gentle current where they are soon hatched, and become salmon fry or par and able to take care of themselves. In consequence of the ova of the salmon, which are deposited in the spawning beds in the months of October, November and December, becoming congealed by frost in the subsequent months, Canada appears to offer greater facilities for their safe transport than those countries in which the system has been so successful, but whose climates are more temperate. Surely, supposing this is a mere untried experiment—which is far from being the case—it would be well worth the while of some of the many wealthy and intelligent dwellers upon the banks of our beautiful rivers to test its value, particularly when they call to mind the well known fact in the natural history of the salmon, that he invariably returns to the stream in which his youth was spent, and that so they may calculate upon having their present barren rivers stocked with as valuable articles of consumption and of commerce as their fowl-houses or their farm-yards.

I shall, for brevity's sake, abstain from enlarging on this subject, merely observing that ample information can be obtained upon it by consulting the works of M.M. Coste and Fry, which are to be found in the libraries and bookshops in this city ; and that in the streams in which it may be put into operation—if there are mill-dams upon them—the artificial construction to enable the fish to descend and ascend to and from the sea will still be requisite.

Having said so much on the decrease and restoration of salmon in Canada, let us now turn our attention for a few moments to their preservation in the rivers in which they still abound. These rivers I believe to be as valuable and inexhaustible as any others upon the face of the globe, but so circumstanced that their capabilities have not been developed, and that one year of neglect will cause their serious injury, if not their utter destruction, as salmon streams. They extend along the northern shore of the St. Lawrence from Quebec to Labrador, a distance of about 500 miles, and are many in number. They are chiefly held under lease from the Government of Canada, by the Hudson's Bay Company, who fish some of them in an unsystematic manner, with standing nets, because they can be conveniently and cheaply so fished, whilst others are left wholly to the destructive spear of the Indian. In the smaller streams on which the fishermen of the company are employed, a series of standing barrier-nets, (which kill indiscriminately every fish of every size and weight,) is used, a process, which in European rivers, would have long since banished salmon from them. But in Canada the high water in the spring enables some of the largest and strongest of the breeding fish to ascend the streams before those nets can be set, and when they get beyond them, they are comparatively safe in the mountain rivers and lakes which never hear a human footfall till winter—which congeals their surfaces into ice—tempts the poor Indian to tread their banks in pursuit of the bear, the marten, the mink and the otter.

In well regulated salmon fisheries in Europe, the fish—by the construction of proper weirs and reservoirs—are almost as much under the control of the managers as the sheep on their farms or the fowl in their poultry-yards. They can send such of them as they please to market, permit the fittest for the purpose to pass on to propagate their kind, allow the young to enjoy life till they become mature, and suffer the sick and unhealthy to return to their invigorating pastures in the depths of the ocean. But no portion of this system is practised in our American rivers. There is not a salmon weir in the province; and the consequence is, that young and old, kelt and grilse, worthless and unwholesome, the fish are killed by the undiscriminating net and the cruel spear.

It appears to me that the Hudson's Bay Company set little value on these fisheries, and maintain them merely as an accident appertaining to the fur trade which is far more profitable. The approaching termination of their lease and the consequent uncertainty of their tenure may perhaps appear a sufficient reason for their not incurring the expense of erecting weirs, by which much more profit could be made of their fisheries. Unproductive and wasteful as their mode of fishing is, *the protection the Hudson's Bay Company affords is the only present safeguard for the existence of Salmon in Canada.* I am persuaded that *were that protection withdrawn for* ONE SUMMER, *without the substitution of some other as effective, this noble fish would be utterly exterminated from our country.* Fishermen from Gaspé, Rimouski, New Brunswick, Labrador, Newfoundland, the Magdalene Islands and the United States—whose numbers and skill would enable them to do thoroughly what the servants of the H. B. C. from their paucity and inexperience do ineffectually—would swarm up our rivers, and with nets. spears, torches, and every other engine of piscine destruction, would kill, burn and mutilate every fish that ventured into the rivers. Already has this been attempted. For the last two or three years schooners from the United States, have regularly arrived, in the salmon season, at the Bay of Seven Islands, their crews well armed, and have set their nets in the river Moisie, in despite of the officers of the H. B. C. Similar circumstances have occurred at other fishing stations in the tributaries of the St. Lawrence; no means, that I am aware of, having been resorted to for punishing the aggressors or preventing a repetition of their outrages. The river Bersimies has this year (1856) been altogether in the hands of a speculating and rapacious American, who employed the spear of the Indian to furnish him with mutilated salmon, several boxes of which he brought to this city, in the month of September, when they were out of season, unfit for food and flavorless, having previously glutted the markets of Portland, Boston and New York with more palatable fish.

There can be but little doubt that many of the salmon streams in Lower Canada would be as productive, under proper management, as rivers in Europe for which large annual rents are paid; but it must be admitted that the great distance at which they are situated from Civilization, the want of the means of intercourse between them and the inhabited parts of the country, the liability to trespass by armed ruffians, and the dreadful rigor of the climate in winter, present very serious obstacles to those who might wish to undertake such management: for obviating some of which I see no better method than the employment, during the summer months, of one or two armed steamers of light draught of water, such as are used for a similar purpose on the east coast of Denmark. These steamers should each have a commander on board, who should be a magistrate and empowered by parliament to act summarily in cases of infraction of the Fishery Laws, and beside supplying the lighthouses and other public works with stores, oil, building materials, etc., conveying the workmen managers and fishermen to their several stations, and protecting the lessees of the Province, might also be profitably employed as the means of transporting the fresh caught salmon from the several rivers, packed in ice, to the Rail-road Stations at St. Thomas and Quebec; from whence they could be distributed to the markets of Canada and the United States. Two Bills for the protection of salmon and trout in Lower Canada have recently become Acts of Parliament. These may possibly be productive of some good in civilized and inhabited districts, but must be utterly ineffective in those parts of the Province where there are no settled inhabitants, no magistrates, and no tribunals before which those who infringe the Law can be cited; and this is the case of all the best rivers in Lower Canada.

I cannot close these observations without endeavoring to impress on all who hear me, the necessity for prompt action in this matter; for there can be no doubt upon the mind of any man who is acquaintted with the localities, that if the King's Posts should be abandoned by the Hudson's Bay Company, before some well devised system be adopted for carrying on the work which they have hitherto effected, two melancholy results will be the inevitable consequences, viz.—the salmon rivers will be taken possession of by hordes of lawless men, who will in no way contribute to the revenue of the country, but will quickly and recklessly exterminate the fish, and then desert our shores, leaving behind them no trace of their temporary occupation except the destruction they have wrought—and more terrible still—a whole tribe of Indians (the Montagnards) will be reduced to a state of positive starvation, for upon the Hudson's Bay Company they have hitherto been, and are now dependent for their ammunition, guns, and other means by which they obtain their food and clothing.

ON PRESERVING TIMBER FROM DECAY.

BY JOSEPH ROBINSON, TORONTO.

Read before the Canadian Institute, December 20th, 1856.

The economic value of timber, and the immense outlay required for the constant restoration of works executed in the cheaper but least durable varieties of woods, have long directed the attention of practical men to the desirableness of discovering some process by which greater durability could be given to a material, in all other respects so admirably adapted to the objects in view, without affecting its original cost to such an extent as to render it no longer available for the numerous ordinary purposes to which it is now applied. To this subject, attention was anew directed in the last number of the *Canadian Journal*, in an article on the "Preservation of Timber;"* and it may not be out of place, by way of adding to the existing fund of information upon a subject of such general interest, to bring before the Institute, a well attested and valuable process invented and used by the eminent French chemist, Dr. Boucherie.

This process is the result of twenty years experimental labor and study, and is regarded in France and England as of the highest importance, being the only mode yet brought into practical and extensive application, by which the durability of woods, liable to decay, can be economically and effectually secured.

It accomplishes two objects: first, that of expelling the sap; and, secondly, filling the pores of the timber with a preservative solution.

The mode of impregnating trees hitherto adopted, has been by saturation only, assisted sometimes by great pressure, and by previously subjecting the timber in cylinders to a vacuum or to heat.

Dr. Boucherie's process differs entirely: inasmuch as he applies a moderate pressure, and to one end only of the sap tubes of the tree, the effect of which is to expel the sap by the preserving liquor which takes its place. By some of the processes hitherto used, the sap (the fermentation of which is admitted to be the cause of decay) is allowed to remain in the tree; in the process now under review, the sap is expelled, and the tubes are thoroughly cleansed from the fermenting matter, which is displaced by an injected solution of a preservative nature.

The tubular structure of trees has been long known, but it has not

* *Vide* Vol. I., p. 559. New Series.

been known that no connexion exists between the tubes laterally; and this is shewn by the interesting experiment of stopping up or shutting off certain of the sap-tubes at the end of the tree, leaving exposed such as form a word: which word, or name, by the injection of a coloring liquor, can be driven from one end of the tree to the other; so that wherever the tree is cut through, the name appears distinctly in colored letters on the exposed sections.

This experiment is interesting, not only in a scientific point of view; but it shews that none of the processes hitherto used, wherein lateral pressure is involved, can force any preserving liquor into a tree without a degree of violence, which must injure the fibre of the wood, and destroy its strength and use for many purposes.

The advantages which would result from expelling the sap and replacing it by an antisceptic fluid, have been long known; and the idea of effecting this by applying the fluid under pressure at the end of a piece of timber is not new, having been suggested and patented many years ago by Mr. Bethel. But the means then used did not accomplish the object in such a manner as to admit of its commercial application. Hence the more expensive process of creosoting has been adopted; where the timber is totally immersed in the oil, under pressure, a method which does not permit the sap to escape.

By the old process of violent pressure, the preserving liquor is forced at right angles to the tubes through the woody fibre of the tree, injuring its strength as well as its capability, in railway sleepers, for example, to resist the wear of the chairs; consuming at the same time an unnecessary amount of the preserving liquor, without (whatever pressure may be applied) thoroughly impregnating the timber, while one-sixth or one-eighth of the force only is necessary by the new process, and the portion alone requiring the preservative infusion, viz. the soft matter between the rings, is impregnated, the woody fibre remaining unbroken and undisturbed.

Another important advantage in Dr. Boucherie's process, is derived from the simplicity and moderate cost of the apparatus, which, for operations on a small scale, will not exceed £10 or £15, and for a railway of two hundred miles, under £50.

The practical application and entire success of this invention in Europe will be seen by the printed official reports. The first of these was made, by order of the French Government, in the year 1850, the second in 1852, and the third in 1856: being an abstract from the official jury report of the Exposition Universelle of 1855, whereby it will be seen that the distinguished honor of one of the large gold medals was awarded to Dr. Boucherie, of which only four were conferred in all.

The mode of application is as follows :—Soon after the tree is felled, a saw-cut is made in the centre, through about nine-tenths of its section. The tree is slightly raised by a lever or wedge at its centre, and the saw-cut thereby partially opened ; a piece of string is then placed round the cut, close to the outer circumference of the tree, the support is withdrawn, and the saw-cut closes on the string, thereby making a water-tight joint. An auger-hole is then bored obliquely into the saw-cut ; a wooden tube is driven into the hole, the conical end of which is attached to a flexible pipe, which is in connexion with a cistern or reservoir, at an elevation of from 30 to 40 feet above the tree intended to be preserved.

When it is necessary to prepare timber in long lengths, a cap is placed at the end of the tree by screws or dogs. The most efficacious solution is composed of sulphate of copper and water, mixed in the proportion of 1 to 100. The strength is easily ascertained, by any intelligent workman, by an hydrometer ;—and the cost of such a solution is so trifling, as to offer no impediment to its universal application for the purpose in view.*

It would be difficult to enumerate all the classes to be benefitted by this invention, and the uses to which it may be applied. Railway companies, ship-builders, telegraph companies, and land owners, would alike benefit by it. Post and rail fencing, field gates, wood farm buildings, frame buildings, and dwellings in general, would last many additional years. Mr. R. Stephenson, the President of the Institute of Civil Engineers, in his inaugural address, adverts to the great consumption of railway sleepers by decay, and estimates it at 2,600,000 per annum, costing upwards of £500,000. Taking the resistance

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* On comparing the above account of Boucherie's process with that described in the *Canadian Journal* (No. 6, pp. 559-561) and for which a patent was taken out in May, 1856, the two processes appear to be identical so far as the employment of hydraulic pressure is concerned, and if such is the case, this part of the patent is void.

The following is the text of the Patent Law bearing upon this point. "If at "the trial in any such action [*for infringement of Patent,*] it shall be made appa- "rent to the satisfaction of the Court....that the thing thus secured by Patent "was not originally discovered by the Patentee, or party claiming to be the "Inventor or Discoverer in the specification referred to in the Patent, but had "been in use, or had been described in some public work, anterior to the supposed "discovery of the Patentee......the Patent shall be declared void." 13 and 14 Vict. "79, c. 8.—(*Ed. Can. Jour.*)

of the proposed sleepers to decay as the only basis of the calculation, a large proportion of this sum would be saved. Assuming the duration of the sleeper to be doubled, and taking into account the mechanical causes of destruction, a saving of £300,000 per annum, would be effected to the railway interest in England alone.

From these data, the value of the invention in Europe will readily be seen, and although it has been patented in France and England, and, as it would seem, to some extent, in Canada, it is believed that the use in this Province is unfettered; 1st, because by the Statutes of Canada, no foreigner can obtain a patent monopoly in this country; and, 2nd, because, being already known and used in other countries, it cannot be patented here.

THE CHINOOK INDIANS.

BY PAUL KANE, TORONTO.

In accordance with an invitation of the Council of the Canadian Institute to communicate notices of some of the tribes of Indians amongst whom I have travelled, I selected the Chinooks, one of the tribes most remote from this part of the continent, and whose manners and customs are so much at variance with our own, as to render some notice of them, from personal observation, probably both novel and interesting. Other communications of the incidents and results of my travels among the Indians of the North West, having since appeared in the Journal, I have revised my account of the Chinooks, with a view to its appearance, along with the notices of the Walla Wallas, and others of the Aborigines of this continent in the New Series.

The Flat-Head Indians are met with along the banks of the Columbia river from its mouth eastward to the Cascades, a distance of about 130 miles; they extend up the Walamett river south about 30 or 40 miles, and through the district lying between the Walamett and Fort Astoria, now called Fort George. To the north they extend along the Cowlitz river and the tract of land lying between that and Puget's Sound. About two-thirds of Vancouver's Island is also occupied by them, and they are found along the coasts of Puget's Sound and the Straits of Juan de Fuca. The Flat-Heads are divided into numerous tribes, each having its own peculiar locality, and differing more or less from the others in language, customs, and manners.

Of these I have selected, as the subject of the present paper, the Chinooks, a tribe inhabiting the tract of country at the mouth of the Columbia river. Residing among the Flat-Heads, I remained from the fall of 1846 to the following autumn of 1847, and had consequently ample opportunity of becoming acquainted with the peculiar habits and customs of the tribe. They are governed by a Chief called Casenov. This name has no translation: the Indians on the west side of the Rocky Mountains differing from those on the east, in having hereditary names, to which no particuliar meaning appears to be attached, and the derivation of which is in many instances forgotten. Casenov is a man of advanced age, and resides principally at Fort Vancouver, about 90 miles from the mouth of the Columbia. I made a sketch of him while staying there, and obtained the following information as to his history:—Previous to 1829 Casenov was considered a great warrior, and could lead into the field 1,000 men, but in that year the Hudson's Bay Company and emigrants from the United States introduced the plough for the first time into Oregon, and the locality, hitherto considered one of the most healthy, was almost depopulated by the fever and ague.

Chinook Point, the principal settlement of the tribe, at the mouth of the river, where King Cumcomley ruled in 1811, was nearly reduced to one-half its numbers. The Klatsup village now contains but a small remnant of its former inhabitants. Wasiackum, Catlamet, Kullowith, the settlements at the mouth of the Cowlitz, Kallemo, Kattlepootle and Walkumup are entirely extinct as villages. On Sovey's Island there were formerly four villages but now there scarcely remains a lodge. They died of this disease in such numbers that their bodies lay unburied on the river's banks, and many were to be met with floating down the stream. The Hudson's Bay Company supplied them liberally with Quinine and other medicines, but the good effects of these were almost entirely counteracted by their mode of living and obstinacy in persisting in their own peculiar mode of treatment, which consisted principally in plunging into the river without reference to the particular crisis of the disease.

From these causes the numbers of the Indians have been very much reduced, and the effective power of the tribes so greatly diminished that the influence which Casenov owed to the number of his followers has correspondingly declined; his own immediate family consisting of ten wives, four children, and eighteen slaves, being reduced in one year to one wife, one child, and two slaves. Their decrease since that time has also been fearfully accelerated by the introduction of ardent spirits, which, in spite of prohibition and fines against selling it to Indians, they manage to obtain from their vicinity to Oregon city, where whiskey, or a poisonous compound called there *blue ruin*, is illicitly distilled. I have scarcely ever met with an Indian in that vicinity who would not get drunk if he could procure the means, and it is a matter of astonishment how very small a quantity suffices to intoxicate these unfortunate beings, although they always dilute it largely in order to prolong the pleasure they derive from drinking.

Casenov is a man of more than ordinary talent for an Indian, and he has maintained his great influence over his tribe chiefly by means of the superstitious dread in which they hold him. This influence was wielded with unflinching severity towards them, although he has ever proved himself the firm friend of the white man. For many years, in the early period of his life, he kept a hired assassin to remove any obnoxious individual against whom he entertained personal enmity. This bravo, whose occupation was no secret, went by the name of Casenov's *Skōcoom* or evil genius. He finally fell in love with one of Casenov's wives who eloped with him. Casenov vowed vengeance, but the pair for a long time eluded his search, until one day he met her in a canoe near the mouth of the Cowlitz river and shot her on the spot. After this he lived in such continual dread of the lover's vengeance that for nearly a year he never ventured to sleep, but in the midst of a body guard of forty armed warriors, until at last he succeeded in tracing his foe out, and had him assassinated by the man who had succeeded him in his old office.

The Chinooks over whom Casenov presides carry the process of flattening the head to a greater extent than any other of the Flat-Head tribes. The process is as follows:—The Indian mothers all carry their infants strapped to a piece of board covered with moss or loose fibres of cedar bark, and in order to flatten the head they place a pad on the forehead of the child, on the top of which is laid a piece of smooth bark bound on by a leathern band passing through holes in the board on either side and kept tightly pressed across the front of the head. A sort of pillow of grass or cedar fibres is placed under the back of the neck to support it.

This process commences with the birth of the infant, and is continued for a period of from eight to twelve months, by which time the head has lost its natural shape and acquired that of a wedge, the front of the skull becoming flat, broad, and higher at the crown, giving it a most unnatural appearance.

It might be presumed that from the extent to which this is carried the operation must be attended with great suffering to the infant, but I never heard the infants crying or moaning, although I have seen their eyes seemingly starting out of the sockets from the great pressure. But on the contrary, when the bandages were removed I have noticed them cry until they were replaced.

From the apparent dullness of the children whilst under the pressure I should imagine that a state of torpor or insensibility is induced, and that a return to consciousness occasioned by its removal must be naturally followed by the sense of pain.

This unnatural operation does not however seem to injure the health, the mortality amongst the Flat-Head children not being perceptibly greater than amongst other Indian tribes. Nor does it seem to injure their intellect; on the contrary, the Flat-Heads are generally considered fully as intelligent as the surrounding tribes who allow their heads to preserve their natural shape; and it is from amongst the round-heads that the Flat-Heads take their slaves. They look with contempt even upon the whites for having round-heads, the *flat-head* being considered as the distinguishing mark of freedom. I may here remark, that, amongst the tribes who have slaves there is always something which conspicuously marks the difference between the slave and the free, such as the Chimseyan, who wear a ring in the nose, and the Babbenes who have a large piece of wood inserted through the under lip. The Chinooks, like all other Indian tribes, pluck out the beard on its first appearance.

I would give a specimen of the barbarous language of these people, were it not impossible to represent by any combination of the letters of our alphabet the horribly harsh, gasping, spluttering sounds which proceed from their throats, apparently unguided either by the tongue or lips. It is so difficult to acquire a mastery of their language that none have been able to attain it unless those who have been born amongst them. They have, however, by their intercourse with the English and French traders succeeded in amalgamating, after a fashion, some words of each of these tongues with their own, and have formed a sort of Patois, barbarous enough certainly, but still sufficient to enable them to communicate with the traders.

This Patois I succeeded, after some short time, in acquiring, and could converse with most of the chiefs with tolerable ease. Their common salutation is *Clah hoh ah yah*, originating, as I believe in their having heard in the early days of the fur trade a gentleman named Clark frequently addressed by his friends, "Clark, how are you?" This salutation is now applied to every white man, their own language affording no appropriate expression. Their language is also peculiar in containing no oaths, or any words expressive of gratitude or thanks.

Their habits are extremely filthy, their persons abounding with vermin, and one of their chief amusements consists in picking these disgusting insects from each others' heads and eating them. On my asking an Indian one day why he ate them, he replied that they bit him and he gratified his revenge by biting them in return. It may naturally be supposed that they are thus beset from want of combs or other means of displacing the intruders; but this is not the case, they pride themselves on carrying such companions about them, and giving their friends the opportunity of amusing themselves in hunting and eating them.

The costume of the men consists of a musk-rat skin robe, the size of one of our ordinary blankets, thrown over the shoulders, without any breech-cloth, moccassins or leggings. Painting the face is not much practised amongst them except on extraordinary occasions, such as the death of a relative, some solemn feast, or going on a war party. The female dress consists of a girdle of cedar bark round the waist, with a dense mass of strings of the same material hanging from it all around and reaching almost to the knees. This is their sole summer habiliment. They, however, in very severe weather add the musk-rat blanket. They also make another description of blanket from the skin of the wild goose, which is here taken in great abundance. The skin is stripped from the bird with the feathers on, and cut into strips, which they twist so as to have the feathers outwards. This makes a feathered cord, and is then netted together so as to form a blanket, the feathers filling up the meshes, and rendering it a light and very warm covering. In the summer these are entirely thrown aside, not being in any case worn from feelings of delicacy, and the men go quite naked, though the women always wear the cedar petticoat.

The country which the Chinooks inhabit being almost destitute of furs they have little to trade in with the whites. This, coupled with their laziness—probably induced by the ease with which they procure fish, which is their chief subsistence—prevents their obtaining ornaments of European manufacture, consequently anything of the kind is seldom seen amongst them. They, however, wear long strings of small shells found on the coast called Ioquas, and used by them also as money.

A great traffic is carried on amongst all the tribes through the medium of these shells, which are found only at Cape Flattery, at the entrance to the Straits of De Fuca. They are fished up from the bottom of the sea, and are found an inch and a-half to two inches in length; they are white, slender, hollow, and tapering to a point, slightly curved, and about the size of the stem of an ordinary clay tobacco pipe. They are valuable in proportion to their length, and their value increases according to a fixed ratio, forty shells being the standard number required to extend a fathoms' length, which number is in that case equal in value to a beaver's skin, but if thirty-nine be found long enough to make the fathom it would be worth two beaver skins, if thirty-eight three skins, and so on, increasing one beaver skin for every shell less than the standard number.

The Chinooks evince very little taste in comparison with some of the tribes on the eastern side of the Rocky Mountains, in ornamenting either their persons or their warlike or domestic implements. The only utensils I saw at all creditable to their decorative skill were carved bowls and spoons of horn, and baskets made of roots and grass woven so closely as to serve all purposes of a pail in holding and carrying water. In these they even boil the salmon which constitute their principal food. This is done by immersing the fish in one of the baskets filled with water, into which they throw red hot stones until the fish is cooked, and I have seen fish dressed as expeditiously by them in this way as if done in a kettle over a fire by our own people.

The salmon is taken during the months of June and July in immense numbers in the Columbia river and its tributaries by spearing and with gill nets. They have also a small hand net something like our common landing net, which is used in rapids where the salmon are crowded together and near the surface. These nets are ingeniously contrived, so that when a fish is in them his own struggles loosen a little stick which keeps the mouth of the net open while empty, but which, when the net is full, immediately draws it together like a purse with the weight of the salmon and effectually secures the prey.

The salmon taken during this period of the year are split open and dried in the sun for their winter's supply. I have never seen salt made use of by any tribe of Indians for the purpose of preserving food, and they all evince the greatest dislike to salt meat.

I may here mention a curious fact respecting the salmon of the Columbia river; they have never been known to rise to a fly, although it has been frequently tried by gentlemen of the Hudson's Bay Company, with the very best tackle. The salmon go up the river as far as they possibly can and into all its tributary streams in myriads; it is, however, a well known fact that after spawning they never return to the sea, but all die in the river; the Columbia is hardly ever free from gill nets, and no salmon has ever been taken returning; and in the fall, wherever still water occurs, the whole place is tainted by their putrid bodies floating in immense masses. I have been obliged to travel through a whole night trying to find an encampment free from their disgusting effluvia.

The Chinooks also catch a considerable number of sturgeon, which here attain to an enormous size, weighing from four to six cwt.; this is done by means of a long-jointed spear handle seventy or eighty feet in length, fitted into, but not actually fastened to a barbed spear-head, to which is attached a line, with this they feel along the bottom of the river, where the sturgeon are found lying at the spawning season. Upon feeling the fish the barbed spear is driven in and the handle withdrawn. The fish is then gradually drawn in by the line, which being very long allows the sturgeon room to waste his great strength, so that he can with safety be taken into the canoe or towed ashore.

At the mouth of the river a very small fish, about the size of our Sardine, is caught in immense numbers. It is called there Uhlékun, and is much prized on account of its delicacy and extraordinary fatness. When dried this fish will burn from one end to the other with a clear steady light like a candle. The Uhlékuns are caught with astonishing rapidity by means of an instrument about seven feet long; the handle is about three feet, into which is fixed a curved wooden blade about four feet, somewhat the shape of a sabre, with the edge at the back. In this edge, at the distance of an inch and a-half, are inserted sharp bone teeth about an inch long. The Indian standing in the canoe draws this edgeways with both hands, holding it like a paddle, rapidly through the dense shoals of fish which are so thick that almost every tooth will strike a fish. One knock across the thwarts safely deposits them in the bottom of the canoe. This is done with such rapidity that the Indians will not use nets for this description of fishing.

There are few whales now caught on the coast, but the Indians are most enthusiastic in the chase. Upon a whale being seen blowing in the offing they rush down to their large canoes and push off, with ten or twelve men in each. The canoes are furnished with a number of strong seal skin bags filled with air, and made with great care and skill, capable of containing about ten gallons. To each bag is attached a barbed spear-head by a strong string about eight or nine feet long, and in the socket of the spear-head is fitted a handle five or six feet in length. Upon coming up with the whale, the barbed heads, with the bags attached, are driven into it and the handles withdrawn. The attack is continually renewed until the whale is no longer able to sink from the buoyancy of the bags, when he is despatched and towed ashore. The blubber of the whale is much prized amongst them, and is cut into strips about two feet long and four inches wide, and eaten generally with their dried fish.

Clams and oysters are very abundant, and seals, wild ducks and geese, are taken in great plenty, but their fishing is so productive that the Indians subsist with little labour. They are also very fond of herrings' roe, which they collect in the following manner:—They sink cedar branches to the bottom of the river, in shallow places, by placing upon them a few heavy stones, taking care not to cover the green foliage, as the fish prefer spawning on anything green, and they literally cover all the branches by next morning with spawn. The Indians wash this off in their water-proof baskets, to the bottom of which the roe sinks; this is squeezed by the hands into little balls and then dried, and is very palatable.

The only vegetables in use amongst the Chinooks are the Camas and Wappattoo. The Camas is a bulbous root much resembling the onion in outward appearance but is more like the potato when cooked and is very good eating. The Wappattoo is somewhat similar but larger and not so dry or delicate in its flavour. They are found in immense quantities in the plains in the vicinity of Fort Vancouver, and in the spring of the year present a most curious and beautiful appearance, the whole surface presenting an uninterrupted sheet of bright ultramarine blue from the innumerable blossoms of these plants. They are cooked by digging a hole in the ground, then putting down a layer of hot stones, covering them with dry grass, on which the roots are placed; they are then covered with a layer of grass, and on the top of this they place earth, with a small hole perforated through the earth and grass down to the vegetables. Into this they pour water, which, reaching the hot stones, forms sufficient steam to completely cook the roots in a short time, the hole being immediately stopped up after the introduction of the water. They often adopt the same ingenious process for cooking fish, meat, and game.

There is another article of food made use of amongst them, which from its disgusting nature I should have been tempted to omit, were it not a peculiarily characteristic trait of the Chinook Indian, both from its extraordinary character, and its use being confined solely to this tribe; it is, however, regarded only as a luxury and not as a general article of food. The whites have given it the name of Chinook Olives, and it is prepared as follows:—About a bushel of acorns are placed in a hole dug for the purpose close to the entrance of the lodge or hut, and covered over with a thin layer of grass, on top of which is laid about half a foot of earth; every member of the family for the next five or six months regards this hole as the special place of deposit for urine, which is on no occasion to be diverted from its legitimate receptacle. Even should a member of the family be sick and unable to reach it for this purpose, the fluid is carefully collected and carried thither. However disgusting such an cdoriferous preparation would be to people in civilized life the product is regarded by them as the greatest of all delicacies; so great indeed is the fondness they evince for this horrid preparation that even when brought amongst civilized society they still yearn after it and will go any distance to obtain it. A gentleman in charge of Fort George had taken to himself a wife, a woman of this tribe, who of course partook with himself of the best food the Fort could furnish; notwithstanding which, when he returned home one day his nostrils where regaled with a stench so nauseating that he at once enquired where she had deposited the Chinook olives, as he knew that nothing else could poison the atmosphere in such a manner. Fearful of losing her dearly-prized luxury she strenuously denied their possession: his nose however, led him to the place of deposit, and they were speedily consigned to the river. His mortification was afterwards not a little increased by learning that she had purchased the delicacy with one of his best blankets.

During the season the Chinooks are gathering Camas and fishing, they live in lodges constructed by means of a few poles covered with mats made of rushes, which can be easily moved from place to place; but in the villages they build permanent huts of split cedar boards. Having selected a dry place for the village, a hole is dug about three feet deep and about twenty feet square: round the sides of this, square cedar boards are sunk and fastened together with cords and twisted roots, rising about four feet above the outer level; two posts are sunk at the middle of each end with a crutch at top, on which the ridge pole rests, and boards are laid from thence to the top of the upright boards. Fastened in the same manner round the interior are erected sleeping places, one above another, something like the berths in a vessel, but larger. In the centre the fire is made, the smoke of which escapes by means of a hole left in the roof for that purpose. These lodges are filthy beyond description and swarm with vermin. The fire is procured by means of a flat piece of dry cedar, in which a small hollow is cut, with a channel for the ignited charcoal to run over; this piece the Indian sits on, to hold it steady, while he rapidly twirls a round stick of the same wood between the palms of his hands with the point pressed into the hollow of the flat piece. In a very short time sparks begin to fall through the channel upon finely frayed cedar bark placed underneath, which they soon ignite. There is a great deal of knack in doing this, but those who are used to it will light a fire in a very short time. The men usually carry these sticks about with them, as after they have been once used they produce the fire quicker.

The only warlike implements I have seen amongst the Chinooks were bows and arrows. The bows are made from the Yew tree, and the arrows are feathered and pointed with sharp bone. These they use with great precision.

Their canoes are hollowed out of the cedar, and some of them are very large, as this tree grows to an immense size in the neighbourhood. They make them exceedingly light, and from their formation they are capable of withstanding very heavy seas.

Slavery is carried on to a great extent along the North-West coast and in Vancouver's Island; and the Chinooks, considering how much they themselves have been reduced in numbers, still retain a large number of slaves. These are usually procured from the Chastay tribe who live near the Umqua, a river south of the Columbia emptying into the Pacific. They are sometimes seized by war parties, but are often bought from their own people. They do not flatten the head, nor is the child of one of them (although by a Chinook father,) allowed this distinguishing mark of freedom. Their slavery is of the most abject description: the Chinook men and women treat them with great severity, and exercise the power of life and death at pleasure. An instance of the manner in which the Chastay slaves are treated presented itself to my own observation one morning while I was out sketching on Vancouver's Island. I saw upon the rocks the dead body of a young woman whom I had seen a few days previously walking about in perfect health, thrown out to the vultures and crows. I mentioned it to a gentleman of the Hudson's Bay Company, who accompanied me to the lodge she belonged to, where we found an Indian woman, her mistress, who made light of her death, and who was no doubt the cause of it. She said a slave had no right to burial. She was furious on being told that the slave was as good as herself. "She, the daughter of a chief, no better than a slave!" She then stalked out of the lodge with great dignity; the next morning she had taken down the lodge and was gone. I was also told by an eye witness, of a chief who, having erected a colossal idol of wood, sacrificed five slaves to it, barbarously murdering them at its base, and asking in a boasting tone who among them could afford to kill so many slaves. One of these slaves was a handsome girl who had lived from her infancy in his family, and begging most piteously for life, reminded him of the care she had taken of his children and all the services she had rendered; but her pleadings were of no avail, and the brutal wretch with his own hand plunged a knife four times into her body before she ceased her appeals for mercy. The only distinction made in her favour was that she was buried, instead of being, like her miserable companions, thrown out on the beach.

The principal amusement of the Chinooks is gambling, which is carried to great excess amongst them. You never visit the camp but you hear the monotonous gambling song of "he ha, ha," accompanied by the beating of small sticks on some hollow substance. Their games do not exceed two or three, and are of a simple nature. The one most generally played consists in holding in each hand a small piece of stick the thickness of a goose quill and about an inch and a-half in length, *one plain and the other distinguished by a little thread* wound round it, the opposite party being required to guess in which hand the marked stick is to be found. A Chinook will play at this simple game for days and nights together, until he has gambled away everything he possesses, even his wife. They play, however, with much equanimity, and I never saw any ill-feeling evinced by the loser against his successful opponent. They will cheat if they can, and pride themselves on its success; if detected no unpleasant consequence follows, the offending party being merely laughed at and allowed to amend his play.

Another game to which the Chinooks are very partial is played by two or three on each side. The rivals sit on the ground opposite each other with the stakes lying in the centre, one begins with his hands on the ground in which he holds four small sticks covered from sight by a mat, these he arranges in any one of a certain number of forms prescribed by the rules of the game, and his opponent on the opposite side endeavours to guess which form he has chosen; if successful a mark is stuck up in his favour, and the sticks are handed to the next, if not the player counts and still goes on till discovered. When those on one side have gone through, the others commence. At the conclusion the marks are counted and the holder of the greater number wins. This game is also accompanied by singing, in which all the bystanders join.

Another game which I have seen amongst them is called Al-kol-loch, and is one that is universal along the Columbia river. It is considered the most interesting and important as it requires great skill. A smooth level piece of ground is chosen, and a slight barrier of a couple of sticks laid lengthways is made at each end. These are forty or fifty feet apart and a few inches high. The two opponents, stripped naked, are armed each with a very slight spear about three feet long and finely pointed with bone. One of them takes a ring made of bone or some heavy wood, about three inches in diameter, and wound round with cord, on the inner circumference of which are fastened six beads of different colours at equal distances, to each of which a separate numerical value is attached; the ring is then rolled along the ground to one of the barriers and is followed at the distance of two or three yards by the players, and as the ring strikes the barrier and is falling on its side the spears are thrown so that the ring may fall on them; if only one of the spears should be covered by the ring the owner of it counts according to the coloured bead over it. But it generally happens, from the dexterity of the players, that the ring covers both spears, and each count according to the colours of the beads above his weapon. They then play towards the other barrier, and so on until one party has attained the number agreed upon for game.

The Chinooks have tolerably good horses, and are fond of racing, at which they bet considerably; they are expert jockeys and ride fearlessly. They also take great delight in a game with a ball, which is played by them in the same manner as by the Cree, Chippewa, and Sioux Indians. Two poles are erected about a mile apart, and the company is divided into two bands armed with sticks, having a small ring or hoop at the end, with which the ball is picked up and thrown to a great distance, each party then strives to get the ball past their own goal. There are sometimes hundreds on a side, and the play is kept up with great noise and excitement. At this game they also bet heavily, as it is generally played between tribes or villages.

The sepulchral rites of this singular tribe of Indians are too curious to be entirely omitted. Upon the death of a Chinook the body is securely tied up in rush matting and placed in the best canoe they can procure, without any peculiar ceremonies. This canoe is as highly decorated as the family of the deceased can afford. Tin cups, kettles, plates, pieces of cotton, red cloth, and furs, and in fact everything which they themselves most value, and which are most difficult for them to obtain, are hung round the canoe; inside, beside the body they place paddles, spears, bows and arrows, and food, with everything else which they consider necessary for a very long journey. I have even found beads, Ioquas shells, brass buttons, and small coins in the mouths of the skeletons. The canoe is then taken to the burial place of the tribe, generally selected for its isolated situation. The two principal places are rocky islands in the lower part of the Columbia River. One is called Coffin Rock from the appearance it presents, covered with the raised biers of the deceased members of the tribe. To these they tow the canoe, which is then either fastened up in a tree or supported on a sort of frame four or five feet from the ground made of strong cedar boards, and holes bored in the bottom of the canoe to let the water run out; it is then covered with a large piece of bark to protect it from the rain. Before leaving, the usefulness of every article left with the corpse is destroyed, by making holes in the kettles, cans, and baskets, cracking the bows, arrows, and spears, and if there is a gun they take the lock off, believing that the Great Spirit will mend them upon the deceased arriving at the hunting grounds of their Elysium. The greatest crime which an Indian can commit in the eyes of his people is that of desecrating one of these canoes, and it very seldom happens that the slightest thing is removed.

In obtaining a specimen of one of the peculiarly formed skulls of the tribe I had to use the greatest precaution, and ran no small risk not only in getting it, but in having it in my possession afterwards. Even the voyageurs would have refused to travel with me had they known that I had it among my collections, not only on account of the superstitous dread in which they hold these burial places, but also on account of the danger arising from a discovery, which might have cost the lives of the whole party.

A few years before my arrival at Fort Vancouver, Mr. Douglass, who was then in charge, heard from his office in the Fort the report of a gun inside the gates; this being a breach of discipline he hurried out to enquire the cause of so unusual a circumstance, and found one of Casenov's slaves standing over the body of an Indian whom he had just killed, and in the act of reloading his gun with apparent indifference, Casenov himself standing by. On Mr. Douglass arriving at the spot, he was told by Casenov, with an apology, that the man deserved death according to the laws of the tribe, who, as well as the white man inflicted punishment proportionate to the nature of the offence. In this case the crime was one of the greatest an Indian could be guilty of, namely, the robbing the sepulchre canoes. Mr.

Douglass after severely reprimanding him allowed him to depart with the dead body.

Sacred as the Indians hold their burial places, Casenov himself, a short time after the latter occurrence, had his only son buried in the cemetery of the fort. He died of consumption—a disease very frequent amongst all Indians—proceeding no doubt from their constant exposure to the sudden vicissitudes of the climate. The coffin was made sufficiently large to contain all the necessaries supposed to be required for his comfort and convenience in the world of spirits. The chaplain of the fort read the usual service at the grave, and after the conclusion of the ceremony, Casenov returned to his lodge, and the same evening attempted, as narrated below, the life of the bereaved mother, who was the daughter of the great chief generally known as King Comcomly, so beautifully alluded to in Washington Irving's "Astoria." She was formerly the wife of a Mr. McDougall, who bought her from her father for, as it was supposed, the enormous price of ten articles of each description, guns, blankets, knives, hatchets, &c., then in Fort Astoria. Comcomly, however, acted with unexpected liberality on the occasion by carpeting her path from the canoe to the Fort with sea otter skins, at that time numerous and valuable, but now scarce, and presenting them as a dowry, in reality far exceeding in value the articles at which she had been estimated. On Mr. McDougall's leaving the Indian country she became the wife of Casenov.

It is the prevailing opinion of the chiefs that they and their sons are too important to die in a natural way, and whenever the event takes place they attribute it to the malevolent influence of some other person, whom they fix upon, often in the most unaccountable manner, frequently selecting those the most dear to themselves and the deceased. The person so selected is sacrificed without hesitation. On this occasion Casenov selected the afflicted mother, notwithstanding she had during the sickness of her son been most assiduous and devoted in her attentions to him, and of Casenov's several wives she was the one he most loved; but it is the general belief of the Indians on the west side of the mountains, that the severer the privation they inflict upon themselves the greater is therefore the manifestation of their grief, and the more pleasing to the departed spirit. Casenov assigned to me, as an additional motive for his wish to kill his wife, that as he knew she had been so useful to her son and so necessary to his happiness and comfort in this world, he wished to send her with him as his companion on his long journey. She, however, escaped into the woods, and next morning reached the Fort, imploring protection; she was accordingly secreted for several days until her own relations took her home to Chinook Point. In the meantime a woman was found murdered in the woods and the act was universally attributed to Casenov or one of his emissaries.

I may here mention a painful occurence which took place on Thompson's River, in New Caledonia, in further illustration of this peculiar superstition. A Chief dying, his widow considered a sacrifice as indispensable, but having selected a victim of rather too much importance, she was unable for some time to accomplish her object; at length the nephew of the chief, no longer able to bear the continual taunts of cowardice which she unceasingly heaped upon him, seized his gun and started for the Company's Fort on the river, about twenty miles distant. On arriving, he was courteously received by Mr. Black, the gentleman in charge of the Fort, who expressed great regret at the death of his old friend the chief. After presenting the Indian with something to eat, and giving him some tobacco, Mr. Black turned to leave the room, and while opening the door was shot from behind by his treacherous guest and immediately expired. The murderer succeeded in escaping from the Fort, but the tribe, who were warmly attached to Mr. Black, took his revenge upon themselves and hunted him down. This was done more to evince their high esteem for Mr. Black than from any sense of impropriety in the customary sacrifice.

I never heard any traditions amongst the Chinooks as to their former origin, although such traditions are common among the Indian tribes on the east side of the Rocky mountains. They do not believe in any future state of punishment, although in this world they suppose themselves exposed to the malicious designs of the Skööcoom or evil genius, to whom they attribute all their misfortunes and ill luck. The good spirit is called the *Hias Soch-a-li Ti-yah*, that is the Great High Chief from whom they obtain all that is good in this life, and to whose happy and peaceful hunting grounds they believe they shall all eventually go, to reside for ever in comfort and abundance.

The medicine men of the tribe are supposed to possess a mysterious influence with these two spirits, either for good or evil, and of course possess great power in the tribe. These medicine men form a secret society, the initiation into which is accompanied with great ceremony and much expense. I witnessed, whilst amongst them, the initiation of a canditate, which was as follows:—The canditate has to prepare a feast for his friends and all who choose to partake of it, and make presents to the other medicine men. A lodge is prepared for him, which he enters, and remains alone for three days and nights, without food, whilst those already initiated keep dancing and singing round the lodge during the whole time. After this fast which is supposed to endue him wi:h wonderful skill, he is taken up apparently lifeless and plunged into the nearest cold water, where they rub and wash him until he revives. This they call "washing the dead." As soon as he revives he runs into the woods, and soon returns dressed as a medicine man, in a costume which generally consists of the light down of the goose stuck all over the body and head with thick grease, and a mantle of friezed cedar bark. With the medicine rattle in his hand he now collects all his property. blankets, shells and ornaments, and distributes the whole amongst his friends, trusting for his future support to the fees of his profession. The dancing and singing are still continued with great vigour during the division of the property, at the conclusion of which the whole party again sit down to feast, apparently with miraculous appetites, the quantity of food consumed being perfectly incredible.

I witnessed one day their mode of treatment of the sick whilst passing through a village. Hearing a horrible noise in one of the lodges, I entered it, and found an old woman supporting one of the handsomest girls of the tribe I had ever seen; cross-legged and naked in the middle of the room sat the medicine man with a wooden dish full of water before him, and twelve or fifteen other men sitting round the lodge. The object in view was to cure the girl of a disease affecting her side. As soon as my presence was noticed a space was cleared for me to sit down. The officiating medicine man appeared in a state of profuse pespiration from the exertions he had used, and soon took his seat amongst the rest as if quite exhausted; a younger medicine man then took his place in front of the bowl and close beside the patient; throwing off his blanket he commenced singing and gesticulating in the most violent manner. whilst the others kept time by beating with little sticks on hollow wooden bowls and drums, singing continually. After exercising himself in this manner for about half an hour, until the pespiration ran in streams down his body, he darted suddenly upon the young woman catching hold of her side with his teeth and shaking her for a few minutes, as one dog does another in fighting. The patient seeming to suffer great agony. He then relinquished his hold, and cried out he had got it, at the same time holding his hands to his mouth, after which he plunged them in the water, and pretended to hold down with great difficulty the disease which he had extracted lest it might spring out and return to its victim. At length having obtained the mastery over it, turning himself round to me in an exulting manner, he held something up between the finger and thumb of each hand, which had the appearance of a piece of cartilage, whereupon one of the Indians sharpened his knife and divided it in two, leaving one end in each hand. One of the pieces he threw into the water and the other into the fire, accompanying the action with a diabolical noise which none but a medicine man can make; after which he got up perfectly well satisfied with himself, although the poor patient seemed to me anything but relieved by the violent treatment she had undergone.

My principal object in travelling among the Indian tribes of the Far West was to obtain accurate sketches of their Chiefs, medicine men, &c., and representations of their most characteristic manners and customs, but it was only by great persuasion that I could induce the Indians to allow me to take their portraits. They had an undefined superstitious dread of losing something by the process, as though in taking their likeness something pertaining to themselves was carried off. The women, moreover, had the idea that the possessor of their picture would hold an unlimited influence over them. In one case I had taken the likeness of a woman at the Cowlitz river, and on my return about three months afterwards, I called at the lodge of Kisscox, the chief of the tribe, where I had been in the habit of visiting frequently, and had always been received with great kindness, but on this occasion I found him and his family unusually distant in their manner, and the children even running away from me and hiding; at last he asked me if I had not taken the likeness of a woman when last amongst them, I said I had, and mentioned her name, "Cawitchum," a dead silence ensued, nor could I get the slightest answer to my enquiries. Upon leaving the lodge I met a half-breed, who told me that Cawitchum was dead, and that I was supposed to be the cause of her death. The silence was occasioned by my having mentioned a dead person's name, which is considered disrespectful to the deceased, and unlucky. I immediatly left the neighbourhood, well knowing the danger that would result from my meeting with any of her relations.

Upon trying to persuade another Indian to sit for his likeness he asked me repeatedly if it would not endanger his life. Being very much in want of tobacco he at length appeared convinced by my assurances that it could do him no harm, but when the picture was finished he held up the tobacco and said it was a small piece to risk his life for. I asked another Indian while he was sitting in his lodge surrounded by his eight wives, for the same favor, but the ladies all commenced violently jabbering at me until I was glad to get off: he apparently was much gratified at the interest which his wives took in his welfare. I however met him alone some short time afterwards and got him to consent, with my usual bribe, a piece of tobacco. I could relate numerous instances of this superstitious dread of portrait painting, but the foregoing sufficiently illustrates the general feeling on the subject.

I shall conclude this paper by relating a legend told me by an old Indian while paddling in a canoe past an isolated rock on the shores of the Pacific, as it gives an idea of the general character of the legends on the coast, which are however very few, and generally told in an unconnected and confused manner. The rock with which the following Indian legend is associated. rises to a height of between six and seven feet above the water, and measures little more than four feet in circumference. I could not observe any very special peculiarity in the formation of this rock while paddling past it in a canoe; and, at least from the points of observation presented to my eye, no resemblance to the human figure—such as the conclusion of the legend might lead us to anticipate,—appeared to be traceable. Standing, however, as this rock does, entirely isolated, and without any other visible for miles around, it has naturally become an object of special note to the Indians, and is not uncalculated, from its solitary position, to be made the scene of some of the fanciful creations of their superstitous credulity.

"It is many moons since a Nasquawley family lived near this spot. It consisted of a widow with four sons; one of them was by her first husband, the other three by her second. The three younger sons treated their elder brother with great unkindness, refusing him any share of the produce of their hunting and fishing; he, on the contrary, wishing to conciliate them, always gave them a share of his spoils. He in fact was a great medicine man, although this was unknown to them, and being tired of their harsh treatment, which no kindness on his part seemed to soften, he at length resolved to retaliate. He accordingly one day entered the lodge where they were feasting and told them that there was a large seal a short distance off. They instantly seized their spears and started in the direction he pointed out, and coming up to the animal the eldest drove his spear into it. This seal was 'a great medicine,' a familiar of the elder brother who had himself created it for the occasion. The foremost of them had no sooner driven in his spear than he found it impossible to disengage his hand from the handle or to draw it out; the two others drove in their spears and with the like effect. The seal now took to the water, dragging them after it, and swam far out to sea. Having travelled on for many miles they saw an island in the distance, towards which the seal made; on nearing the shore they found that they could, for the first time, remove their hands from their spears; they accordingly landed, and supposing themselves in some enemies' country, they hid themselves in a clump of bushes from observation. While lying concealed they saw a diminutive canoe coming round a point in the distance, paddled by a very little man, who, when he came opposite to where they were, anchored his boat with a stone attached to a long line, without perceiving them. He now sprang over the side, and diving down, remained a long time under water, at length he rose to the surface and brought with him a large fish, which he threw into the boat; this he repeated several times, each time looking in to count the fish he had caught. The three brothers being very hungry, one of them offered to swim out while the little man was under water and steal one of the fish; this he safely accomplished before the return of the fisherman, but the little fellow no sooner returned with another fish than he discovered that one of those already caught was missing, and stretching out his hand he passed it slowly along the horizon, until it pointed directly to their place of concealment. He now drew up his anchor and paddled to the shore, and immediately discovered the three brothers; and being as miraculously strong as he was diminutive, he tied their hands and feet together and throwing them into his canoe, jumped in and paddled back in the direction from whence he had come. Having rounded the distant point where they first descried him, they came to a village inhabited by a race of people as small as their captor, their houses, boats, and utensils being all in proportion to themselves. The three brothers were taken out and thrown bound as they were into a lodge, while a council was convened to decide upon their fate. During the sitting of the council an immense flock of birds resembling geese, but much larger, pounced down upon the inhabitants and commenced a violent attack. These birds had the power of throwing their sharp quills like the porcupine, and though the little warriors fought with great valour they soon became covered with the piercing darts, and all sunk insensible on the ground; when all resistance had ceased the birds took to flight and disappeared. The three brothers had witnessed the conflict from their place of confinement, and with much labour had succeeded in releasing themselves from their bonds, when they went to the battle ground and commenced pulling the quills from the apparently lifeless bodies, but no sooner had they done this than all instantly returned to consciousness. When all of them had become well again they wished to express their gratitude to their preservers and they offered to grant whatsoever they should desire. The three brothers therefore requested to be sent back to their own country. A council was accordingly called to decide upon the easiest mode of doing so, and they eventually determined upon employing a whale for the purpose. The three brothers were then seated upon the back of the monster and proceeded in the direction of Nasquawley: however, when they had reached about half way the whale began to think what a fool he was for carrying them instead of turning them into porpoises and letting them swim home themselves. Now the whale being a "Soch-a-li-Tiyah" or great spirit—that is the highest of all animal spirits—but of course inferior to the "Ilias Soch-a-li Tiyah," who is the Great Spirit over all things, was able to do this at will, and he accordingly turned the three brothers into porpoises. This therefore is the way that the porpoises first came into existence, and accounts for their being constantly at war with the seals, one of which species was the cause of their first misfortunes. After the three brothers had so strangely disappeared their mother came down to the beach and remained there for days watching for their return and bewailing their absence with tears. While thus engaged one day the whale happened to pass by and taking pity on her distress he turned her into that stone."

NOTE ON THE OXALATE OF MANGANESE.

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Read before the Canadian Institute, December 20th, 1856.

In Gmelin's Handbuch, Vol. IV., the oxalate of the protoxide of manganese is described as having been obtained by Graham, combined with 5 equivalents (24,16 per cent.) of water, by precipitation of a solution of one part of manganese-salt in 100 of water, by means of oxalate of potassa; and this compound is stated to lose no water at 212°.F. Nothing is said with regard to the amount of water in the precipitate obtained from concentrated manganese solutions by oxalic acid.

There is evidently some error in the above statement, for the formula MnO, C^2O^3+5 HO requires 38,60 per cent. of water, and Mn O, C^2O^3+3 HO requires 27 39.

In the 89th volume of the Annalen der Chemie and Pharmacie, Hausmann and Löwenthal give an analysis of the oxalate obtained by acting on freshly precipitated carbonate of manganese with oxalic acid, from which they deduce the formula Mn O, C^2O^3+2 HO, for the salt dried at 212°. F.

The following experiments were made for the purpose of explaining the discrepancy.

Strong solutions of sulphate of manganese were precipitated by saturated solutions of oxalic acid, a granular white precipitate was obtained in both cases, which did not lose water at 212°. F. I. and II.

Similar solutions were mixed when boiling. III.

Sulphate of manganese was dissolved in 30 parts of water, and oxalic acid added, a light pinkish crystalline precipitate was formed after a time, which, in the course of a few days, changed into a perfectly white granular powder. IV.

Sulphate of manganese was dissolved in 30 parts of water, and a solution of oxalate of potassa added, a light pinkish crystalline precipitate gradually formed, having the appearance and lightness of benzoic acid, it absorbed and retained water like a sponge, and remained unchanged in the air at ordinary temperatures, but became perfectly white at 212°. F. V.

Sulphate of manganese was dissolved in 100 parts of water, and oxalate of potassa added; the same pink salt was obtained. VI. This should be the compound described by Graham, with 5 HO.

WHITE SALT.

I.	1.391	grms.	gave	0.5890	Mn^3O^4	= 39 38	per cent.	MnO
II.	1.292	"	"	0.5566	"	= 40.07	"	"
III.	1.717	"	"	0.7510	"	= 40.68	"	"
IV.	1.295	"	"	0 5545	"	= 39.83	"	"
					Mean	39.99.		

The formula MnO, C^2O^3+2 HO requires 39.72.

PINK SALT.

V.	1.0575 grms.	gave	0.418	Mn^3O^4	= 36.77	per cent.	MnO
	1.3700 "	"	0.536	"	= 36.79	"	"
VI.	1.4395 "	"	0.567	"	= 36.64	"	"
	1.5300 "	"	0.597	"	= 36,39	"	"
				Mean	36.62.		

1.5300 heated to 212°.F. lost 0.134 HO = 8.75 per cent. HO, and became perfectly white.

The formula MnO, C^2O^3+3 HO requires 36.09 per cent. MnO and one equivalent of water would = 9 09 per cent.

The red oxide of manganese is obtained by heating this salt, in a crystalline form; the complete conversion of the protoxide into the red oxide is only effected after a rather long roasting.

Burin du Buisson is of opinion that pure salts of the protoxide of manganese are colourless when in an anhydrous state, but reddish when hydrated, while Reithner and others ascribe the red colour to the presence of a salt of the sesquioxide. The pink colour of the above hydrate can scarcely be owing to the latter cause, inasmuch as the salt is produced both by oxalic acid and by oxalate of potash; and the salt with 2 HO is generally obtained perfectly white. (This salt is described by Liebig as having a tinge of pink, but in my experiments it was always white.) The pink crystallized salt changes in a warm atmosphere, even when kept in a close vessel, into the white compound, evolving water.

The oxalate dissolves readily in a hot solution of oxalate of ammonia, and crystalline compounds can be obtained as already described by Winkelblech: these crystalline crusts, however, seem to vary much in their composition, and are probably combinations of the true double salt with variable proportions of oxalate of ammonia, similar to the magnesia compounds lately described by Souchay and Leussen.

REVIEWS.

Canada at the Universal Exhibition of 1855.—Printed by order of the Legislative Assembly. Toronto: John Lovell, 1856.

The success which attended the Canadian exhibition at London, in 1851, naturally led to the expectation that no efforts would be spared to present at Paris, in 1855, a correct representation of the Natural Productions and Industry of this vast Province.

It was a triumph of no common order to receive a public acknowledgement of "the superiority of the Canadian collection at London, as far as the mineral kingdom was concerned, to all countries that forwarded their products to the Exhibition," and the "very remarkable specimens of the chief varieties of Canadian timber," together "with the fine supply of wheats, every sample of more than average excellence," so favorably noticed by the jurors, inspired the hope that Canada would be fairly represented and appreciated at the great Paris Exhibition, in 1855. Nor has this hope been disappointed, when the vast distance which separated us from the scene of rivalry and display is considered, and the facilities which wealth, leisure, and position, conferred on the majority of European Exhibitors.

With few exceptions, it could scarcely be a subject of personal pecuniary interest to the farmers and manufacturers of this country to send the results of their industry or skill to compete with ages of experience in Europe. Even the products of our forests, though if known in all their variety and excellence beyond our borders, they would doubtless create a profitable market, yet, if their representation had been altogether left to the unremunerated zeal of private contributors, it is scarcely probable that even they would have been fairly represented. Hence the Provincial Committee, appointed to secure a fitting representation of the products of this Country at the Paris Exhibition, arrived at the conclusion, that any attempt to induce *voluntary* efforts by local fairs, such as those which were held at Toronto and Montreal previous to the Exhibition of 1851, would be fruitless, and that it would be absolutely necessary that the Provincial Committee should have the authority to purchase such articles as they deemed it expedient to transmit to Paris.

In accordance with this suggestion the Canadian Government appropriated a sufficient sum to cover all the expenses of the transit and ultimate purchase of the articles sent. It was further suggested by the Executive Committee that every effort should be made to secure a satisfactory representation of the great staple products of Canada—Minerals, Agricultural Products, and Timber—so successfully represented at London in 1851; and also, that the manufactures of the country should be exhibited in their progressive stages up to the highest point of perfection. Local exhibitions were held at Toronto and Montreal, and selections made as in 1851, for transmission to Paris. Hence it appears that no effort was spared to have Canada properly represented, and with what success we are informed by Mr. Taché's Report of "Canada at the Universal Exhibition of 1855."

We are told that the display of the products of Mines, Forests, and Agriculture "was truly magnificent," and that the premiums obtained were such as to give full satisfaction to all who were interested in exhibiting the natural resources of Canada to the greatest advantage. The samples of agricultural product were very fine, and included every variety of the cereals cultivated in this country. Fifty-six different kinds of minerals are enumerated in the catalogue of articles sent, and sixty-four kinds of woods, together with numerous models in wax of the vegetables and fruits grown in the Province. The Executive Council close their report, which forms the first part of Mr. Taché's volume, "with the consoling reflection that the most complete success has crowned the undertaking, for the due carrying out of which, the country has manifested such earnest solicitude."

The two special Commissioners, Sir W. Logan and Mr. Taché, divided the duties of their office, the former undertaking the arrangement of the exhibition; the latter, the diffusion of information respecting Canada throughout Europe, and of the entire exhibition throughout Canada. These efforts resulted in attracting a larger share of public attention to Canada, in proportion to its population, than to any other country; and, Count Jaubert, in his work entitled "La Botanique à l'exposition universelle de 1855," reproachfully says, "now we can form an estimate of the value of those few arpents of snow ceded to England with such culpable carelessness by the Government of Louis XV."

The testimony of many distinguished men may be adduced to shew that the most complete success crowned the efforts made by this country at the Universal Exhibition, and in one history of that wonderful pageant, Mr. Robin, the author, remarks: "the efforts made by Canada, that old French Colony, to make a suitable appearance at the great Exhibition of 1855, efforts which have resulted, moreover, in the most complete success, coupled with the undoubted importance of that fine country, whose future cannot be otherwise than brilliant, render it a duty on our part to devote to it a distinct chapter." Canada obtained one grand medal of honour (Sir W. Logan,) and is the only colony which secured that distinction—one medal of honour for the collection of woods and grains, thirteen silver medals, thirty bronze medals, and forty-eight 'honorable mentions,'—making altogether ninety-three prizes carried off at Paris, while at London the number of prizes awarded to this country amounted only to sixty-three. Mr. Romain's Steam Cultivator was not exhibited, it having been purchased and withdrawn from the exhibition by the celebrated

Agricultural Machine makers, Crosskill & Co., and is now designated as "Romain's Canadian Steam Cultivator."

Mr. Taché published in Paris his prize essay entitled "Esquisse sur la Canada consideré sous le point de vue économiste,"—and in the report before us a translation of this little work is given. He also published a descriptive catalogue of the productions of Canada, exhibited in Paris in 1855, and at the end of each enumeration of articles embraced in the different classes, he gives their prices in this country, and appends remarks as to their distribution, commercial importance, &c. With reference to our progress in mining industry, we find that the exportations of metals from our mines was valued at £8,350 in 1852, and £74,000 in 1854. Attention is directed to the value of the Tamarack, as a serviceable wood, rapidly growing into favour in Europe. The oil of the black porpoise, *Delphinus minor*, is particularly noticed, on account of its remarkable property of retaining its fluidity at a very low temperature. Porpoise leather is altogether an article of Canadian manufacture, and possesses many valuable peculiarities. Birds'-eye maple was found to be excluded from general use in the Paris cabinet manufactories, on account of its price, and Mr. Taché very appropriately mentions the fact that it is used for fuel in Canada, and ought to be supplied at a price little above that of the commonest woods.

We are next furnished with "Observations on the Exhibition," which have already been published in the form of correspondence, addressed, during the exhibition, to a portion of the French Press of Lower Canada; these are republished in the Report, by order of the House of Assembly. Among many facts of interest to Canadians, contained in these instructive and attractive letters, we are told that the total area of the Crystal Palace at London, in 1851, was about 800,000 square feet—that of the Palace of Industry and its Annexe at Paris, exclusive of the Palace used for the exhibition of Fine Arts, 1,200,000 feet. The number of exhibitors at London was 14,840, at Paris 20,839.

Bearing in mind the depopulated condition of many of our Canadian rivers, which once swarmed with fish, Mr. Taché notices the illustrations of the new art of Pisciculture, and the specimens of young fry and spawn exhibited by Mr. Mallet, "who rears pike, carp, eels, &c., as other people do puppies." Various plans of fish-ways up mill dams are eminently suggestive, and ought to be introduced on every Canadian river where a dam is constructed, tending to oppose the upward progress of the fish in spawning time, and thus to depopulate our rivers.

Mr. Letailleur's success in replacing rare furs by sheep skins prepared and dyed in various ways and colours, appears likely to commend itself to Canadian manufacturers.

Comparing the Canadian part of the Exhibition with its European rivals, Mr. Taché says:

"In the first class, embracing all that relates to the extraction of mineral substances, and to the minerals themselves, we were among the last, and far behind most countries, in regard to metallurgical operations, for the very simple reason that we are deficient in the population and capital which carry on, and still more deficient in the men of science, who in France, England, Austria, Prussia, Belgium, and other countries, direct and enlighten the labors of the mine. But if we proceed to an examination of the minerals in their natural state, our section at once assumed the first rank, and no country was in a condition to compete with us for a moment, either in the aggregate or the details of the department. The class of Canadian minerals was the most complete, and had the advantage of displaying at a glance to the learned observer the geological configuration of the country, with reference to the industrial results which it may yield. For this success, which is a mere repetition of that obtained at London in 1851, Canada is indebted entirely to the geological commissioners; and this shews to demonstration, the necessity of continuing the labors of that commission on a more liberal scale. We possess in the bosom of the earth the untouched riches, which in England have been the main element of industrial and commercial greatness; but the conditions of progress towards that greatness, are the light of science, and extensive enterprise. Mining operations cannot be profitably conducted on a small scale.

When we reflect that the iron which abounds in Canada is nearly of the same quality as that of Sweden, that it is found in places, surrounded by immense forests, and that, we have at hand the stone, sand, and other matters which are necessary for the smelting, moulding, and casting of the metal, we may well wonder that every year we import from England, Sweden, and the United States, manufactured iron to the amount of more than £1,000,000. But, we must again observe, success attends such enterprises, only when undertaken on a grand scale, whatever the abundance of the raw material. The working of an iron mine is not for limited means, nor to be carried on on a petty scale. A cheap market must be a full market. In Europe blast furnaces are now built, capable of smelting 80,000 lbs. per diem. The want of coke in Canada, be it observed, does not oppose an obstacle to the successful prosecution of iron-works. Ours is a country of rich forests 270,000 square miles in extent. Sweden smelts her iron with charcoal only, and sells it to England for a paying price; the English convert it into steel and send it to other countries. Other European countries use charcoal, notwithstanding the general scarcity and dearness of wood in Europe."

It appears also that "no country could compete with us in the show of woods, and particularly of the kinds used in ship-building, including in the estimate all the various species. In this class are embraced, moreover, all the products of the chase and the fisheries, in which departments the Gulf, and the vast territories of the Saguenay and the North-West, place us beyond competition, if not as producers, at least as proprietors of the finest field for production, in the whole world." The hints derived from an inspection of the raw material used by cabinet makers and carpenters among European nations, suggest very extensive alterations in the mode of getting out timber in our Canadian Forests, which deserve special notice.

"In lumbering, as the making of timber is termed in Canada, just that amount of intelligence is brought into action, which is required for the squaring of the logs, and the sawing of them into the planks of commerce. None of that skill of woodcraft is exercised which turns to the best and most profitable account the various species, by attending to their several degrees of adaptation to the mechanic arts, and to the preparation to be expended on them to make them fit for market. As before observed, two things only are known, square timber and the plank three inches thick. A more recondite study of the application of timber to the mechanic arts, would instruct us in the fact, that there are conditions of length, girth, and diameter required in those arts, by the influence of which the square log of 50 feet long by 20 inches square, and plank of 12 feet by 10 inches, lose their intrinsic value as compared with that higher value which is derivable from compliance with those conditions. How many are the trees left to rot in the forest because they are not reducible to a saw log of the standard measure, or a square stick of the required dimensions: which, trimmed to another form, would in other markets bear a greater value, though diminished in volume.

Of more than sixty principal species of timber which we possess, we make profitable use of scarcely ten, the rest are left to absolute decay. In Europe the birds'-eye maple is considered as equal to the most precious of the woods used in cabinet-work. It is indeed hardly attainable, and when found, it bears a higher price than mahogany. From this cause arises the dearness of all the articles made of maple in Parisian cabinet-work, the finest in the world."

Our agricultural productions when compared with those of other countries placed us on a level with the foremost: "our grain won the admiration of all who saw it." The absence of Hemp, Flax and Tobacco, however, was particularly noticed in the Canadian section, and our climate and soil were thought to furnish very favourable conditions for the cultivation of those valuable articles. It is not perhaps generally known by those who expressed surprise at the absence of Tobacco, that the late spring frosts to which our climate is subject, render the growth of Tobacco an expensive and very hazardous experiment. Where labour is very dear and sowing time very transient, it becomes a mere matter of calculation how far the growth of Tobacco may be made remunerative. It has often succeeded admirably in the western peninsula, but the occurrence of late frosts has not unfrequently destroyed the crops over wide areas and discouraged the cultivation of this important narcotic. Hemp and Flax give better promise of remunerative returns, and will no doubt soon form an important article of Canadian production.

Our castings did not meet with much favour, and the reasons may be drawn from the following observations by Mr. Taché :

"What lightness is found in the railings, the iron seats, &c., of the English manufacture of the Coalbrookdale Company in Shropshire, and how cheap also are the articles? The reason is plain, the purchaser has not to pay for a lot of useless iron."

"What elegance there is in the stoves and other articles of French manufacture, from the blast furnaces of the Marquis de Vogué of France? These designs of hunting and historical scenes are bas-reliefs of art, and the articles are not dearer on that account, because the material is not wasted; and as to the casting, the beautiful costs no more than the most deformed piece that ever was moulded. This is now generally understood; and in England where art is less perfect than in France and Belgium, the proprietors of foundries endeavour to procure artists from those two countries. A French sculptor, M. Geneste, is at this moment, in the receipt of a salary of £2000 per annum from an English manufacturer."

"The art of combining the useful with the agreeable is the climax of material progress. The study of the beautiful in art, is, to the intellectual man, what the study of truth is to his moral existence."

From many admirable inventions and applications which commend themselves to the attention of Canadians, and which are specially noticed with that object by Mr. Taché, we select some which appear likely to meet with adoption and favour. A smoke consuming coal grate, which is in the shape of an endless chain, and uncoils as the coal is consumed, thus combining advantages of health and economy. A machine by M. Chevalier, which by means of an endless steel wire adapted to pullies, saws with the greatest regularity the hardest stone, as quartz, granite, and even crystal. Two machines by M. Sautreuil, of Léchamp; one for preparing flooring boards by a single stroke, the other a planing machine, for smoothing timber for building purposes, on four sides at once. Messrs. Irey and Roly, of Paris, have introduced caoutchouc as a material for springs in all their machines. In the manufacture of chemical matches, for the production of an instantaneous light, Austria employs not less than 20,000 persons, and the highest price for round matches is only one penny per thousand. Mr. Quinti, of Vienna, showed how by interrupting the current by non-conductors, two communications may be transmitted simultaneously in opposite directions by the same wire. The preservation of food by the perfect exclusion of external air is easily accomplished by the immersion of game, or other meats, in a warm solution of gelatine. The celebrated Russia Leather is tanned with the decoction of willow bark, and impregnated with an oil extracted from the bark of the bouleau. A curious result of the artificial preparation of a valuable pigment is shown in the manufacture of Ultramarine. The nattural mineral used to cost £75 per pound, and no more than four pounds were used in Europe in a year; now Europe manufactures and consumes 5,000,000 lbs. per annum, at a cost of one shilling per pound. One of the active principles in opium having been artificially produced there is no doubt but that quinine and other valuable medicinal agents will be prepared on a large and cheap scale in the laboratory. Vegetables may be prepared, for keeping by exposure to hot air and powerful compression, so that 1200 lbs. of dried vegetables may be packed into a space little exceeding a cube yard; but 1200 lbs. of dried vegetables represent 8000 lbs. in their natural condition, which would require nearly forty cubic yards to contain them. The allied armies in the Crimea were provided with vegetables thus prepared to the extent of 42,000,000 rations. M. Coignet, of St Denis, exhibited a stone consisting of coal ashes and quick lime; or of sand, small shingle and lime: it is run like grouting. We may here observe that this method of building has long been practised in Amerca and even in the neighbourhood of Toronto.

It is unnecessary to advert to the "Sketch of the Geology of Canada," by Sir W. Logan and Mr. Hunt, or to the beautiful geological map accompanying the sketch, which are together appended to Mr. Taché's report, a. these admirable and instructive illustrations of our mineral wealth have already been noticed in the Canadian Journal (new series, vol. i, p. 379.) We shall draw this brief summary of Mr. Taché's report to a close with a quotation from M. Fresca's work on the Exhibition; deeming it more satisfactory to receive and accept the testimony of a distinguished foreigner, than to express the favourable opinions of our great success at Paris which the perusal of Mr. Taché's report create.

"Canada," says M. Fresca, "is a land of hope not likely to be disapointed. Active, intelligent, and enterprising beyond all other nations, which equally abound in the elements of industral production, she claims and demands our attention."

H. Y. H.

The Tenth Annual Report of the Smithsonian Institution for the year 1855. Washington, 1856.

To such of our readers as are unacquainted with the origin and operation of this splendid establishment, the following brief notice may not be unacceptable:

Hugh Smithson, from whom the institution derives its name, was a relative of the Duke of Northumberland. He was much devoted to physical science, and at Oxford, where he graduated, enjoyed the reputation of being the best chemist in the university. He was a cosmopolitan in his views, and used to express himself to the effect that the man of science belongs exclusively to no country; that the world is his country and all men are his countrymen. It was, it is believed, at one time his intention to leave his property to the Royal Society of London, for the promotion of science, but in consequence of a misunderstanding with the council of the society, he changed his mind and left it to his nephew, and, in case of the death of that relation without issue, to the United States of America, to found the institution which now bears his name.

In 1829 Smithson died, leaving his fortune, £120,000, 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.

In 1838, the nephew having died, the money was paid over by the English Court of Chancery to the Agent appointed by the Government of the United States; and eight years afterwards, in 1846, an Act was passed through Congress for the establishment of the Smithsonian Institution.

By this Act the immediate government of the institution devolved upon the Board of Regents consisting of the following 15 members:

The Vice-President of the United States, the Chief Justice of the Supreme Court, 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 of Representatives, appointed by the Speaker; six persons 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.

With a view of carrying the wishes of the testator into effect the Secretary, Professor Henry, was empowered to draw up a programme for the organization of the institution, which was presented in his first Annual Report to the Board of Regents and adopted by them in 1847.

As this programme is presented in the report before us we are enabled to give some extracts which serve to exhibit the principles that guide the governing body, as well as the mode of carrying the objects of the institution into effect.

"General considerations which should serve as a guide in adopting a plan of organization.

(1). Will of Smithson. The property is bequeathed 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.

(2). The bequest is for the benefit of mankind. The Government of the United States is merely a trustee to carry out the design of the testator.

(3). The institution is not a national establishment, as is frequently supposed, but the establishment of an individual, and is to bear and perpetuate his name.

(4). The objects of this institution are, 1st., to increase, and 2nd, to diffuse, knowledge among men.

(5). These two objects should not be confounded with one another. The first is to enlarge the existing stock of knowledge by the addition of new truths; and the second, to disseminate knowledge, thus increased, among men.

(6). The will makes no restriction in favor of any particular kind of knowledge; hence all branches are entitled to a share of attention.

(13). It should be recollected that mankind in general are to be benefited by the bequest, and that, therefore, all unnecessary expenditure on local objects would be a perversion of the trust.

(14). Besides the forgoing considerations, deduced immediately from the will of Smithson, regard must be had to certain requirements of the Act of Congress establishing the institution. These are, a library, a museum, and a gallery of art, with a building on a liberal scale to contain them."

In order to carry out the two leading objects of the will of Mr. Smithson, the *increase*, namely, and the *diffusion* of knowledge, the same report recommends the following plans:

To *increase* knowledge one means proposed is to stimulate men of talent to make original researches by offering suitable rewards for memoirs containing new truths. The memoirs thus obtained are to be published in a series of volumes, and entitled Smithsonian Contributions to Knowledge.

Among the various objects of research named for which pecuniary appropriations may be made are included, a system of meteorological observations for solving the problem of American storms; Explorations in Natural History and Geology; Magnetic and Topographical Surveys; the solution of various experimental problems; and Statistical, Historical and Ethnological enquiries.

To promote the *diffusion* of knowledge the two leading means suggested are the publication of periodical reports on the progress of different branches of knowledge, and the publication occasionally of separate treatises.

For the preparation of these reports it is proposed that men eminent in the respective branches be employed, that they be furnished with journals and other necessary publications, and that they be paid a certain sum for their labors.

In virtue of the Act of Congress, the Secretary and his assistants, during the session of Congress, will be required to illustrate new discoveries in science and to exhibit new objects of art; distinguished individuals will also be invited to give lectures on subjects of general interest.

On the occasion of the meeting of the Regents in 1847, it was resolved to divide the income into two equal parts; one to be appropriated to increase and diffuse knowledge agreeably to the scheme above given; and the other part to be appropriated to the formation of a library and a collection of objects of nature and of art.

This resolution was, however, rescinded at the meeting of January, 1855, when it was determined that

"The annual appropriations should be apportioned specially among the different objects and operations of the institution, in such manner as might, in the judgment of the Regents, be necessary and proper for each, according to its intrinsic importance, and a compliance in good faith with the law."

Admirably adapted as the foregoing scheme would seem to be for carrying out *bonâ fide*, the design of the founder, efforts have been made by some persons to divert from their legitimate channel the funds destined for cosmopolitan purposes, and to expend them on objects of a comparatively local character The good sense and honorable feeling of the nation have, however, triumphed, and will, it is hoped, insure the permanence of the institution on its present footing. The mode of procedure adopted by the Regents in conducting the affairs of the institution having been brought under the notice of Congress in 1855, the matter was referred to a Special Committee of the House of Representatives and to the Judiciary Committee of the Senate. In reporting subsequently on the matter the Judiciary Committee unanimously approved of the acts of the Regents in construing the law of Congress, in interpreting the will of Smithson, and in what they had done in the way of increasing and diffusing knowledge among men.

In the verdict of the Judiciary Committee we find the following language:

(Referring to the legacy). "It is not bequeathed to the United States to be used for their own benefit and advantage only, but in trust to apply to the increase and diffusion of knowledge among mankind generally, so that other men and other nations might share in its advantages as well as ourselves."

Again, in reference to the proposed application of the funds to the formation of a library, the Judiciary Committee go on to say:

"Such an application of the funds could hardly be regarded as a faithful execution of the trust; for the collection of an immense library at Washington would certainly not tend to increase or diffuse knowledge in any other country, not even among the countrymen of the testator; very few even of the citizens of the United States would receive any benefit from it.

"This is the construction which the Regents have given to the Acts of Congress, and in the opinion of the committee, it is the true one, and, acting under it, they have erected a commodious building, given their attention to all the branches of science mentioned in the law, to the full extent of the means afforded by the fund of the institution, and have been forming a library of choice and valuable books, amounting already to more than fifteen thousand volumes. The books are, for the most part, precisely of the character calculated to carry out the intentions of the donor of the fund, and of the Act of Congress. They are chiefly composed of works published by or under the auspices of the numerous institutions of Europe which are engaged in scientific pursuits, giving an account of their respective researches and of new discoveries whenever they are made. These works are sent to the Smithsonian Institution in return for the publications of this institution which are transmitted to the learned societies and establishments abroad. The library thus formed, and the means by which it is accomplished, are peculiarly calculated to attain the objects for which the munificent legacy was given in trust to the United States. The publication of the results of scientific researches made by the institution is calculated to stimulate American genius, and at the same time enable it to bring before the public the fruits of its labors. And the transmission of these publications to the learned societies in Europe, and receiving in return the fruits of similar researches made by them, gives to each the benefit of the increase of knowledge which either may obtain, and at the same time diffuses it throughout the civilized world. The library thus formed will contain books suitable to the present state of scientific knowledge, and will keep pace with its advance; and it is certainly far superior to a vast collection of expensive works, most of which may be found in any public library, and many of which are mere objects of curiosity or amusement, and seldom, if ever, opened by any one engaged in the pursuit of science."

The Judiciary Committee conclude their report in the following terms:

"From the views entertained by the committee, after an impartial examination of the proceedings referred to, the committee have adopted the language of the resolution, 'that no action of the Senate is necessary and proper in regard to the Smithsonian Institution; *and this is the unanimous opinion of the committee.*'"

Having then briefly considered the origin, proposed objects and mode of action of this magnificent establishment, it remains for us to examine from the report for the year 1855 how far the proposed objects are in course of accomplishment.

The following are the principal contents of the report of the Regents for 1855;

The Report of the Secretary to the Board of Regents; the Report of the Assistant Secretary and Curator; Reports of sub-committees relative to expenditure; Journals of meetings of the board; outlines of several lectures delivered in the rooms of the institution; directions to meteorological observers and various reports and suggestions relative to meteorological observations; correspondence relative to Ethnological and Topographical researches; and, finally, a long and able report on the present condition of the science of galvanism, by Professor Müller, of Freiburg, and translated from the German by Mr. Baker, of the Coast Survey.

SECRETARY'S REPORT.

Among the memoirs which, in accordance with the announcement in the Secretary's Report, form the eighth volume of the Smithsonian Contributions are the following: along with others, by Major B. Alvord, and Dr. Joseph Jones; and a record of Auroral phenomena, by P. Force:

(1). On the progress of information and opinion respecting the archæology of the United States, by Samuel F. Haven, Librarian of the American Antiquarian Society.

(2). A paper on the recent secular period of the Aurora Borealis, by Professor Olmstead.

One useful function of the Smithsonian Institution is that of effecting literary and scientific exchanges between individuals and societies. The extent of their operations in this department may be judged of by the fact that in the year 1855, 8585 packages for distribution passed through the hands of the institution.

The Smithsonian agency is not confined to the transmission of works from the United States, but is extended to those of Canada and Central and South America, and its foreign relations embrace every part of the civilized world. It brings into friendly correspondence cultivators of original research the most widely separated, and emphatically realizes the idea of Smithson, that "the man of science is of no country;" that "the world is his country, and all mankind his countrymen."

The system of exchange has found favor with foreign governments, and the Smithsonian packages are now admitted into all parts to which they are sent, without detention and free of duty.

METEOROLOGY.

Since the publication of the former report an arrangement has been made with the Commissioner of Patents, by which the system of Meteorological observations established under the direction of the institution will be extended, and the results published more fully than the Smithsonian income will allow.

With respect to the complaints that have been made that but few of the materials collected have been published, the report remarks, "It is more important that the information should be reliable than that it should be quickly published," and "what may be lost by delay is more than compensated by the precision and value of the results.

The reduction of the meteorological observations have been continued by Professor Coffin. He has completed the discussion of all the records for 1854, and those of 1855 as far as they have been sent in.

LIBRARY.

It is the present intention of the Regents to render the Smithsonian library the most extensive and perfect collection of Transactions and scientific works in this country, and this it will be enabled to accomplish by means of its exchanges, which will furnish it with all the current journals and publications of societies. The Institution has already more complete sets of transactions of learned societies than are to be found in the oldest libraries in the United States.

MUSEUM.

It is no part of the plan of the institution to form a Museum merely to gratify the curiosity of the casual visitor to the Smithsonian building, but it is the design to form complete collections in certain branches, which may serve to facilitate the study and increase the knowledge of natural history and geology.

With respect to the condition of the Museum, the report asserts that no collection of animals in the United States, nor indeed in the world, can even now pretend to rival the richness of this Museum in specimens which tend to illustrate the natural history of North America.

In the report of Professor Baird, the Assistant-Secretary, many details are given relative to the additions to the Museum. These additions have been made in great measure through the agency of the government exploring expeditions, and partly also through that of individuals under the orders of the institution.

LECTURES.

The titles of the lectures, of which the substance is given in the volume before us, are as follows:

(2). A course of lectures on Marine Algæ, by W. H. Harvey, of the University of Dublin.

(2). Natural History as applied to farming and gardening, by Rev. J. G. Morris of Baltimore.

(3). Insect instincts and transformations, by the same.

(4). On oxygen and its combinations, by Professor Chase, of Brown University

(5). On meteoric stones, by Lawrence Smith, of the University of Louisville, Ky

(6). On planetary disturbances, by Professor Snell, of Amherst College.

The first lecture, by the Rev. Mr. Morris, on natural history as applied to farming and gardening, will be read with peculiar interest at the present time, when attention has been so much attracted to insect ravages on the corn crops. One practical evil, spoken of by the lecturer, arising from ignorance of the habits of insects, is that farmers and gardeners, by destroying one class of noxious animals, expose themselves to the ravages of more numerous and destructive creatures, whose numbers, the first, if suffered to live, would have kept within bounds. Speaking of one kind of moth, peculiarly hurtful to the vineyards in France, and of what may be done to check the evil if the habits of the creature be understood, he states that in twelve days from twenty to thirty women and children destroyed upwards of forty millions of eggs that would have been hatched in a few days. From the sketch of this lecture given, we are led greatly to regret that the abstract should not have had a greater space allotted to it than five pages.

LECTURE ON METEORIC STONES, BY DR. J. L. SMITH.

The lecturer distinctly maintains the lunar organ of meteoric stones. The discussion which, even in its abridged form, occupies twenty-four pages, is concluded in the following terms:

"To sum up the theory of the lunar origin of meteorites, it may be stated that "the moon is the only large body in space of which we have any knowledge, "possessing the requisite conditions demanded by the physical and chemical pro- "perties of meteorites; and that they have been thrown off by volcanic action, "(doubtless long since extinct) or some other disruptive force, and encountering "no gaseous medium of residence, reached such a distance as that the moon ex- "ercised no longer a preponderating attraction, the detached fragment possessing "an orbital motion and an orbital velocity, which it had in common with all parts of "the moon, but now more or less modified by the projectile force and new condi- "tion of attraction in which it was placed with reference to the earth, acquired "an independent orbit more or less elliptical. This orbit, necessarily subject to "great disturbing influences may sooner or later cross our atmosphere and be "intercepted by the body of the globe."

The lecture of Professor Snell is an able popular exposition of the subject of planetary disturbances.

METEOROLOGY.

Of the matter contained in the present volume, that of the greatest importance on account of its immediate connection with a great scientific movement now in progress in Canada, is the body of directions for the meteorological observations adopted by the Smithsonian Institution. These instructions are well worthy of the study of all persons interested in this class of research.

Following the directions to observers is an account of a series of observations carried on, chiefly for the purpose of ascertaining the duration of thunder claps.

The Report of Professor Müller on galvanism, extending as it does through upwards of 100 closely printed pages, puts any attempt at analysis in our limited space utterly out of the question; we can only, therefore, refer our readers, for more ample details, to the pages of the wor'

In laying down for the present the report of the Smithsonian Institution, (and it is with no little regret that we lay it down,) we derive our chief consolation from the recollection that it is not a solitary work, but one of a series, and that we may look forward to a renewal on each succeeding year of the enjoyment we have found in the perusal of the volume that we have just closed.

G. T. K.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

FOSSILS FROM ANTICOSTI.

During a recent visit to the Museum of the Geological Survey in Montreal, we were much gratified by the inspection of a fine collection of fossils, just received by Sir William Logan, from the Island of Anticosti. The greatest praise is due to Mr. Richardson, by whom, in the short space of a few months, this really magnificent collection was obtained. A preliminary examination by Professor Hall, of Albany, and Mr. Billings, the palæontologist attached to the Survey, has shewn the existence of a great number of new Brachiopods and other types—some, indeed, of a character at present altogether problematical. Amongst other facts of interest brought to light by the collection, we may mention the simultaneous occurrence in one of the Anticosti beds, of many well-marked forms belonging to both the Lower and Upper divisions of the Silurian series: a phenomenon not hitherto observed, or at least to a similar extent, in American rocks—the line of demarcation between the Upper and Lower Silurians of the Western World, being, as a general rule, very strongly pronounced. The lowest of the observed beds in Anticosti itself, belongs to the Hudson River Group; but the Sillery formation (the next in an ascending order) so largely developed along the Southern shores of the St. Lawrence, appears to be entirely wanting. Geologists may look forward with much interest, to the results of Professor Hall's detailed examination of this important addition to our knowledge of Palæozoic forms.

ASAPHUS LATIMARGINATUS.

[*A. Canadensis*—E. J. C.]

In the *Canadian Journal* for September of last year (vol. 1, p. 482), we called attention, under the name of *Asaphus Canadensis*, to a new form of Trilobite, from Whitby, in Canada West. Quite recently, we have received a letter from Professor Hall, in which that able palæontologist suggests to us that the Trilobite in question is probably his *Asaphus latimarginatus*. Professor Hall states that the

Museum of the Geological Survey of Canada has lately received some very perfect specimens of that species from the neighbourhood of Whitby; and he kindly promises us a drawing and revised description of his original species, for an ensuing number of the Journal. The only figures of *Asaphus latimarginatus* that we have had an opportunity of examining, consist merely of two more or less imperfect caudal shields given in the first volume of Hall's Palæontology of New York. Neither thorax nor buckler has, we believe, been hitherto figured or described—at least beyond the brief description given in our note in the number of the *Canadian Journal* already alluded to. If the two forms prove to be identical, the original name of *A. latimarginatus*, as applied by Prof. Hall to the species founded on the two imperfect caudal shields figured by him in his Palæontology, must, of course, take the place of *A. Canadensis*, notwithstanding the appropriateness of the latter. Up to the present time, indeed, it is only in Canada that anything like complete specimens have been met with. The following is a description of the form to which our original remarks applied:

Cephalic shield pointed anteriorly, and in its general outline closely resembling that of *Asaphus platycephalus**, but with the posterior angles terminating in horns† which extend downwards to the bottom of the fourth thoracic segment. Facial sutures united in front at the extreme anterior margin of the buckler, and terminating as in *A. platycephalus* about midway between the glabella and the angles of the head-shield. Glabella very feebly raised; broad, and somewhat squared above; but without furrows of any kind. Eyes apparently as in *A. platycephalus*, but much destroyed in all the specimens examined. For dimensions, see below.

Thorax with eight segments. Pleuræ somewhat sabre-shaped (the curve upwards‡); grooved to about half their length from the axis outwards, and then crossed obliquely by a curvilinear ridge: the points of the pleuræ beyond the ridge, delicately striated.

Caudal shield with well developed axis: the axis tapering, and terminating rather abruptly before reaching the extremity of the pygidium; number of the rings not observable in the specimens examined.§ Pleuræ 14 in number, without grooves or ridges; bent downwards abruptly near the striated margin into which they merge. The lower ones, almost vertical.

Whole surface of the trilobite finely punctured, except at the striated limb. The punctures on the pleuræ, larger and farther apart than those on the axis. Also of a crescented or semi-circular form, with the convex and more deeply indented side turned inwards.

Relative (approximate) dimensions:—Assumed length of Buckler =1. Glabella, length =·812. Thorax, length =·875. Pygidium, length =1·06. Middle lobe of Thorax, breadth =·50 to ·60. Outer lobes (each). breadth =·70. The small breadth of the middle lobe in relation to the side lobes, as compared with *Asaphus platycephalus*, appears to be of some importance, unless it be a mere sexual

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* *Isotelus gigas*, Auct.

† This part of the head-shield is very obscure in the specimens hitherto examined. We were led at first to believe that the angles were rounded.

‡ This, however, is only to be seen when the pleuræ have become accidentally separated to a certain extent from one another.

§ Since the above description was written, the son of His Excellency the Governor General, has kindly submitted to us some specimens obtained by him personally from the Whitby quarries. In one of these, the pygidium of a young individual, fourteen rings may be counted in the axis.

difference. Where, however, the ' uræ are bent, the length of the side lobes can rarely be estimated with any great exactness.

The average adult size of these trilobites appears to be about 4½ inches in length, by about 3 inches in breadth; but, judging from isolated fragments, larger individuals no doubt occur. Many of the Whitby specimens, at the same time, are much below the above dimensions. Most of them are converted into iron pyrites. The *Asaphus Barrandi* of Hall appears to be a closely related species.

FOSSILS FROM ALTERED ROCKS IN EASTERN MASSACHUSETTS.

A very interesting discovery of a trilobite—a species of Paradoxides—in the metamorphic rocks of Quincy and Braintree, about ten miles South of Boston, has just been announced to the scientific world, by Professor W. B. Rogers. The true place of these rocks, hitherto of uncertain paleozoic range, would thus appear to belong to quite the base of the Silurian series: at least if the trilobite in question be really a paradoxides—in which case, it will also be of interest, as constituting the first true species of that genus met with in American rocks since the announcement of Green's debatable *Paradoxides Harlani* in 1832. Full particulars of this discovery will be found in the last October number of the Edinburgh New Philosophical Journal; and in the Proceedings of the Natural History Society of Boston, for the same month.

BURR-STONE.

A curious deposit of Burr-stone, constituting a vein of considerable thickness, has lately been discovered by Sir William Logan, in the gneiss of Chatham, in Canada East. The stone, probably a siliceous deposit from heated waters, occurs, according to Sir William, in close association with several complicated veins of igneous rock of at least three different periods of formation. As the stone is of excellent quality, and readily obtainable, the discovery—apart from the scientific interest belonging to the mode of occurrence of the deposit—is one of no little importance. Specimens may be seen in the Museum of the Geological Survey at Montreal.

RED OXIDE OF COPPER.

Mr. James Gilbert, lately returned from California, has presented to the Institute, some specimens of red copper ore from the Arizona mines, 110 miles S. E. of Fort Yuma, and about 35 miles from the River Gila. As samples, the specimens are extremely rich, being almost free from rock matter. They contain small strings of native copper, from which the Cu^2O has evidently been derived; and by a further process of alteration, the ore is converted externally, into malachite, The occurrence of red copper in California has not hitherto been announced in any of our treatises on Mineralogy. We are ignorant of its geological associations.

VANADINITE.

In the last number of the *Journal*, (vol. 1, page 553), an analysis, by Rammelsberg, of Vanadinite from Windisch-Kappel, was given; the results of which lead to the inference that VO^3 and PO^5 are isomorphous. Adolf Kengott, (in Poggendorff's Annalen, 1856, No. 9), has subjected this analysis to a very elaborate discussion, in which he seeks to maintain that the loss of 3.21 per cent. therein exhibited, must be due to some cause other than accidental. To account for this loss, he assumes the original existence in the mineral of the hypothetical compound VO^5. Rammelsberg's analysis gave 17.41 per cent. of VO^3: a value corresponding to 20.31 per cent. of VO^5. In this manner the total results of the analysis are brought up to 99.69; and the isomorphism of Vanadinite with Pyromorphite satisfactorily explained. Before this view can be received, however, it will be for the chemist to determine if there be any real grounds for the assumption of the existence of this higher oxygen compound. So far as present researches go, the tendency of vanadic acid, VO^3, would appear to be altogether towards reduction. The question, however, here, is not the conversion of VO^3 into VO^5, but the reverse: a process which we might readily conceive to take place, were the existence of the latter compound allowed to be probable.

E. J. C.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

CHELTENHAM, 6th August, 1856.

After the requisite preliminary business, conducted by the General Committee of the Association, and including the reading of the Report of the Council, and of that of the Kew Committee, the body of members assembled to witness the resignation of the Chair by the Duke of Argyle, to his successor, Professor Daubeny, and to hear the President's Address. On this occasion the occupation of the Chair of the British Association by one not only distinguished as a Chemist, but by one who is no less eminent as a Botanist, gave a new character to the Presidential Address. After some preliminary remarks of a personal nature, Dr. Daubeny proceeded with his address, from which we have only room for a brief selection of passages of special interest. Referring to the British Association as alike valuable as an efficient instrument for the furtherance of scientific objects, and as a model after which other associated scientific bodies have been organized, the President thus proceeded:

It is rather remarkable that the first idea of an Association of such a kind should have suggested itself only a year after death had deprived us of our three most distinguished philosophers:—for who had we then left to compare with Davy for the brilliancy and importance of his discoveries; with Young for the singular union of almost universal acquirements with admirable powers of invention; and with Wollaston for an acuteness of mental vision, which gave him the same advantage in the pursuits of science which the naturalist, armed with a microscope has over the unassisted observer? Just as in the animal economy the *vis medicatrix naturæ* sometimes makes an extraordinary effort to repair the damage inflicted by injury or disease, so it would seem as if Science, conscious of the loss she had sustained in the almost simultaneous extinction of her three brightest luminaries, endeavoured to make good the deficiency by concentrating into one *focus* those that yet remained, to light her onwards on her path. At any rate, the progress which the Natural Sciences have made since that period, although doubtless attributable to several concurrent causes, is a fact which must not be overlooked in estimating the services rendered by this Association to the cause of human advancement; nor can I in any better manner point out its value than by bringing before your notice a few of the additions to our knowledge which have been made since I last addressed you.

Beginning then with Chemistry, as the subject with which I am most familiar, let me remind you, that at a period not much more remote than the one alluded to, all of it that could be quoted as really worthy the name of a science was comprehended within the limits of the mineral kingdom. Here at least the outline had been traced out with sufficient precision—the general laws established on a firm basis—the nomenclature framed with logical exactness—the facts consistent with each other, and presented in a scientific and luminous form. Thus a philosopher, like Sir Humphrey Davy, who had contributed in so eminent a degree to bring the science into this satisfactory condition, might, at the close of his career, have despaired of adding anything worthy of his name to the domain of chemistry, and have sighed for other worlds to subdue. But there was a world almost as little known to the chemists of that period as was the Western Hemisphere to the Macedonian Conqueror,—a World comprising an infinite variety of important products, called into existence by the mysterious operation of the vital principle, and therefore placed, as was imagined, almost beyond the reach of experimental research. This is the new World of Chemistry, which the Continental philosophers in the first instance, and subsequently those of our own country, have during the last twenty years been busy in exploring, and by so doing have not only bridged over the Gulf which had before separated by an impassable barrier the kingdoms of inorganic and of organic nature, but also have added provinces as extensive and as fertile as those we were in possession of before, to the partrimony of Science.

It is indeed singular, that whilst the supposed elements of mineral bodies are very numerous, the combinations between them should be comparatively few; whereas amongst those of vegetable and animal origin, where the ultimate elements are so limited in point of number, the combinations which they form appear almost infinite. Carbon and hydrogen, for instance, constitute, as it were, the keystone of every organic fabric; whilst oxygen, nitrogen, and less frequently sulphur and phosphorus, serve almost alone to build up their superstructure. And yet what an infinity of products is brought about by ringing the changes upon this scanty alphabet! Even one series of bodies alone, that known by the name of the Fatty Acids, comprises several hundred well-ascertained combinations, founded however upon a single class of hydro-carbons or compound radicals, in which the carbon and hydrogen stand to each other in equal atomic proportions, and are in each case acidified by the same number of equivalents of oxygen. These acids are all monobasic, or combine with only one proportion of base; but add to any one of them two equivalents of carbonic acid, and you obtain a member of a second series, which is bibasic, or is capable of forming two classes of salts. The above therefore constitute a double series, as it were, of organic acids, the members of which are mutually related in the manner pointed out, and differ from each other in their mode of combining according to the relation between their respective elements. But already, by the labours of Hofmann and of other chemists, two other double series of acids, the one monobasic, the other bibasic, mutually related exactly in the same manner as those above, have been brought to light; each series no doubt characterized by an equally numerous appendage of alcohols, of æthers, and of aldehydes, to say nothing of the secondary compounds resulting from the union of each of these bodies with others.

Hence the more insight we obtain into the chemistry of organic substances the more we become bewildered with their complexity, and in investigating these phenomena, find ourselves in the condition of the explorer of a new continent, who, although he might see the same sun over his head, the same ocean rolling at his feet, the same geological structure in the rocks that were piled around him, and was thus assured that he still continued a denizen of his own planet, and subject to those physical laws to which he had been before amenable, yet at every step he took was met by some novel object, and startled with some strange and portentous production of Nature's fecundity. Even so the chemist of the present day, whilst he recognizes in the world of organic life the same general laws which prevail throughout the mineral kingdom, is nevertheless astonished and perplexed by the multiplicity of new bodies that present themselves, the wondrous changes in them resulting from slight differences in molecular arrangement, and the simple nature of the machinery by which such complicated effects are brought about. And as the New World might never have been discovered, or, at all events, would not have been brought under our subjection, without those improvements in naval architecture which had taken place prior to the age of Columbus, so the secrets of organic chemistry would have long remained unelicited, but for the facilities in the methods of analysis which were introduced by Liebig. Before his time the determination of the component elements of an organic substance was a task of so much skill as well as labour, that only the most accomplished analysts—such men, for instance, as my lamented friend Dr. Prout in this country, or as the great Berzelius in Sweden—could be depended upon for such a work; and hence the data upon which we could rely for deducing any general conclusions went on accumulating with extreme slowness. But the new methods of analysis invented by Liebig have so simplified and so faciliated the processes, that a student, after a few months' practical instruction in a laboratory, can, in many instances, arrive at results sufficiently precise to be made the basis of calculation, and thus to enable the master mind, which is capable of availing itself of the facts before it, to breathe life into these dry numerical details,—just as the sculptor, by a few finishing stokes, brings out the expression of the statue, which has been prepared for him by the laborious chiselling of a number of subordinate workmen. And as the established laws and institutions of the Old World have been modified—may I not say in some instances rectified?—by the insensible influence of those of the New, so have the principles that had been deduced from the phenomena of the mineral kingdom undergone in many instances a correction from the new discoveries made in the chemistry of the animal and vegetable creation. It was a great step indeed in the progress of the science, when Lavoisier set the example of an appeal to the balance in all our experimental researches, and the Atomic Theory of Dalton may be regarded as the necessary, although somewhat tardy, result of the greater numerical precision thus introduced. But no less important was the advance achieved, when structure and polarity were recognized as influencing the condition of matter; and when the nature of a body was felt to be determined, not only by the condition of its component elements, but also by their mutual arrangement and collocation—a principle which, first illustrated amongst the products of organic life, has since been found to extend alike to all chemical substances whatever.

Formerly it had been the rule to set down the bodies which form the constituents of the substances we analyzed, and which had never yet under our hands undergone decomposition, as elementary; but the discovery of cyanogen in the first instance, and the recognition of several other compound radicals in organic chemistry more lately, naturally suggest the idea that many of the so-called elements of inorganic matter may likewise be compounds, differing from the organic radicals above mentioned merely in their constituents being bound together by a closer affinity. And this conjecture is confirmed by the curious numerical relations subsisting between the atomic weights of several of these supposed elements; as, for example, between chlorine, bromine and iodine : an extension of the grand generalization of Dalton, which, although it was unforeseen by the Founder of the system, and therefore, like Gay-Lussac's Theory of Volume, might very possibly have been repudiated by him, had it been proposed for his acceptance, will be regarded by others as establishing, in a manner more conclusive than before, the soundness of his antecedent deductions. What, indeed, can be a greater triumph for the theorist, than to find that a law of nature which he has had the glory of establishing by a long and painful process of induction, not only accommodates itself to all the new facts which the progress of discovery has since brought to light, but is itself the consequence of a still more general and comprehensive principle, which philosophers, even at this distance of time, are still engaged in unfolding?

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But passing over speculations which have not as yet received the general assent of chemists, let me advert to others of an older date, possessing as I conceive, the strongest internal evidence in their favour, which the case admits, from the harmony they tend to introduce into the chaos of facts which the late discoveries in organic chemistry have brought to light. Amongst these, one of the most generally received, and at the same time one of the most universal application, is that which represents the several combinations resulting from organic forces, as being put together according to a particular model or type, which impresses upon the aggregate formed certain common properties, and also causes it to undergo change most readily, through the substitution of some other element in the place of one of those which already enters into its constitution. And this principle, having been established with regard to one class of bodies, has since been extended to the rest; for it now begins to be maintained, that in every case of chemical decomposition a new element is introduced in the place of one of those which constituted a part of the original compound, so that the addition of a fresh ingredient is necessarily accompanied by the elimination of an old one. The same doctrine, too, has even been extended to the case of combination with a body regarded as elementary, for here also the particles are considered as being in a state of binary combination one with the other, owing perhaps to their existing in opposite electrical conditions, and therefore possessing for each other a certain degree of chemical affinity. Thus, when we unite hydrogen with oxygen, we substitute an atom of the latter for one of the former, previously combined with the same element.

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To the microscope we owe all that is as yet known with respect to the reproductive process in cryptogamous plants, which are now shown to possess a structure analogous to that of flowering ones in respect to their organs of reproduction; not, indeed, as Hedwig supposed, that parts corresponding to stamens and pistils in appearance and structure can be discovered in them, but that as the primary distinction of sexes seems to run throughout the Vegetable Kingdom, new parts are superadded to a structure common to all as we ascend in the scale of creation, until from the simple cell, which, in consequence of some differences of structure, to our eyes inappreciable, appears to exercise in one case the function of the male, in another of the female, as is found the case in certain of the Confervæ, we arrive at length at the complicated machinery exhibited in flowering plants, in which the cell containing the fecundating principle is first matured in the stamen, and afterwards transmitted, through an elaborate apparatus, to the cells of the ovule, which is in like manner enveloped in its matrix, and protected by the series of investing membranes which constitutes the seed-vessel. Thus, as Goethe long ago observed, and as modern physiologists have since shown to be the case, the more imperfect a being is, the more its individual parts resemble each other—the progress of development, both in the Animal and Vegetable Kingdoms, always proceeding from the like to the unlike, from the general to the particular. But whilst the researches of Brown and others have shown that there is no abrupt line of division in the Vegetable Kingdom, and that one common structure pervades the whole, the later inquiries of Suminski, Hofmeister, Unger, Griffith, and Henfrey, have pointed out several curious and unlooked-for analogies between plants and animals. I may mention, in the first place, as an instance of this analogy between plants and animals, the existence of moving molecules, or phytosperms, in the antheridia of ferns and other Cryptogams, borne out, as it has been in so remarkable a manner, by the almost simultaneous observations of Bischoff and Meissner on the egg, confirmatory of those formerly announced by Barry and Newport, and by the researches of Suminski, Thuret, and Pringsheim, with respect to the ovule of plants. I may refer you also to a paper read at the last Meeting of the Association, by Dr. Cohn, of Breslau, who, in bringing this subject before the Natural History Section, adduced instances of a distinction of sexes which had come under his observation in the lower Algæ. In like manner a curious correspondence has been traced between the lower tribes of animals and plants, in the circumstance of both being subject to the law of what is called alternate generation. This consists in a sort of cycle of changes from one kind of being to another, which was first detected in some of the lower tribes of animals; a pair of insects, for example, producing a progeny differing from themselves in outward appearance and internal structure, and these reproducing their kind without any renewed sexual union,—the progeny in these cases consisting of females only. At length, after a succession of such generations, the offspring reverts to its primæval type, and pairs of male and female insects, of the original form, are reproduced, which complete the cycle, by giving rise in their turn to a breed presenting the same characters as those which belong to their own progenitors. An ingenious comparison had been instituted by Owen and others between this alternation of generations in the animal, and the alternate production of leaves and blossoms in the plant; but the researches to which I especially allude have rendered this no longer a matter of mere speculation or inference, inasmuch as they have shown the same thing to occur in ferns, in lycopodia, in mosses, nay, even in the confervæ. We are indebted to Prof. Henfrey for a valuable contribution to our Transactions in 1851 on these subjects, given in the form of a Report on the Higher Cryptogamous Plants; from which it at least appears that the proofs of sexuality in the Cryptogamia rank in the same scale, as to completeness, as those regarding flowering plants did before the access of the pollen tubes to the ovule had been demonstrated. Indeed, if the observations of Pringsheim with respect to certain of the Algæ are to be relied upon, the analogy between the productive process in plants and animals is even more clearly made out in these lower tribes than it is in those of higher organization. It also appears that the production in ferns and other Acrogens of what has been callled a *pro-embryo;* the evolution of antheridia and archegonia, or of male and female organs, from the former; and the generation from the archegonia of a frond bearing spores upon its under surface, is analogous to what takes place in flowering plants in general; where the seed, when it germinates, produces stem, roots, and leaves; the stem for many generations gives rise to nothing but shoots like itself; until at length a flower springs from it, which contains within itself for the most part the organs of both sexes united, and, therefore, occasions the reproduction of the same seed with which the chain of phenomena commenced. This is the principle which a learned Professor at Berlin has rather obscurely shadowed out in his treatise on the Rejuvenescence of Plants, and which may perhaps be regarded as one, at least, of the means by which Nature provides for the stability of the forms of organic life she has created, by imparting to each plant a tendency to revert to the primeval type.

To the elder De Candolle we are also indebted for some of our most philosophical views with respect to the laws which regulate the distribution of plants over the globe,—views which have been developed and extended, but by no means subverted, by the investigations of subsequent writers; amongst whom Sir Charles Lyell, in his 'Principles of Geology,' and the younger De Candolle, a worthy inheritor of his father's reputation, in his recently published work on Botanical Geography, have espescially signalized themselves. But it is to the late Prof. Edward Forbes, and to Dr. Joseph Hooker, that we have principally to attribute the removal of those anomalies, which threw a certain degree of doubt upon the principles laid down by De Candolle in 1820, in his celebrated article on the Geography of Plants, contained in the 'Dictionnaire des Sciences Naturelles,' where the derivation of each species from an individual, or a pair of individuals, created in one particular locality, was made the starting point of all our inquiries. These anomalies were of two different kinds, and pointed in two opposite directions: for we had in some cases to explain the occurrence of a peculiar Flora in islands cut off from the rest of the world, except through the medium of a wide intervening ocean; and in other cases to reconcile the fact of the same or of allied species being diffused over vast areas, the several portions of which are at the present time separated from each other in such a manner, as to prevent the possibility of the migration of plants from one to the other. Indeed, after making due allowances for those curious contrivances by which Nature has in many instances provided for the transmission of species over different parts of the same continent, and even across the ocean, and which are so well pointed out in De Candolle's original essay, we are compelled to admit the apparent inefficiency of existing causes to account for the distribution of the larger number of species; and must confess that the explanation fails us often where it is most needed, for the Compositæ in spite of those feathery appendages they possess, which are so favorable to the wide dissemination of their seeds, might be inferred, by their general absence from the fossil Flora, to have diffused themselves in a less degree than many other families have done. And on the other hand, it is found, that under existing circumstances, those Compositæ, which are disseminated throughout the area of the Great Pacific, belong in many cases to species destitute of these auxiliaries to transmission. But here Geology comes to our aid; for by pointing out the probability of the submergence of continents on the one hand, and the elevation of tracts of land on the other, it enables us to explain the occurrence of the same plants in some islands or continents now wholly unconnected, and the existence of a distinct Flora in others too isolated to obtain it under present circumstances from without. In the one case we may suppose the plants to have been distributed over the whole area before its several parts became disunited by the catastrophes which supervened; in the other, we may regard the peculiar Flora now existing as merely *the wreck, as it were, of one which once over-*spread a large tract of land, of which all but the little patch on which it is now found had been since submerged. Upon this subject our opinions may in some measure be swayed by the nature of the conclusion we arrive at with respect to the length of time during which seeds are capable of mantaining their vitality; for if after remaining for an indefinite period in the earth they were capable of germinating, it would doubtless be easier to understand the revival, under favorable circumstances, of plants which had existed before the severance of a tract of land from the continent in which they are indigenous. An *inquiry has accordingly* been carried on for the last fifteen years under the auspices of, and with the aid of funds supplied by, this Association, the results of which, it is but fair to say, by no means corroborate the reports that had been from time to time given us with respect to the extreme longevity of certain plants, exemplified, as it was said, in the case of the mummy-wheat and other somewhat dubious instances; inasmuch as they tend to show, that none of the seeds which were tested, although they were placed under the most favorable artificial conditions that could be devised, vegetated after a period of forty-nine years; that only twenty out of 288 species did so after twenty years; whilst by far the larger number had lost their germinating power in the course of ten. These results, indeed, being merely negative, ought not to outweigh such positive statements on the contrary side as come before us recommended by respectable authority, such, for instance, as that respecting a Nelumbium seed, which germinated after having been preserved in Sir Hans Sloane's Herbarium for 150 years; still, however, they throw suspicion as to the existence in seeds of that capacity of preserving their vitality almost indefinitely, which alone would warrant us in calling to our aid this principle in explaining the wide geographical range which certain species of plants affect.

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Amongst the many services rendered to the Natural Sciences by Dr. Hooker, in conjunction with his fellow traveller, Dr. Thomson, one of the greatest I conceive to be, that they have not only protested against that undue multiplication of species, which had taken place by exalting minute points of difference into grounds of radical and primary distinction, but that they have also practically illustrated their views with respect to the natural families which have been described by them in the volume alluded to. They have thus contributed materially to remove another difficulty which stood in the way of the adoption of the theory of specific centres, —I *mean the replacement of forms of vegetation in adjoining countries by others,* not identical, but only as it should seem allied; for it follows from the principles laid down by these authors, that such apparently distinct species may after all have been only varieties, produced by the operation of external causes acting upon the same species during long periods of time.

But if this be allowed, what limits, it may be asked, are we to assign to the changes which a plant is capable of undergoing,—and in what way can we oppose the principle of the transmutation of species, which has of late excited so much *attention, and the admission of which is considered to involve such startling* consequences? I must refer you to the writings of modern physiologists for a full discussion of this question. All that I shall venture to remark is, that had not Nature herself assigned certain boundaries to the changes which plants are capable of undergoing, there would seem no reason why any species at all should be restricted within a definite area, since the unlimited adaptation to external conditions which it would then possess might enable it to diffuse itself throughout the world, as easily as it has done over that portion of space within which it is actually circumscribed. Dr. Hooker instances certain species of Coprosma, of Celmisia, and a kind of Australian Fern, the *Lomaria procera*, which have undergone such striking changes in their passage from one portion of the Great Pacific to another, that they are scarcely recognizable as the same, and have actually been regarded by preceding botanists as distinct species. But he does not state that any of these plants have ever been seen beyond the above-mentioned precincts, and yet if Nature had not imposed some limits to the susceptibility of change, one does not see why they might not have spread over a much larger portion of the earth, in a form more or less modified by external circumstances. The younger De Candolle, in his late admirable treatise already referred to, has enumerated about 117 species of plants which have been thus diffused over at least a third of the surface of the globe, but these apparently owed their power of transmigration to their insusceptibility of change, for it does not appear that they have been much modified by the effect of climate or locality, notwithstanding the extreme difference in the external conditions to which they were subjected. On the other hand, it seems to be a general law, that plants whose organization is more easily affected by external agencies become from that very cause, more circumscribed in their range of distribution; simply because a greater difference in the circumstances under which they would be placed brought with it an amount of change in their structure which exceded the limits prescribed to it by Nature. In short, without pretending to do more than to divine the character of those impediments, which appear ever to prevent the changes of which a plant is suceptible from proceeding beyond a certain limit, we seem to catch a glimpse of a general law of Nature, not limited to one of her kingdoms, but extending everywhere throughout her jurisdiction,—a law, the aim of which may be inferred to be that of maintaining the existing order of the universe, without any material or permanent alteration, throughout all time, until the fiat of Omnipotence has gone forth for its destruction. The will which confines the variations in the vegtable structure within a certain range, lest the order of creation should be disturbed by the introduction of an indefinite number of intermediate forms is apparently the same in its motive as that which brings back the celestial luminaries to their original orbits, after the completion of a cycle of changes induced by their mutual perturbations; it is the same which says to the ocean, Thus far shalt thou go, and no further; and to the winds, Your violence, however apparently capricious and abnormal, shall nevertheless be constrained within certain prescribed limits—

> Ni faciat, maria et terras cœlumque profundum,
> Quippe ferant rapidi secum, verrantque per auras.

The whole, indeed, resolves itself into, or at least is intimately connected with, that law of symmetry to which Nature seems ever striving to conform, and which possesses the same significance in the organic world, which the law of definite proportions does in the inorganic. It is the principle which the prophetic genius of Goethe had divined, long before it had been proved by the labours of physiologists to be a reality, and to which the poet attached such importance, that the celebrated discussion as to its merits which took place in 1830 between Cuvier and Geoffry St. Hilaire so engrossed his mind, as to deprive him, as his biographer informs us, of all interest in one of the most portentous political events of modern days which was enacting at the very same epoch,—I mean the subversion of the Bourbon dynasty.

It is, indeed, not less calculated to subserve to the gratification of our sense of the Beautiful than to provide against too wide a departure from that order of creation which its great Author has from the beginning instituted; and, as two learned Professors of a sister kingdom have pointed out in Memoirs laid before this Association, and have since embodied in a distinct treatise, manifests itself not less in the geometrical adjustment of the branches of a plant, and of the scales of a fir-apple —nay even, as they have wished to prove, in the correspondence between the form of the fruit and that of the tree on which it grows—than in the frequent juxtaposition of the complimentary rays of the spectrum, by which that harmony of colour is produced in Nature which we are always striving, however unsuccessfully, to imitate in Art. The law, indeed, seems to be nothing else than a direct consequence of that unity of design pervading the universe, which so bespeaks a common Creator—of the existence in the mind of the Deity of a sort of archetype, to which His various works have all, to a certain extent, been accommodated; so that the earlier forms of life may be regarded as types of those of latter creation, and the more complex ones but as developments of rudimentary parts existing in the more simple.

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I might be disposed to claim for the recent investigations of botanists some share in fixing the relative antiquity of particular portions of the globe, for from the Floras they have given us of different islands in the Great Pacific, it would appear that the families of plants which characterize some groups are of a more complicated organization than those of another. Thus, whilst Otaheite chiefly contains Orchids, Apocyneæ, Asclepiadeæ, and Urticeæ; the Sandwich Islands possess Lobeliaceæ and Goodenoviæ; and the Galapagos Islands, New Zealand and Juan Fernandez, Compositæ, the highest form, perhaps, of dicotyledonous plants. In deducing this consequence, however, I am proceeding upon a principle which has lately met with opposition, although it was formerly regarded as one of the axioms in Geology. Amongst these, indeed, there was none which a few years ago seemed so little likely to be disputed as that the classes of animals and vegetables which possessed the most complicated structure were preceded by others of a more simple one; and that when we traced back the succession of beings to the lowest and the earliest of the sedimentary formations, we arrived at length at a class of rocks, the deposition of which must be inferred, from the almost entire absence of organic remains, to have followed very soon after the first dawn of creation. But the recognition of the footsteps and remains of reptiles in beds of an earlier date than was before assigned to them, tended to corroborate the inferences which had been previously deduced from the discovery, in a few rare instances, in rocks of the secondary age, of mammalian remains; and thus has induced certain eminent geologists boldly to dispute, whether from the earliest to the latest period of the earth's history any gradation of beings can in reality be detected. Into this controversy I shall only enter at present, so far as to point out an easy method of determining the fact, that organic remains never can have existed in a particular rock, even although it may have been subjected to such metamorphic action as would have obliterated all traces of their presence. This is simply to ascertain that the material in question is utterly destitute of phosphoric acid; for inasmuch as every form of life appears to be essentially associated with this principle, and as no amount of heat would be sufficient to dissipate it when in a state of combination, whatever quantity of phosphoric acid had in this manner been introduced into the rock, must have continued there till the end of time, notwithstanding any igneous operations which the materials might have afterwards undergone. But as the discovery of very minute traces of phosphoric acid, when mixed with the other ingredients of a rock, is a problem of no small difficulty, an indirect method of ascertaining its presence suggested itself to me in some experiments of the kind which I have instituted, namely, that of sowing some kind of seed, such for instance as barley, in a sample of the pulverized rock, and determining whether the crop obtained yielded more phosphoric acid than was present in the grain, it being evident that any excess must have been derived from the rock from which it drew its nourishment Should it appear by an extensive induction of particulars, that none of the rocks lying at the base of the Silurian formation, which have come before us, contain more phosphoric acid than the minute quantity I detected in the slates of Bangor and Llanberris, which were tested in the above manner, it might perhaps be warrantable hereafter to infer that we had really touched upon those formations, that had been deposited at a time when organic beings were only just beginning to start into existence, and to which therefore, the term Azoic, assigned to these rocks by some of the most eminent of our geologists, might not be inappropriate. The proofs of the former extension of glaciers in the Northern hemisphere, far beyond their actual limits, tend also to complicate the question which has at all times so much engaged the attention of cosmogonists with respect to the ancient temperature of the earth's surface, compelling us to admit that, at least during the latter of its epochs, oscillations of heat and cold must have occurred, to interfere with the progress of refrigeration which was taking place in the crust. On the other hand, facts of an opposite tendency, such as the discovery announced at our last meeting by Capt. Belcher, of the skeleton of an Ichthyosaurus in lat. 77°, and of the trunk of a tree standing in an erect position in lat. 75°, have been multiplying upon us within the same period; inasmuch as they appear to imply, that a much higher temperature in former times pervaded the Arctic regions that can be referred to local causes, and therefore force upon us the admission, that the internal heat of the nucleus of our globe must at one time have influenced in a more marked manner than at present the temperature of its crust.

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Twenty years ago it was thought necessary to explain at our meetings the character and objects of this Association, and to vindicate it from the denunciations fulminated against it by individuals, and even by parties of men, who held it up as dangerous to religion, and subversive of sound principles in theology. Now so marked is the change in public feeling, that we are solicited by the clergy, no less than by the laity, to hold our meetings within their precincts; and we have never received a heartier welcome than in the city in which we are now assembled, which values itself so especially, and with such good reason, on the extent and excellence of its educational establishments. It begins, indeed, to be generally felt, that amongst the faculties of the mind, upon the development of which in youth success in after life mainly depends, there are some which are best improved through the cultivation of the Physical Sciences, and that the rudiments of those sciences are most easily acquired at an early period of life. That power of minute observation —those habits of method and arrangement—that aptitude for patient and laborious inquiry—that tact and sagacity in deducing inferences from evidence short of demonstration, which the Natural Sciences more particularly promote, are the fruits of early education, and acquired with difficulty at a later period. It is during childhood, also, that the memory is most fresh and retentive and that the nomenclature of the sciences, which, from its crabbedness and technicality, often repels us at a more advanced age, is acquired almost without an effort. Although, therefore it can hardly be expected that the great schools in the country will assign to the Natural Sciences any important place in their systems of instruction until the Universities for which they are the seminaries set them the example, yet I cannot doubt but that, the signal once given, both masters and scholars will eagerly embrace a change so congenial to the tastes of youth, and so favorable to the development of their intellectual faculties. And has not, it may be asked, the signal been given by the admission of the Physical Sciences into the curriculum of our academical education? I trust that this question may be answered in the affirmative, if we are entitled to assume that the recognition of them which has already taken place will be constantly followed up by according to them some such substantial encouragement as that which has been afforded hitherto almost exclusively to classical literature. Our ability to accomplish this, with the means and appliances at our command, does not, I think, admit of dispute. All, therefore, that seems wanted, is, on the one hand, a more equal distribution of the existing emoluments between the several professions, and on the other, the admission of the claims of the sciences received into our educational system to share in the emoluments which up to this time, have been monopolized by the Classics. And, as it is far from my wish to curtail the older studies of the University of their proper share of support—for who that has passed through a course of academical study can be insensible of the advantages he has derived from that early discipline of the mind which flows from their cultivation?—I rejoice to think, that when the Legislature shall have completed the removal of those restrictions which have hitherto prevented us in many instances from consulting the claims of merit in the distribution of our emoluments, there will be ample means afforded for giving all needful encouragement to the newly-recognized studies, without trenching unduly upon that amount of pecuniary aid which has been hitherto accorded to the classics. In anticipation of which change, I look forward with confidence to the day when the requirements at Oxford in the department of Physical Sciences will become so general and so pressing, that no institution which professes to prepare the youth it instructs for academical competition will venture to risk its reputation by declining to admit these branches of study into its educational courses.

ON THE THEORY OF COMPOUND COLOURS WITH REFERENCE TO MIXTURES OF BLUE AND YELLOW LIGHT. BY MR. J. C. MAXWELL.

When we mix together blue and yellow paint, we obtain green paint. This fact is well known to all who have ever handled colours; and it is universally admitted that blue and yellow make green. Red, yellow, and blue being the primary colours among painters, green is regarded as a secondary colour, arising from the mixture of blue and yellow. Newton, however, found that the green of the spectrum was not the same thing as the mixture of two colours of the spectrum, for such a mixture could be separated by the prism, while the green of the spectrum resisted further decomposition. But still it was believed that yellow and blue would make a green, though not that of the spectrum. As far as I am aware, the first experiment on the subject is that of M. Plateau, who, before 1819, made a disc with alternate sectors of Prussian blue and gamboge, and observed that, when spinning, the resultant tint was not green, but a neutral grey, inclining sometimes to yellow or blue, but never to green. Prof. J. D. Forbes, of Edinburgh, made similar experiments in 1849, with the same result. Prof. Helmholtz, of Königsberg, to whom we owe the most complete investigation on visible colour, has given the true explanation of this phenomenon. The result of mixing two coloured powders is not by any means the same as mixing the beams of light which flow from each separately. In the latter case we receive all the light which comes either from the one powder or the other. In the former, much of the light coming from one powder falls on a particle of the other, and we receive only that portion which has escaped absorption by one or other. Thus, the light coming from a mixture of blue and yellow powder, consists partly of light coming directly from blue particles or yellow particles, and partly of light acted on by both blue and yellow particles. This latter light is green, since the blue stops the red, yellow, and orange, and the yellow stops the blue and violet. I have made experiments on the mixture of blue and yellow *light*—by rapid rotation, by combined reflection and transmission, by viewing them out of a focus, in stripes, at a great distance, by throwing the colours of the spectrum on a screen, and by receiving them into the eye directly; and I have arranged a portable apparatus by which any one may see the result of this or any other mixture of the colours of the spectrum. In all these cases blue and yellow do *not* make green. I have also made experiments on the mixture of coloured powders. Those which I used principally were "mineral blue" (from copper) "and chrome yellow." Other blue and yellow pigments gave curious results, but it was more difficult to make the mixtures, and the greens were less uniform in tint. The mixtures of these colours were made by weight, and were painted on discs of paper, which were afterwards treated in the manner described in my paper 'On Colour as perceived by the Eye, in the *Transactions of the Royal Society of Edinburgh*, Vol. xxi., Part 2. The visible effect of the colour is estimated in terms of the standard coloured papers:—vermilion (V,) ultramarine (U,) and emerald green (E.) The accuracy of the results, and their significance, can be best understood by referring to the paper before mentioned. I shall denote mineral blue by B, and chrome yellow by Y; and B_5 Y_3 means a mixture of three parts blue and five parts yellow.

Given Colour.				Standard Colours.			Co-efficient.
				V.	U.	E.	
	B_8	100	=	2	36	7	45
B_7	Y_1	100	=	1	18	17	37
B_6	Y_2	100	=	4	11	34	49
B_5	Y_3	100	=	9	5	40	54
B_4	Y_4	100	=	15	1	40	56
B_3	Y_5	100	=	22	−2	44	64
B_2	Y_6	100	=	35	−10	51	76
B_1	Y_7	100	=	64	−19	64	109
	Y_8	100	=	180	−27	124	277

—The columns V., U., E. give the proportions of the standard colours which are equivalent to 100 of the given colour; and the sum of V., U., E. gives a co-efficient, which gives a general idea of the brightness. It will be seen that the first admixture of yellow *diminishes* the brightness of the blue. The negative values of U. indicate that a mixture of V., U., and E. cannot be made equivalent to the given colour. The experiments from which these results were taken had the negative values transferred to the other side of the equation. They were all made by means of the colour-top, and were verified by repetition at different times.

"ON SOME DICHROMATIC PHENOMENA AMONG SOLUTIONS, AND THE MEANS OF REPRESENTING THEM," BY DR. GLADSTONE.

This paper was an extension of Sir John Herschel's observations on dichromatism, that property whereby certain bodies appear of a different colour according to the quantity seen through. It depends generally on the less rapid absorption of the red ray as it penetrates a substance. A dichromatic solution was examined by placing it in a wedge-shaped glass trough, held in such a position that a slit in a window shutter was seen traversing the varying thicknesses of the liquid. The diversely coloured line of light thus produced was analyzed by a prism; and the resulting spectrum was represented in a diagram by means of coloured chalks on black paper, the true position of the apparent colours being determined by the fixed lines of the spectrum. In this way the citrate and comenamate of iron, sulphate of indigo, litmus in various conditions, cochineal, and chromium, and cobalt salts where examined and represented. Among the more notable results were the following:—A base, such as chromic oxide, produces very nearly the same spectral image with whatever acid it may be combined, although the salts may appear very different in colour to the unaided eye. Citrate of iron appears green, brown, or red, according to the quantity seen through. It transmits the red ray most easily, then the orange, then the green, which covers the space usually occupied by the yellow; it cuts off entirely the more refrangible half of the spectrum. Neutral litmus appears blue or red, according to the strength or depth of the solution. Alkalies cause a great development of the blue ray; acids cause a like increase of the orange, while the minimum of luminosity is altered to a position much nearer the blue. Boracic acid causes a development of the violet. Alkaline litmus was exhibited so strong that it appeared red, and slightly acid litmus so dilute that it looked bluish purple; indeed, on account of the easy transmissibility of the orange ray through an acid solution, the apparent paradox was maintained that a large amount of alkaline litmus is of a purer red than acid litmus itself. Another kind of dichromatism was examined, dependent not on the actual quantity of coloured material, but on the relative proportion of the solvent. Diagrams of the changing appearances of sulphocyanide of iron, of chloride of copper, and of chloride of cobalt were exhibited.

"ON A METHOD OF DRAWING THE THEORETICAL FORMS OF FARADAY'S LINES OF FORCE WITHOUT CALCULATION," BY MR. J. C. MAXWELL.

The method applies more particularly to those cases in which the lines are entirely parallel to one plane, such as the lines of electric currents in a thin plate, or those round a system of parallel electric currents. In such cases, if we know the forms of the lines of force in any two cases, we may combine them by simple addition of the functions on which the equations of the lines depend. Thus the system of lines in a uniform magnetic field is a series of parallel straight lines at equal intervals, and that for an infinite straight electric current perpendicular to the paper is a series of concentric circles whose radii are in geometric progression. Having drawn then two sets of lines on two separate sheets of paper and laid a third piece above, draw a third set of lines through the intersections of the first and second sets. This will be the system of lines in a uniform field disturbed by an electric current. The most interesting cases are those of uniform fields disturbed by a small magnet. If we draw a circle of any diameter with the magnet for centre, and join those points in which the circle cuts the lines of force, the straight lines so drawn will be parallel and equi-distant, and it is easily shewn that they represent the actual lines of force in a paramagnetic, diamagnetic, or crystallized body, according to the nature of the original lines, the size of the circle, &c.

ON THE FORM OF LIGHTNING.

Mr. J. Nasmyth read a paper to the effect that the form of lightning as exhibited by nature was an irregular curved line, shooting from the earth below to the cloud above, and often continued from the cloud downwards again to some distant point of the earth; and this appearance was the result of the rapidly-shooting point of light, which constituted the true lightning, leaving on the eye the impression of the path it traced. These views led to much discussion in the Section.

(*To be continued.*)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Tenth Meeting of the American Association for the Advancement of Science was opened at Albany, in the Capitol of the State of New York, on the 20th of August, by Professor James B. Hall. A deputation from Montreal was introduced to the association on the following day, and Principal Dawson of McGill College, in the name of the deputation, communicated the invitation to the Association,—which at a subsequent meeting was accepted,—that the next meeting should be held in Montreal.

The American Association is still on a much smaller scale than its British prototype; and in some respects presents characteristic differences. The arrangements of business, which are left in the British Association exclusively in the hands of the Central Committee, were at Albany repeatedly made the subject of discussion by the whole body; and a good deal of time was lost in debates in general meeting, upon questions of order and constitutional forms, little calculated to interest those who had been attracted from a distance by the desire to listen to the communications of the distinguished representatives of American Science assembled on the occasion. Another characteristic, which could scarcely fail to strike those who are familiar with the proceedings of the British Association, was the absence of that numerous body of youthful aspirants for a place among the ranks of the Scientific Legion, which constitutes so valuable a feature in the Sections at Home. Already, chairs in the Colleges of England, Scotland, and Ireland, are filled by those who owed their first introduction to the Scientific world to the Sections of the British Association; and not the least of the benefits traceable to that institution pertain to this important feature of its organization, which has been so employed as to invite the younger students of Science into the arena, and stimulate them to compete with those whose rank has long been established by universal consent. The American Association on the contrary seems chiefly composed of the veterans of Science; nor was there wanting some appearance of an apprehension of any greater infusion of the popular element, such as the influence of the political institutions of that Country on all large and somewhat miscellaneous assemblies may perhaps fully justify. But whatever may be the effects of this absence of the predominating element of youthful aspirants for honors in the field of Scientific adventure, the assembly of so many of the most distinguished representatives of American Scientific Veterans, was a peculiarly acceptable feature to those who were allured from other countries, by the echo of their fame. Nor must it be overlooked that in whatever other respects the popular element may work, it is scarcely possible for a warmer or more hospitable welcome to be offered any where, than that which the citizens of Albany, and the Official representatives of the State of New York, tendered to the assembled Congress of American Science, and to the visitors attracted by the justly earned reputation of its members.

The great feature of interest at this meeting was the inauguration of the Dudley Astronomical Observatory. This observatory has been founded by the liberality of some citizens of Albany, among whom Mrs. Dudley, whose name it bears, has not only contributed upwards of $25,000 for the building and instruments but has announced a further donation of $50,000 towards its permanent endowment. The Hon. Edward Everett delivered a splendid oration on the occasion, in the presence of the Association, the dignitaries of the State, and the citizens of Albany, the venerable foundress herself occupying the seat of honour. The observatory is built in a solid and massive style, and finely situated on the brow of a hill; its erection was superintended by a committee of eminent astronomers, and the construction of the instruments was entrusted to Dr. Gould, who has accepted the appointment of Director. At a meeting in Section, Dr. Gould described in detail the new instruments. The minor instruments have been received, and the Observatory has been fitted up with these and others lent by Prof. Bache from the Coast Survey, but the reception of the larger instruments will be delayed for a few weeks longer. The Transit circle, combining in one the Transit telescope and meridian circle, was ordered from Pistor and Martius, the celebrated manufacturers of Berlin, by whom the new instrument at Ann Arbor was made. A number of improvements have been introduced in the Albany instruments, not perhaps all absolutely new, but an eclectic combination of late adaptations with new improvements. Dr. Gould made a distinction of modern astronomical instruments into two classes, the English and the German. The English is the massive type; the German, light and airy. The English instrument is the instrument of the engineer; the German, the instrument of the artist. In ordering the instruments for the Albany Observatory, the Doctor had endeavoured to combine the two, with, however, a preference to the German type. The circle is three feet in diameter, graduated to intervals of two minutes, and read by micrometers to tenths of seconds. The microscopes are four in number, and are not carried by moveable frames, but are imbedded in the piers. The piers themselves completely surround the circle so as to eliminate the effect of changes of temperature by radiation. The tube of the telescope is eight feet in length, and the object glass is eight inches clear aperture. The glass was made by Chance, of Birmingham, and ground by Pistor himself. The eye-piece, in addition to the diaphragm, is furnished with two micrometers, one for vertical, the other for horizontal motion, the use of these being for the circumpolar stars, whose motion is too slow for registration by the Chronographic method. One principle has been adhered to in the whole of the instrumental arrangements, namely: that every error is capable of being determined in two independent ways.

Much trouble was experienced in securing a good casting for the steel axis of the instrument. Three were found imperfect under the lathe, and the fourth was chosen, but even then, the pivots were made in separate pieces, which were set in very deeply, and welded.

Dr. GOULD said he would have preferred a smaller instrument, in which the facilities of manipulation would have been greater, but was hampered by one proviso, upon which the Trustees of the institution insisted—that this should be the biggest instrument of its kind, and the instruction was obeyed. He had been requested by the gentlemen who had this enterprise in charge, to suggest, as a mark of respect to a gentleman of Albany, who was a munificent patron of Science, that this instrument be known as the Olcott Meridian Circle. The other large instrument for the Observatory, the Heliometer, has been entrusted to an American artist, but is not yet completed. It was also announced that the American Astronomical Journal, hitherto supported at Dr. GOULD'S own expense, was in future to be published at Albany, under Dr. GOULD'S editorship, the responsibility of its cost having been assumed by a number of gentlemen of that City.

Among the Astronomical papers read before the Association was one by Dr. PETERS on a *Periodical Comet of thirteen years.* This Comet was discovered by Dr. PETERS, at Naples, in 1846. He has prepared an ephemeris of the Comet from 1857 to 1860. The comet was very difficult to observe; its light was so faint in 1846 that he could not perceive it until he had reposed his eye for some seconds in darkness. Even under these circumstances he had only seen it at intervals during a period of twenty days. He had devoted some time to calculating where the comet might be looked for on its re appearance, and had drawn lines on a map, from eight days to eight days, so that the observer would be saved much of the labor of sweeping, and the comet could readily be discovered. The probable orbit gives an ellipse of thirteen years, with a probable error of one year, so that its period might be twelve or fourteen years. In 1854, Saturn came into nearly the same position as this comet, and some uncertainty exists as to its distance, it having been difficult to ascertain whether it was nearer the interior or the exterior of that planet. Unless some accident had happened, the comet might be looked for either fifty-six days before or fifty-six days after the 15th of March, 1859. This enquiry had become of more importance since two comets pronounced periodic, those of de Vico and Brünnow, had failed to re-appear. Dr. PETERS remarked that the discovery of comets has decreased. Last year, not more than one or two were discovered. He thought this falling-off is owing partly to the fact that the award of a comet medal has been abandoned by the King of Denmark. For many years, the discoverer of any telescopic comet received a comet-medal from the King, but in 1848 the custom was abolished, and the zeal for discovery has since declined. He hoped the institution of the comet-medal would be renewed here.

Dr. GOULD observed that it was not a little curious that since the establishment of the Observatory at Pultowa the realm of Denmark had contributed 200 per cent. more to the progress of astronomical science, in proportion to its population, than any other country. The comet medal, whose institution was suggested by Schumacher, continued to be awarded for fifteen years, during which period the discoveries of comets averaged five to seven per annum, and the average discoveries of each comet by independent observers three to four. Since it has been abolished the discoveries of comets have not averaged over three per annum, and the independent simultaneous discoveries of the same comet have become exceedingly rare.

THE UNITED STATES COAST SURVEY.

The progress of this magnificent work has furnished, as usual, many valuable results in Science since the preceding meeting of the Association; the following abstracts of the Papers read will shew how great credit is due both to the energy and skill of the conductors of this undertaking, and to the wise liberality of the Government which supports it.

"The Distribution of Terrestrial Magnetism in the United States," by Prof. Bache and J. D. Hilgard.

The magnetic observations made in connection with the Survey were scattered, at 160 different stations, along the entire sea coast, and the data were reduced to the common period of the year 1850. The line of no variation, or that passing through all the places where the magnetic needle points to the true north, intersects the coast near Ocracoke, between Cape Hatteras and Cape Fear, in a N.N.W. direction, curving gradually to the North, and passing through the middle of Lake Erie.

To the north and east of this line the declination (or variation of the compass) is to the west of north, being 6° near New York, 10° near Boston, and 16° in the eastern part of Maine. To the south and west of the line of no variation it is east of north, being 8° east along a line running directly south a little to the west of St. Louis and New Orleans, 13° near San Diego, and 21° near Cape Flattery on the western coast. The dip of the needle varies from 75° in the North eastern States to 60° along the northern shore of the Gulf of Mexico, and the horizontal force from 3.5 to 6.0 in the same regions.

SUPPLEMENT TO THE PAPER PUBLISHED IN THE PROVIDENCE PROCEEDINGS, ON THE SECULAR VARIATION IN MAGNETIC DECLINATION IN THE ATLANTIC AND GULF COAST OF THE UNITED STATES, FROM OBSERVATIONS IN THE SEVENTEENTH, EIGHTEENTH AND NINETEENTH CENTURIES, UNDER PERMISSION OF THE SUPERINTENDENT. BY CHAS. A. SCHOTT.

In a paper communicated to the Association at the Providence meeting the secular change of the magnetic declination was investigated by Mr. Schott. In the course of last summer he made some additional observations by direction of the Superintendent of the Coast Survey, and in the paper now presented the results are combined with those previously obtained. The former deductions have gained considerably in accuracy, and have received important additions. The number of stations is increased from ten to thirteen. The recent observations appear to show a slight diminution in the rate of increase of westerly declination, leading to the supposition that the inflexion in the curve representing the secular variation corresponds to about 1850. All the observations concur in placing the minimum about 1800. The present rate of increase of westerly declination is about five minutes annually along the Atlantic coast.

DISCUSSION OF THE SECULAR VARIATION OF MAGNETIC INCLINATION IN THE NORTH-EASTERN STATES. COMMUNICATED, UNDER PERMISSION OF THE SUPERINTENDENT AND AUTHORITY OF THE TREASURY DEPARTMENT, BY CHARLES A. SCHOTT.

The results are confined to the limits of 38 deg. and 44 deg. of North latitude, there being too few observations in the southern part of the United States to permit safe inferences there. The element of magnetic dip, though less important practically than that of declination, is of value in navigation in certain latitudes, and from its connection, through Gauss' investigations, with the declination and intensity, assumes a high degree of importance. While the declination observations on this coast go back to the seventeenth century, the dip has only been accurately observed for 23 years; for the earliest observations made in 1782 were, from the imperfection of the instruments, of little value. During this period the dip has decreased, reached a minimum, and begun again to increase, so that it has been a highly interesting period for observation. The lines of equal dip have been deduced by Professor Loomis, from the observations which he had accumulated before the date of his paper. The present memoir includes additional results, and discusses 161 observations made at the different stations between Toronto on the north, and Baltimore on the south. The average probable error of the result at any one station is about one minute and six-tenths of dip, and the time of minimum dip is ascertained to be about two years and seven-tenths. This time was the year 1843, or rather the close of 1842 (1842–7). Mr. Schott points out why these results do not agree with Professor Hansteen's, who had not observations enough to determine the epoch of minimum dip with accuracy. Observations on the Western coast confirm these results for the Eastern.

ON THE CAUSE OF THE INCREASE OF SANDY HOOK. BY PROF. BACHE.

It is well known, as one of the developments of the Survey, that the Hook is gradually increasing, growing to the northward into the main ship channel. At a spot north of the Hook, where there were forty feet of water when Captain GEDNEY made his survey, in less than ten years it was nearly bare. The importance of determining the cause of this increase, as leading to the means of controlling it cannot be over estimated. The Commissioners on Harbor Encroachments had early attended to the matter and requested that the necessary observations for its investigation should be made. These were under the immediate direction of Prof. BACHE, the observations having been made by HENRY MITCHELL, one of the sub-assistants in the Coast Survey, with all desirable zeal and ability.

Various causes had been assigned for this growth from the action of the waves and the winds, sometimes on the outer side and sometimes on the inside of the Hook. The effect of the opening and closing of Shrewsbury inlet had also been insisted upon.

To examine these and other probable causes laborious observations of tides and currents had been made in the vicinity of stations which Prof. BACHE showed upon the map. Careful measurements of the low water line had also been made in connection with these observations, and with others of the force and direction of the winds. Objects easily distinguished from the sand, and of various specific gravities, and shapes, had been deposited near the shore of the Hook to determine the power and direction of transportation of matter along the shores of the Hook. The results of these observations have not yet been worked out in all their detail, but the conclusions from them are perfectly safe, and are of the highest importance. It turns out that this growth of the Hook is not an accidental phenomenon, but goes on regularly and according to determinable laws. The amount of increase depends upon variable causes, but the general fact is that it increases year by year, and the cause of this is a remarkable northwardly current, the amount and duration of which these observations assign along both shores of the Hook, the outer one extending across the whole breadth of False Hook channel, with varying velocity, and the one inside of the Hook extending nearly one-third of the distance across Sandy Hook Bay. These currents run to the north, during both the ebb and flood tide, with varying rates, and result from those tides directly and indirectly. The inner current is the one by which the flood and ebb tides draw, by the lateral communication of motion, the water from Sandy Hook Bay, and the outer is similarly related to those tides as they pass False Hook channel. The velocities and directions found, favor this conclusively.

An important observation for navigation results from this, for eleven hours out of the twelve, there is a northwardly current running through False Hook channel, which assists vessels entering New York harbor on the ebb tide, and is to be avoided in passing out with the ebb.

It is the conflict of these two northwardly currents outside and inside, and the deposit of the materials which they carry to the point of the Hook, which causes its growth.

Within a century it has increased a mile and a quarter, and at about the rate of one sixteenth of a mile a year, on the average, for the last twelve years.

Flynn's Knoll, on the north side of the main ship channel, does not give way, as the point of the Hook advances. The importance of watching this movement cannot, therefore be over stated.

The mode of controlling the growth is obvious from the result obtained. The observations are still continued, to obtain the necessary numerical results.

APPROXIMATE COTIDAL LINES OF DIURNAL AND SEMI-DIURNAL TIDES OF THE COAST OF THE UNITED STATES ON THE GULF OF MEXICO—BY A. D. BACHE, SUPERINTENDENT UNITED STATES COAST SURVEY. COMMUNICATED BY AUTHORITY OF THE TREASURY DEPARTMENT.

This paper is supplementary to those on cotidal lines of the Atlantic and Pacific coasts heretofore communicated to the Association. Preparation was made at the last meeting for these conclusions by presenting the type curves of the Gulf coast The tides from Cape Florida to St. George's are of the usual type, with a large daily inequality. From St. George's to the mouth of the Mississippi they are of the single day type. Then the half-day tides reappear to extend beyond Galveston, the day tides recurring at Aransas, in Texas, and southward. When the type curves were presented, the mode of decomposing them with a diurnal and semi-diurnal wave was described. The tide stations extend along our whole coast, but observations are much wanted beyond it to complete the investigation, on the south side of the Straits of Florida, on the eastern coast of the Gulf of Mexico south of Texas, and especially between Cuba and Yucatan, at the entrance of the Gulf from the Caribbean sea.

A table of the stations at which the observations were made, of the heights of tide (rise and fall) observed, and of the half-day and day tides, was given; and another showing the period of observation and the name of the observer. The first table is represented on a diagram by which a navigator may find the rise and fall of tide approximately on any part of our Gulf coast. The least observed rise and fall is at Brazos Santiago, Texas, and is nine tenths of a foot. The greatest is at Cedar keys, Florida, and is two and a half feet. The difficulties of the problem presented by these tides are explained, removable in part by the progress of the survey of the Gulf, inherent in them in part. The labors of Mr. Pourtales and other gentlemen concerned in the discussion of these tides are acknowledged. The single-day tides have not been so elaborately discussed by former physicists or mathematicians as to prepare the way fully for this work. The formula for the times given by Professor Avery in his "Tides and Waves," when compared with the observed times, differs remarkably in certain parts of the lunar month. A diagram shows the general form of the curve of interval between the moon's transit and high water. Advantage is taken of the part of the curve which changes but little in ordinate to obtain an average luni-tidal interval corresponding in kind with the number for semi-diurnal tides, known at the establishment. These tides occur about the period of greatest declination of the moon. These intervals, at greatest declination, vary greatly during the year; and the form of curve showing the annual change is presented, as deduced from observations at key West, Fort Morgan (Mobile entrance), and Galveston, as well as from San Francisco, on the Western coast, where the results are remarkably regular. These annual curves are used to deduce the average number for the interval of the daily tides from the short series of observations; the limits of uncertainty of the process are pointed out. These intervals are next turned into cotidal hours by the usual process of correcting for the difference of longitude, for transit, for depth, and by the process just described for the annual change. A table of cotidal hours for the various stations is then given. By it the cotidal lines are traced, the tide waves entering the Straits of Florida, passing through them, crossing to the entrance of the Mississippi, and passing laterally to the western coast of the peninsula of Florida from south to north, and along the southern coast of Upper Florida, along the eastern coast of Louisiana from the Southwest Pass northward, and along the coast of Mississippi. Also, into the Gulf between Southwest pass and the Rio Grande, in such a way that Galveston has, as the head of the Gulf, the latest cotidal hour. By forming groups of stations, the direction of the cotidal lines, the mean cotidal hour, and the velocity of the wave's movement are roughly determined. The difficulties of forming the groups are explained, and the general character of the results given by them are shown in a table and upon a diagram map. Upon the map also are given the cotidal hours of the stations, and the results of the grouping. Finally, from the study of the groups and their connection, the cotidal lines or the daily tides are drawn upon the map. The main cotidal hour of the northern shore of the Gulf is twenty-six hours, twenty seven occurring at the head of the bight in which Galveston lies. The twenty-five hour line appears at Cedar Keys, and touches the coast again at Brazos Santiago. Twenty-three is at the Tortugas and Key West, and nineteen at Cape Florida.

A similar course to that just described is followed in the discussion of the semi-diurnal tides. The table of stations, their positions, and the other data necessary to obtain cotidal hours is given. The progress of the semi-diurnal wave as indicated by three hours is also shown. The general motion of the wave is like that of the diurnal wave, with very characteristic peculiarities. From the line of deep water joining the Tortugas and Southwest Pass at the entrance of the Mississipi the semi-diurnal wave reaches the stations on the western coast of the Florida peninsula in this order, from south to north and west. The movement west of St. George's appears to be in the order of Pensacola, Fort Morgan and Cat Island, while for the diurnal wave it was Cat Island, Fort Morgan, Pensacola. To the westward of Southwest Pass there is a sudden increase of establishment, as if another semi-diurnal wave brought the tides there. The mean cotidal hour of the five sections west of Southwest Pass is 20 h. 6 m., while that of Southwest Pass and three east of it is 16 h. 17 m., a difference of about four hours. This taken with the remarks already made in regard to the appearance of two high waters in the curves for Isle Dernier and Calcasieu, indicate a system of interferences yet to be unravelled. As was the case with the diurnal wave, the stations at Isle Dernier and Calcasieu gave cotidal hours very like those of Brazos Santiago and Aransas, and Galveston is later then either.

The differences between the cotidal hours for the diurnal and semi-diurnal tides are shown in a table. The grouping of the semi-diurnal results is next made, and the results tabulated and drawn on a diagram map. This map also shows the cotidal lines deduced. The cotidal lines of thirteen and fourteen hours only appear on the coast of the Florida Keys; that of sixteen hours is well marked, near Egmont Key (Tampa), and passes around the shore of the great Bay, between Louisiana and Florida, to near Southwest Pass. The line of eighteen hours is at the head of the heights, between St. George's and Cedar keys, and seventeen in that near Cat Island; the lines of sixteen and twenty-one have succeeded each other closely in the bay to the westward of Southwest Pass.

In comparing the two sets of cotidal lines for the diurnal and semi-diurnal waves, we find a general resemblance in the great bay between the western coast of Florida and the eastern coast of Louisiana. The lines of 24, 25 and 26 of the diurnal tide on the eastern side of the bay, corresponding generally with 16, 17 and 18 of the semi-diurnal tides and 25 and 26 hours of the diurnal tide on the western side of the bay corresponding generally to 16 and 17 of the semi-diurnal. On the southern coast of Florida, by the Keys, on the contrary the lines of 19, 20, 21, 22 and 23 hours succeed each other rapidly between Cape Florida and the Tortugas, in the diurnal series, along the same shores in the semi-diurnal tide. On the contrary on the west of southwest Pass, the lines of 26, 27 and 28 hours only occur at considerable distances in the diurnal system, while 16, 17, 18, 19, 20 and 21 occur in the same space between Southwest Pass and Brazos Santiago in the same diurnal tide.

NOTES ON THE PROGRESS MADE IN THE COAST SURVEY, IN PREDICTION TABLES FOR THE TIDES OF THE UNITED STATES COAST, BY A. D. BACHE, SUPTD., ETC.

Communicated by authority of the Treasury Dept.

As soon as tidal observations had accumulated sufficiently to make the task a profitable one, I caused them to be treated, under my immediate direction, by the methods in most general acceptance. The observations at Old Point Comfort, Virginia, were among the earliest used for this purpose, and the labors of Commander Charles H. Davis, U. S. N., then an assistant in the coast survey, were directed to their reduction chiefly by the graphical methods pointed out by Mr. Whewell. This work was subsequently continued by Mr. Lubbock's method, by Mr. Henry Mitchell; and next the tides of Boston harbor were taken up as affording certain advantages in the observations themselves, which could not be claimed for those of Old Point.

The system of Mr. Lubbock is founded on the equilibrium theory, and in it the inequalities are sought by arranging the elements of the moon's and sun's motions, upon which they depend. Having obtained the coefficient of the half monthly inequality of the semi-diurnal tide at Boston, from seven years' observations, through the labors of the tidal division, and approximate corrections for the parallax and declination, I was much disappointed in attempting the verification by applying to individual tides for a year during which we had observations. There was a general agreement on the average but a discrepancy in the single cases, which was quite unsatisfactory. Nor were these discrepancies without law, as representing their residuals by curves did not fail to show. By introducting corrections for declination and parallax of the moon increasing and decreasing, we reduced these discrepancies, but still the results were not sufficient approximations. With the numerical reductions of the observations before referred to, was commenced in 1853, under my immediate direction, by Mr. L. W. Meech, a study of the theory of the tides, directed chiefly to the works of Bernoulli, La Place, Avery, Lubbock and Whewell The immediate object which I had in view was the application of the wave theory to the discussion of our observations. I thought that the mind of an expert mathematician, directed entirely to the theoretical portions of this work, with direction by a physicist, and full opportunities of verifying results by extenced series of observations, the computations of which should be placed by others in any desired form, would give, probably, the best result in this combined physical and mathematical investigation.

The general form of the different functions expressing the tidal inequalities is the same in the different theories, and may be said on the average to be satisfactory as to the laws of change which these inequalities present. Whether we adopt, with La Place, the idea that periodical forces produce periodical effects, or with Avery, that the tidal wave arrives by two or more canals; or with Bernoulli and Lubbock, the results of an equilibrium spheroid; or with Whewell, make a series of inequalities, semi-menstrual, parallax and declination, with different epochs, we arrive at the same general results, that the heights and times of high water may be represented by certain functions, with indeterminate co-efficients, in the form of which the theories in a general way agree. By forming equations from the observations, and obtaining the numerical values of the co-efficients by the methods used so commonly in astronomical computations, the result is accomplished.

A general consideration of the co-ordinates in space of the moon and sun, without any special theory, would lead to the same result, representing the luni-tidal interval by a series of sines and co-sines, with indeterminate co-efficients.

The grouping of the observations of one year at Boston, to apply this method-the formation of the equations and their solution by the method of indirect elimination has been the work of Mr. R. L. Avery.

To test the co-efficients, computations, for the predicted times of the tide at Boston harbor were made for a period from March 1853, to January 1854, and from comparison of these with the observed, it appears that in twenty pairs of tides, the morning and afternoon being grouped to get rid of the diurnal inequality, there are two differences of less than two 2 m., thirteen of more than 2 m. and less than 4 m., three of more than 4 m. and less than 10 m., two of more than 10 m. The probable error of the prediction of a single pair of tides is 4.12 m. so that greater accuracy of prediction has been attained by this method from a single years's observations that was found at London bridge from a period of nineteen years.

LAW OF MORTALITY.

Prof. McCoy, of Albany, read a paper in which he announced the important discovery of a mathematical formula which correctly expressed the law of mortality for all ages; it was first evolved from an analysis of the Carlisle and Northampton tables, but the Professor had compared it with a large number of others and said that, "so complete is its agreement with all, that at no age does the calculated number of the living differ from the number given in the tables by a single year's mortality." The formula is, that, for the age x, the rate of mortality or the ratio of the dead to the living for that age is expressed by

$$a b^{c^{x}}$$

where, a, b, c, are constants which differ for different tables. From this the Professor drew the following conclusions;

1. The rate of mortality invariably increases from youth to old age.
2. This rate is continually accelerated even in a higher ratio than in geometrical progression.
3. In early manhood, the rate does not differ much from a slow arithmetical progression.
4. There are no crises or climacterics at which the chances for life are stationary or improving.
5. There are no periods of slow and rapid increase succeeding each other; but one steady, invariable progress.
6. The law, though not the rate of mortality, is the same for city and country, for healthy and unhealthy places, for every age and country and locality; and this law is that the differences of the logarithms of the rates of mortality are in geometrical progression.

OZONE OBSERVATION.

Prof. Rogers gave an account of some observations made by him on the existence of ozone in the atmosphere. In the first instance these were made at Boston, and he here found winds blowing from the sea heavily ozonised, while those from the land were less so; on removing, however, fifty miles inland, he found the indications of ozone apparently independent of the quarter from which the wind was blowing, and depending more on its velocity; in a calm there being but slight ozonic effect, the increase being marked with the violence of the wind. This was to have been expected from the imperfect character of the mode of observation, since the effect produced on the test paper would depend on the quantity of ozone brought in contact with it, and this of course depended on the quantity of air that passed over it in a given time. To remedy this defect, he had arranged an apparatus by which the number of cubic feet of air passing over the test paper could be measured.

Dr. Webster, of Norfolk, added an important observation, "*Last year, while the yellow fever was at Norfolk and Portsmouth, I kept an ozonometer constantly exposed to the air, and never detected ozone. This year I have used the ozonometer in the same place, and at the same period of time, and I find ozone in abundance.*"

THERMIC EFFECT OF THE SUN'S RAYS.

In a paper, by Mrs. Eunice Foote, some interesting results of experiments on this subject were given. The experiments were made by exposing freely to the Sun's rays a thermometer, with blackened bulb, enclosed in a glass receiver, which contained the various gases experimented on. The effect was found to be greatest of all in Carbonic Acid gas: for example, when in air the thermometer stood at 106°, in Hydrogen it stood at 104°; in Oxygen, at 108°, and in Carbonic Acid at 125°. It was also found that the thermic effect was increased in air by an increase of its density and also by an increase of the moisture in it.

(*To be continued.*)

MONTHLY METEOROLOGICAL REGISTER AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST, OCTOBER, 1856.

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°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M	2 P.M	10 P.M	ME'N	Mean Temp. + or — of the Av'age.	Tens. 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	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't. Direction.	Direction of Wind. 6 A.M	2 P.M.	10 P.M.	Result'.	ME'N	Rain in inches.	Snow in inches.
1	29.225	29.263	29.335	29.2805	40.0°	50.0°	43.0°	44.63°	+ 5.78°	.213	.218	.200	.212	.87	.61	.72	.73	S W b W	S W b W	S W b S	S 38° W	2.8	13.6	6.0	9.89	10.08		...
2	343	395	541	.4412	45.1	51.7	45.8	47.47	— 2.47	177	232	248	217	60	62	82	68	S W b S	S S W	S W	S 50 W	13.5	17.8	1.8	8.24	9.59	...	...
3	693	718	788	.7380	38.4	57.9	47.4	48.53	— 1.00	197	237	220	217	85	50	68	66	W N W	S W b S	S W	S 47 W	7.0	8.3	2.5	3.68	4.79	...	...
4	841	786	732	.7833	42.0	57.2	51.0	50.95	+ 1.92	235	288	305	285	89	[illegible]	83	78	N	E	N E b E	N 71 E	1.0	6.4	1.4	2.83	3.01	...	...
5	701	628	—	—	43.4	63.2	—	—	—	256	398	—	—	92	[illegible]	—	—	Calm	S b W	S W b W	S 58 W	0.0	4.8	2.0	2.52	4.11	Inap	...
6	728	781	896	.8092	54.2	62.0	49.2	54.78	+ 6.57	283	274	297	282	69	51	86	69	N W b W	N b W	N b W	N 20 W	5.6	11.6	7.2	7.24	7.48	...	...
7	969	952	894	.9362	41.1	51.9	42.8	46.07	— 1.78	216	278	247	249	81	73	91	81	N b E	S E b E	Calm	N 73 E	2.8	3.6	0.0	2.37	2.73	...	...
8	892	840	822	.8492	39.8	59.4	48.1	49.67	+ 2.22	220	359	204	295	91	72	89	84	Calm	S	Calm	S 32 E	0.0	2.2	0.0	0.58	0.76	...	...
9	853	798	801	.8152	45.2	70.1	55.3	56.72	+ 9.65	279	383	355	337	94	54	83	77	Calm	S	E b S	S 62 E	0.0	1.0	1.5	0.59	0.82	...	...
10	821	769	719	.7672	44.9	67.3	50.6	54.83	+ 8.17	287	346	253	314	97	53	70	76	N E b N	Calm	Calm	S 62 E	1.5	0.0	0.0	0.45	0.51	...	...
11	721	779	873	.7992	52.1	64.9	50.8	56.42	+10.17	291	242	281	281	76	40	77	65	S S W	N W	N	N 19 W	1.4	12.4	10.3	7.96	9.13	...	...
12	29.822	790	—	—	45.4	54.6	—	—	—	209	312	—	—	70	75	—	—	N N E	S E	E	S 79 E	1.0	4.5	0.8	0.86	1.08	0.115	...
13	616	635	806	.6960	51.0	53.9	40.6	48.07	+ 2.50	341	216	127	223	97	53	50	65	Calm	N W b N	N	S 20 E	0.0	21.8	16.8	12.49	13.54	Inap	...
14	956	979	30.080	30.0198	35.2	39.9	33.7	36.32	— 8.95	114	110	106	119	56	45	55	53	N b E	N N E	N b E	N 16 E	9.2	10.0	6.6	9.74	9.96	...	...
15	30.175	30.128	30.088	30.1325	28.4	43.4	31.6	35.17	— 9.68	110	163	144	140	70	59	80	69	N b E	S	Calm	N 43 W	6.7	2.4	0.0	0.22	2.50	...	...
16	30.032	29.951	29.900	29.9617	27.3	48.9	38.8	38.57	— 5.97	130	224	177	177	86	65	75	75	Calm	S W b S	N N W	S 83 W	0.0	7.8	4.8	1.49	3.48	...	...
17	29.888	29.823	705	.7905	37.0	51.3	46.7	44.90	+ 0.67	174	302	274	248	80	81	87	83	N	E N E	N b E	N 49 E	4.7	8.3	2.8	5.83	6.40	0.365	...
18	610	608	705	.6137	45.6	47.9	47.3	47.05	+ 3.02	288	289	290	291	95	89	90	91	N E	N N W	W N W	N 32 W	6.4	9.2	0.4	3.47	4.46	0.225	...
19	835	859	—	—	44.2	53.3	—	—	—	268	321	—	—	93	81	—	—	Calm	S W	Calm	S 60 W	0.0	3.0	0.0	0.72	0.77	0.010	...
20	952	891	913	.9170	37.5	53.8	40.4	44.05	+ 0.48	214	331	237	267	96	82	95	93	Calm	Calm	Calm	S 33 W	0.0	0.0	0.0	0.04	0.04	...	...
21	891	802	690	.7892	38.4	52.6	48.5	46.70	+ 5.45	217	326	295	283	94	84	88	89	Calm	Calm	Calm	N 66 W	0.0	0.0	0.0	0.13	0.14	...	...
22	607	537	553	.5610	54.2	59.3	52.8	55.17	+12.20	367	418	313	366	89	85	80	85	Calm	N	N N W	N 25 W	0.0	0.8	11.4	4.40	4.63	0.025	...
23	635	714	883	.7515	44.9	44.9	33.4	40.97	— 1.78	248	132	108	167	84	45	57	64	N b E	N N W	N b E	N 23 W	0.3	21.8	9.2	9.82	10.40	...	...
24	989	957	943	.9513	23.3	38.4	30.5	31.52	—10.98	107	124	134	121	83	54	75	69	N	S E	E b N	N 83 E	1.4	8.5	1.1	3.28	4.36	...	...
25	830	696	690	.7407	38.8	42.1	42.1	40.60	— 1.68	169	166	183	167	73	63	69	67	E b S	E S E	Calm	S 82 E	13.9	14.2	0.0	7.64	7.68	0.010	...
26	818	778	—	—	38.8	50.8	—	—	—	260	288	—	—	85	78	—	—	Calm	S b W	S b W	S 32 W	0.0	6.0	1.2	1.85	2.45	...	...
27	519	350	403	.4202	46.0	46.0	45.2	45.47	+ 3.68	279	292	270	281	90	95	90	93	S S W	E N E	W b S	S 54 W	4.0	2.0	19.0	4.38	7.39	0.105	...
28	355	321	451	.3838	37.3	45.9	40.7	41.90	+ 0.42	193	163	178	176	87	53	71	69	S W b W	W S W	W S W	S 73 W	4.0	21.5	14.5	15.12	15.17	...	...
29	523	466	234	.4048	41.5	47.4	47.0	45.45	+ 4.18	244	186	267	233	91	57	84	78	W S W	S W	E S E	S 43 W	8.5	10.0	4.6	9.33	11.45	0.020	...
30	274	288	345	.3023	42.0	39.4	34.5	38.22	— 2.73	247	116	157	166	94	48	78	72	S W	W b S	S W b W	S 76 W	12.6	21.0	12.0	13.99	14.17	...	Inap
31	329	384	464	.3970	31.2	35.0	35.1	34.13	— 6.62	154	127	119	132	88	62	58	68	W b S	W b N	S W b W	S 75 W	10.4	14.5	9.6	13.99	14.89	...	0.1
M	29.7145	29.6891	29.7132	29.7069	40.83	51.20	43.44	45.34	+ 0.30	.222	.242	.225	.231	.85	.63	.77	.75	....	....	....	....	3.84	8.68	4.76	......	6.07	0.875	0.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER.

Highest Barometer . . . . 30.200 at 8 a. m. on 15th } Monthly range=
Lowest Barometer . . . . 29.217 at midn't. on 29th } 0.983 inches.

Highest registered temperature . . . 71°4 on p. m. of 9th } Monthly range=
Lowest registered temperature . . . . 23°0 on a. m. of 24th } 48°4

Mean maximum temperature . . 54°04 } Mean daily range = 18°82
Mean minimum temperature . . 35°22 }

Greatest daily range . . . . 28°5 from p. m. of 13th to a. m. of 14th.
Least daily range . . . . 6°4 from p. m. of 18th to a. m. of 19th.

Warmest day . . 9th ... Mean Temperature . . . 56°72 } Difference=25°20.
Coldest day . . . . 24th .. Mean Temperature . . . . 31°52 }

Greatest intensity of Solar Radiation . . 88°4 on p. m. of 9th } Monthly range=
Lowest point of Terrestrial Radiation . 7°5 on a. m. of 24th } 80°9

Aurora observed on 3 nights, viz.: on the 4th, 8th and 23rd; possible to see Aurora on 19 nights; impossible to see Aurora on 12 nights.

Snowing on 2 days; depth, 0.1 inches; duration of fall, 1.5 hours.

Raining on 10 days; depth, 0.875 inches; duration of fall, 27.8 hours.

Mean of cloudiness=0.47; most cloudy hour observed, 4 p. m., mean=0.58: least cloudy hour observed, midnight; mean=0.40.

Sums of the components of the Atmospheric Current, expressed in Miles.

North.	South.	East.	West.
1362.21	1187.47	703.87	2263.32

Resultant direction of the wind, N 76° W; Resultant Velocity, 2.15 miles per hour.

Mean velocity of the wind . . . . 6.07 miles per hour.
Maximum velocity . . . . 27.4 miles per hour, from 3 to 4 p. m. on 13th.

Most windy day . . . . 28th—Mean velocity, 15.17 miles per hour.
Least windy day . . . . 20th—Mean velocity, 0.04 do

Most windy hour . Noon to 1 p. m—Mean velocity, 9.82 do } Difference
Least windy hour 11 p. m. to midnight.—Mean velocity, 3.86 do } 5.96 miles.

1st to 2nd. Hoar Frost on these mornings at 6 a. m.
4th. Sheet Lightning, not accompanied by Thunder, during the Evening.
10th. Very dense ground Fog at 6 a. m.
" Small halo round the Moon at 10 p. m.
14th and 15th. Thin Ice on the water at 6 a. m.
19th to 22nd inclusive. Extraordinary and continuous dense Fog.
22nd. Sheet Lightning and distant Thunder 8 to 11 p. m.
30th. First Snow of the Season at 11 a. m.
31st. Snowing slightly most of the day.

This month was marked by an unusual scarcity of rain, the quantity that fell having been less than one-third of the average.
The Resultant direction of the Wind for October, from 1848 to 1856 inclusive, was N 63° W, and the Resultant velocity 1.35 miles per hour.

COMPARATIVE TABLE FOR OCTOBER.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Difference from Average.	Maximum observed.	Minimum observed.	Range.	No. of dy's.	Inches.	No. of dy's.	Inches.	Resultant. Direction.	Resultant. Velocity.	Mean Velocity
1840	44.4	—0.8	23.9	20.9	41.6	13	1.860	3	—	—	—	—
1841	41.6	— 3 6	58.3	20.3	38 0	6	1.360	2	—	—	—	0.41 lbs.
1842	45.1	— 0.1	68.5	30.0	38 5	8	5.175	0	—	—	—	0.35 "
1843	41.8	— 3.4	65.7	24.5	41.2	12	3.790	4	2.5	—	—	0.54 "
1844	43.3	— 1.9	69.6	17.8	51.8	7	Impft	4	12.0	—	—	0.43 "
1845	46.4	+ 1.2	62.7	20.0	42.7	11	1.760	1	Inapp	—	—	0.26 "
1846	44.6	— 0 6	69 7	20.7	49.0	14	4.180	2	Inapp	—	—	0.44 "
1847	44.0	— 1.2	65.0	20.3	44.7	13	4.390	2	Inapp	—	—	0.19 "
1848	46.3	+ 1.1	62.2	26.4	35.8	11	1.550	0	0.0	N 54 W	1.24	4.60 mls.
1849	45.3	+ 0.1	59.2	25.5	33.7	13	5.965	1	Inapp	N 12 W	1.27	4.76 "
1850	45.4	+ 0.2	66.6	24.8	41.8	10	2.085	0	0.0	N 66 W	1.10	5.30 "
1851	47.4	+ 2.2	66.1	25.0	41.1	10	1.680	2	0.3	S 72 W	1.06	4.39 "
1852	48.0	+ 2.8	70.7	29.8	40.9	12	5.280	0	0.0	N 5 E	1.19	4.47 "
1853	44.4	— 0.8	64.7	25.5	39.2	10	0.875	2	Inapp	S 87 W	1.52	4.72 "
1854	49.5	+ 4 3	74.2	29.8	44.4	15	1.495	3	Inapp	N 25 E	1.38	4.60 "
1855	45.4	+ 0.2	64.3	28.0	36.3	14	2.485	5	0.8	N 82 W	4.91	9.88 "
1856	45.3	+ 0.1	70.1	23.3	46.8	10	0.875	2	0.1	N 76 W	2.15	6.07 "
Mean	45.19	...	66.24	24.45	41.79	11.1	2.800	1.9	1.1	—	—	5.42

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY TORONTO, CANADA WEST—NOVEMBER, 1856.

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°. 6 A.M.	2 P.M.	10 P.M.	MEAN	Temp. of the Air. 6 A.M	2 P.M	10 P.M	ME'N	Mean Temp. + or − of the Av'age.	Tens. 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	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direction.	Velocity of Wind. 6 A.M	2 P.M	10 P.M	Result.	ME'N	Rain in Inches.	Snow in Inches.
1	29.227	29.067	29.279	29.1908	39.5°	53.1°	41.0°	44.05°	+ 3.68°	.146	.225	.215	.200	.60	.56	.84	.69	S S W	W S W	W	S 54° W	19.7	22.1	3.0	9.42	10.75	...	...
2	.372	.427	—	—	42.7	51.0	—	—	—	.2?3	.269	—	—	.82	.73	—	—	N b W	S	S W	S 40 W	2.2	5.1	0.6	2.20	3.74	0.175	...
3	.623	.445	.408	.4880	48.8	49.5	49.9	48.98	+ 8.98	.321	.298	.337	.314	.94	.85	.97	.92	E b N	E	Calm.	N 88 E	7.8	8.0	0.0	3.88	3.93	0.205	...
4	.201	28.902	.202	.1780	51.0	56.4	34.8	46.02	+ 6.25	.353	.344	.115	[illegible]	.96	.76	.55	.76	E b S	S S W	W N W	S 78 W	4.4	20.0	31.5	14.96	20.93	...	...
5	.591	29.802	30.094	.8223	26.4	32.5	25.1	27.92	—11.57	.106	.090	.094	.098	.72	.49	.67	.64	W	[illegible] W	W N W	N 65 W	18.6	16.2	3.0	10.49	10.95	...	...
6	30.041	.940	29.814	.9255	22.8	40.3	39.9	35.43	— 3.73	.106	.1[illegible]8	.196	.157	.84	.59	.81	.75	Calm.	S b W	S b E	S 5 W	0.0	19.6	6.0	8.36	8.70	...	...
7	29.772	.725	.613	.6948	42.7	49.3	50.3	47.72	+ 8.72	.240	.242	.266	.251	.89	.70	.73	.77	S b E	S	S b E	S 1 E	7.0	9.0	6.2	6.17	6.59	0.180	...
8	.283	.684	.920	.6308	50.6	38.8	28.4	39.32	+ 0.63	.238	.141	.136	.201	.93	.60	.87	.78	S b E	W	N W b N	S 86 W	12.2	30.6	2.0	10.77	13.85	0.045	Inap
9	.922	.878	—	—	29.6	33.0	—	—	—	.125	.131	—	—	.76	.69	—	—	N W b N	W	N W b W	N 76 W	5.4	7.4	9.5	5.33	5.61	...	...
10	.914	.893	.823	.8738	24.8	35.9	37.3	33.15	— 4.93	.108	.120	.156	.133	.79	.57	.71	.70	N W b W	S E b S	S S E	S 33 E	1.4	8.0	6.5	5.05	6.37	...	...
11	.755	.761	.823	.7813	39.5	43.7	40.2	40.35	+ 2.57	.204	.171	.176	.187	.85	.61	.72	.76	S S W	S S W	W b N	S 72 W	11.2	4.5	5.1	2.42	3.74	...	...
12	.851	.833	.882	.8605	36.7	43.6	36.9	38.70	+ 1.29	.178	.153	.148	.171	.82	.55	.68	.73	N W b N	W N W	W b N	N 69 W	3.5	12.0	9.0	8.82	9.05	...	0.1
13	.871	.788	.740	.7892	33.0	38.8	36.1	36.03	— 1.15	.175	.216	.184	.187	.94	.93	.87	.89	W S W	S b E	N E b E	N 88 E	1.1	0.8	2.8	3.00	5.48	0.290	0.5
14	.656	.691	.795	.7195	34.5	38.4	34.8	35.67	— 1.23	.194	.167	.169	.171	.98	.72	.84	.83	N E	N	N b W	N 6 E	12.3	13.5	8.5	9.74	10.78	0.055	0.5
15	.703	.588	.372	.5577	24.1	36.6	39.0	33.70	— 2.80	.115	.136	.174	.153	.86	.63	.74	.78	N W b N	S S W	S	S 25 W	5.2	9.0	12.5	6.61	8.22	0.015	...
16	.257	.312	—	—	39.1	41.6	—	—	—	.221	.200	—	—	.94	.76	—	—	S W	W b S	W N W	S 89 W	9.0	19.0	9.5	9.73	10.58	...	0.6
17	.392	.473	.635	.5120	27.3	32.3	30.2	29.77	— 6.03	.126	[illegible]	.145	.133	.85	.61	.86	.81	N W b N	W	N W b W	N 65 W	9.0	16.2	10.0	10.91	11.08	...	0.1
18	.720	.757	.807	.7643	30.9	35.6	32.0	32.95	— 2.53	.158	.144	.141	.143	.93	.69	.78	.76	W N W	N W b W	W	N 74 W	16.5	17.2	3.6	8.73	9.05	...	...
19	.852	.858	.936	.8885	27.3	38.1	29.5	32.03	— 3.05	.131	.139	.138	.136	.86	.61	.84	.76	W b S	W	Calm.	N 88 W	1.9	3.3	0.0	0.12	1.33	...	...
20	.991	.930	.957	.9717	31.7	36.5	35.9	34.85	+ 0.05	.149	.157	.164	.160	.83	.73	.78	.79	Calm.	E	E	N 80 E	0.0	5.0	5.8	5.73	5.79	...	...
21	.807	.554	.227	.5152	37.3	40.3	46.3	41.55	+ 7.17	.195	.195	.266	.219	.88	.79	.86	.83	E b N	E	E	S 55 E	14.8	15.6	4.0	6.83	16.51	0.195	...
22	.437	.707	.860	.6933	44.9	42.0	33.8	39.68	+ 5.60	.252	.156	.147	.171	.85	.59	.75	.70	S W	W S W	Calm.	S 62 W	25.0	17.2	0.0	10.07	10.09	...	...
23	.897	.690	—	—	32.0	40.9	—	—	—	.153	.212	—	—	.85	.81	—	—	Calm.	E N E	N E b E	N 67 E	0.0	8.3	1.5	4.89	5.33	...	...
24	.594	.595	.790	.7050	34.8	45.4	40.4	39.52	+ 6.2?	.185	.218	.185	.192	.92	.72	.74	.80	Calm.	N N W	Calm.	N 10 E	0.0	4.0	0.0	0.78	1.07	...	...
25	.763	.464	.245	.4720	39.5	39.8	41.3	40.58	+ 7.62	.208	.214	.247	.228	.87	.88	.97	.91	E b N	E b N	E b N	N 83 E	9.0	20.6	3.0	9.46	13.53	0.215	...
26	.324	.503	.631	.5048	45.2	44.5	38.8	41.87	+ 9.30	.211	.161	.224	.194	.71	.56	.95	.75	W b S	W	W	S 80 W	20.7	26.2	3.5	13.09	13.18	Inap	...
27	.594	.565	.598	.5900	37.7	40.2	29.3	35.20	+ 3.02	.160	.129	.126	.136	.75	.51	.78	.67	W b S	W b N	W b S	S 80 W	10.0	20.2	3.6	10.16	10.29	...	...
28	.626	.592	.512	.5740	29.4	33.9	35.2	33.13	+ 1.25	.145	.146	.158	.148	.89	.74	.78	.78	W b N	E b N	E	N 74 E	3.0	8.3	12.0	7.69	9.17	...	3.5
29	.279	.260	.495	.3185	29.1	26.1	26.9	26.57	— 4.93	.142	.130	.131	.130	.88	.89	.88	.88	N E b E	N N W	N N W	N 1 W	20.2	11.0	1.0	6.02	8.19	...	4.2
30	.330	.802	—	—	27.8	34.8	—	—	—	.129	.157	—	—	.84	.77	—	—	W b S	W N W	W N W	N 72 W	8.5	15.8	5.0	7.32	8.71	...	Inap
M	29.6410	29.6211	29.6387	29.6421	35.58	40.16	36.51	37.39	+ 1.24	.186	.174	.178	.179	.85	.68	.80	.78					8.65	13.12	5.62		8.75	1.375	9.5

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR NOVEMBER.

Highest Barometer .... 30.048 at 8 a. m., on 6th } Monthly range=
Lowest Barometer ... . 28.902 at 2 p. m., on 4th } 1.146 inches.

Highest registered temperature......... 56°4 at p. m., on 4th } Monthly range=
Lowest registered temperature......... 18°8 at a. m., on 6th } 37°6

Mean maximum Thermometer... ..... 43°02 }
Mean minimum Thermometer......... 28°74 } Mean daily range = 14°27

Greatest daily range .... 32°4 from p. m. of 4th to a. m. of 5th.
Least daily range............................ .. 6°1 from a. m. of 20th to a. m. of 21st.

Warmest day......... 3rd ... Mean temperature......... 48°98 }
Coldest day........... 29th ... Mean temperature......... 26°57 } Difference = 22°41.

Greatest intensity of Solar Radiation .... 67°5 on p. m. 4th } Monthly range=
Lowest point of Terrestrial Radiation .... 5°8 on a. m. 6th } 61°7

Auroral Light observed on 1 night, viz.. 4th; possible to see Aurora on 10 nights; impossible to see aurora on 20 nights.

Snowing on 9 days.—depth 9.5 inches—snowing 30.2 hours.
Raining on 10 days,—depth 1.375 inches—raining 42.3 hours.

Mean of cloudiness =0.81; most cloudy hour observed, 8 a. m., mean =0.91; least cloudy hour observed, 10 p. m., mean, =0.74.

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

North.	South.	East.	West.
1296.20	1401.66	1428.63	3539.50

Resultant direction of the wind, S 85° W.; Resultant Velocity 2.95 miles per hour.
Mean velocity of the wind......... 8.75 miles per hour.
Maximum velocity .... 40.8 miles per hour, from 4 to 5 p. m. on 4th.
Most windy day........................ 4th...Mean velocity 20.03 miles per hour.
Least windy day .... 24th...Mean velocity 1.07 ditto.
Most windy hour ... 2 to 3 p. m............Mean velocity 13.29 ditto.
Least windy hour, Midnight to 1 a.m. ...Mean velocity 5.70 ditto.
Mean diurnal variation = 7.59 miles.

4th—Dense Fog, 6 to 8 a. m.
4th—Auroral Light at Midnight.
6th—Halo round the Moon, 7 to 9 p. m.
8th—Zodaiacal Light, very bright, 5.30 to 6 p. m.
10th—Halo round the Moon, 8 to 9 p. m.
15th—Halo round the Sun, and faint Parhelion at 2 p. m.
25th—Dense Fog at Midnight.
30th—First Sleighing in Toronto this Season.

Rain—The scarcity shown by the record of October, continued to a great extent through November, the amount that fell in November having been less than half the average.

Wind—The mean velocity of the wind was 2.23 above the average, and was but once exceeded during the last nine years.

The Resultant Direction of the wind for November of the last nine years was N 70° W, and the resultant velocity 1.84 miles per hour.

COMPARATIVE TABLE FOR NOVEMBER.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	M'n.	Diff. from Aver.	Max. ob'd.	Min. ob'd.	Range.	Days.	Inch's.	Days.	Inch's.	Resultant. Direction.	Resultant. V'y.	Mean Force or Velocity.
	°	°	°	°	°							
1840	35.9	−0.9	54.4	20.5	33.9	5	1.220	8	...	...	...	....
1841	35.0	−1.8	63.2	7.6	55.6	8	2.450	5	...	...	...	0.91 lb
1842	33.3	−3.5	50.6	7.6	43.0	9	5.310	10	...	...	...	1.22 "
1843	33.5	−3.3	51.2	14.4	36.8	10	4.765	7	1.2	...	...	0.59 "
1844	34.9	−1.9	49.8	12.0	37.8	8	imper	4	8.0	...	...	0.48 "
1845	36.8	0.0	58.8	7.6	51.2	7	1.105	4	5.0	...	...	0.53 "
1846	41 3	+4.5	55.5	18.2	37.3	12	5.805	2	0.4	...	...	0.64 "
1847	38.6	+1.8	58.2	7.8	50.4	14	3.155	3	Inapp	...	...	0.36 "
1848	34.5	−2.3	49.3	16.5	32.8	9	2.020	3	1.4	N 81° W	1.81	4.81 miles.
1849	42.6	+5.8	56.7	28.4	28.3	10	2.815	2	1.0	N 40° W	1.55	4.78 "
1850	38.8	+2.0	62.3	18.1	44.2	7	2.955	1	Inapp	N 42° W	1.43	5.27 "
1851	32.9	−3.9	50.1	16.5	33.6	5	3.885	6	6.7	N 50° W	1.25	4.70 "
1852	36 0	−0.8	50.4	18.7	31.7	7	1.775	3	2.0	N 59° W	1.53	6.50 "
1853	38.7	+1.9	54.1	14.4	39.7	15	2.425	6	2.7	N 1° E	0.56	5.52 "
1854	36.8	0.0	54.9	15.1	39.8	13	1.115	4	1.3	S 88° W	3.72	7.58 "
1855	38.6	+1.8	54.1	18.7	35.4	8	4.590	6	3.0	N 66° W	3.18	10.81 "
1856	37.4	+0.6	56.4	22.8	33.6	10	1.375	9	9.5	S 85° W	2.95	8.75 "
M	36.80	...	54.71	15.58	39.12	9.2	2.923	4.9	3.0			6.52 miles.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—OCTOBER, 1856.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M.D., LL.D.

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

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Mean direction of Wind.	Velocity in miles per hour. 6 A.M.	2 P.M.	10 P.M.	Snow in Inches.	Rain in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29.351	29.356	29.451	48.6	57.2	46.0	.348	.447	.273	.96	.93	.82	W S W	W S W	W S W	W 23 S	9.06	5.71	5.81	...	2.698	Rain.	Cir. Str. 8.	Cir. Str. 8.
2	.308	.548	.701	43.6	49.8	47.0	263	270	291	80	74	86	S W	S W by S	W S W	W 45 S	16.40	12.70	6.71	...	Inp	Cir. Str. 10.	Cir. Str. 8.	Do. 8.
3	.756	.790	.901	43.6	59.6	40.7	272	358	240	91	70	91	W by S	W N W	N W b N	W 30 S	0.62	5.56	3.01	...	...	Clear.	Cir. Cm. Str. 4.	Clear.
4	.980	.992	30.093	36.3	64.0	43.0	230	321	252	96	54	85	W N W	W N W	S by W	W 4 N	0.00	3.08	0 00	...	...	Str. 8.	Cum. 2.	Clear. Aur. Bor.
5	.915	.780	29.728	42.7	68.1	58.5	242	523	462	85	76	93	S E	S by E	W S W	S 11 E	0.36	0.00	0.00	...	0.050	Clear.	Cir. Cum-Str. 6	Str. 10.
6	.768	.877	.981	36.2	66.4	47.2	458	464	313	98	72	93	W S W	W S W	N by E	S 33 W	0.80	10.00	4.55	...	0.330	Rain.	Cir. Str. 7.	Cir. Str. 4.
7	30.184	30.111	30.050	48.6	68.4	44.3	312	513	268	89	72	85	W	W	S by E	W 11 N	0.11	1.16	0.90	...	...	Clear.	Cir. Str. 2.	Cir. Str. 4.
8	29.916	29.890	29.901	43.0	67.2	54.0	272	455	351	91	69	83	S by W	S W by S	S W	W 34 S	0.00	4.85	0.00	...	...	Str. 2.	Str. 2.	Clear.
9	.912	.851	.996	52.3	74.9	65.6	319	617	499	87	74	80	W by S	W by S	W by S	W 22 S	8 00	0.00	3.81	...	...	Cir. Str. 3.	Clear.	Do.
10	.930	.814	.839	54.8	80.6	61.0	373	617	441	87	61	81	W S W	W S W	S W	W 40 S	5.05	6.17	4.97	...	...	Cir. Cm. St. 4.	Do.	Do.
11	.713	.907	30.007	53.4	69.9	49.0	361	461	206	87	65	81	W by S	W by S	N by W	W 23 N	9.31	11.11	2.92	...	...	Clear.	Do.	Do.
12	.970	.834	29.750	54.3	63.0	48.9	194	366	302	91	64	86	N E	W S W	W S W	W 22 S	0.45	3.21	4.27	...	...	Do.	Do.	Do. Eclip. of M.
13	.650	.704	.847	42.8	67.0	40.6	272	480	203	91	72	79	W by N	W by S	N W	W 2 N	5.47	4.73	5.72	...	...	Do.	Cir. Str. 8.	Cir. 2.
14	.943	30.022	30.191	31.9	41.0	28.1	167	189	144	84	70	83	N by W	N by W	N W	W 40 N	10.40	6.85	6.55	...	...	Do.	Clear.	Clear.
15	30.254	.203	.121	24.9	47.4	34.6	117	234	189	75	69	86	N W b W	W by S	S W	W 34 S	0.90	9.90	4.31	...	...	Do.	Do.	Do.
16	.044	.025	.088	32.0	54.1	40.2	164	283	190	81	66	75	S W	W b S	W	W 33 S	0.22	3.86	5 08	...	...	Do.	Do.	Do.
17	.036	.031	30.013	32.4	56.6	41.1	175	363	250	87	79	87	S E	S E	S E	E 6° N	0.22	1.02	2.22	...	...	Do.	Do.	Do.
18	29.898	29.850	29.837	40.0	44.6	44.0	233	282	283	87	91	92	E N E	N E by E	N E b N	E 34 N	5.70	8.82	9.33	...	0.466	Cir. Str. 10	Cir. Str. 10.	Cir. Str. 10.
19	.854	.900	.998	44.3	51.3	42.8	283	337	272	92	87	90	W N W	W by S	W S W	W 12 S	2.20	6.22	7.70	...	...	Do. 4.	Do. 6.	Clear.
20	30.046	30.024	30.013	40.7	56.1	38.2	245	326	226	92	87	91	S W by W	W by S	S W	W 33 S	0.02	2.01	0.12	...	...	Fog.	Fog.	Dense Fog.
21	29.961	29.910	29.901	41.0	56.4	50.4	250	385	349	87	84	92	S W	W	N W	W 4 S	1.70	2.07	0 00	...	Inp	Fog.	Fog.	Rain.
22	.736	.654	.657	43.0	44.9	42.3	274	232	263	93	64	90	N E	N E by N	S W b W	N 34 E	11.08	5.95	2.23	...	0.533	Rain.	Cir. Str. 10.	Cir. Str. 10.
23	.654	.714	.870	38.8	42.7	30.1	207	243	145	84	83	79	N W	N W	N W b W	N 40 W	5.00	17.30	9.30	...	...	Clear.	Clear.	Cir. Aur. Bor.
24	.987	.953	30.105	23.6	43.2	20.6	106	184	152	73	63	85	N W	N by E	S W	N 23 W	7.71	8.17	3.22	...	...	Do.	Do.	Do.
25	30.052	30.014	29.945	24.5	47.9	32.3	115	252	170	76	74	[illegible]	S W	S W	S S W	W 35 S	0.10	0.98	1.31	...	...	Do.	Do.	Do.
26	29.913	29.857	.902	36.8	53.9	38.0	210	255	190	90	61	78	N W	W	W S W	W 12 S	0.00	0.41	2 03	...	...	Do.	Cir. Cum. Str. 4	Do.
27	.843	.549	.807	25.9	45.0	42.0	170	272	250	91	86	87	S S W	S	E by S	S 12 E	1.27	1.62	0.89	...	0.153	Cir. Str. 4.	Cir. Str. 10.	Cir. Str. 10.
28	.461	.327	.310	41.6	50.6	42.5	235	246	232	85	65	82	W by S	W	W	W 5° S	0.82	6.83	11.21	...	0.500	Do. 6.	Do. 9.	Do. 2.
29	.481	.559	.601	35.3	43.6	36.3	155	199	192	70	68	83	W N W	N W b W	S by W	W 33 N	28.01	14.63	7.01	...	...	Do. 10.	Clear.	Do. 10.
30	.336	.358	.394	40.2	41.5	37.4	227	254	199	85	92	83	S S W	W N W	W N W	W 23 N	5.76	5.62	7.71	...	0.490	Rain.	Do.	Clear.
31	.407	.307	.441	28.4	39.8	20.8	141	184	152	83	73	85	W N W	W N W	W N W	W 23 N	7.90	9.22	12.75	...	...	Clear.	Cir. Str. 4.	Do.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—NOVEMBER, 1856.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., LL.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°			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in miles per hour.			Mean direction of Wind.	Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	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	29.414	29.233	29.202	33.6	34.0	42.2	.204	.206	.234	.92	.92	.83	W S W	S W b W	W	14.00	10.05	7.00	W °3 N	0.033	Inp	Cir. Str. 8.	Cir. Str. 10.	Cir. Str. 10.
2	.582	.600	.756	40.6	47.6	45.6	.248	.291	.292	.90	.86	.92	W S W	S W by S	S W b W	12.75	0.22	0.45	W 4 S	0.120	...	Nimb. 10.	Nimb. 10.	C. Str. 6.
3	.855	.784	.677	43.4	45.0	43.6	.272	.296	.279	.91	.90	.9	S E by S	E	N E b E	1.00	2.62	9.70	E 33 N	0.216	...	Cir. Str. 10.	Cir. Str. 10.	Cir. Str. 10.
4	.482	.114	.037	42.5	56.1	54.4	.284	.408	.418	.92	.88	.92	E N E	E N E	W	3.80	5.71	4.01	E 33 N	0.090	...	Do. 10.	Do. 10.	Rain.
5	.377	.685	.956	26.5	31.0	24.3	.108	.171	.115	.66	.89	.76	W by N	N N W	N W	25.43	33.37	21.06	W 23 N	0.110	...	Do. 10.	Do. 4.	Clr. Aur. Bor.
6	30.238	.220	30.221	17.1	34.9	26.1	.696	.203	.129	.83	.90	.80	W S W	S W by S	S b W	10.03	6.04	4.51	W 40 S	...	...	Clear.	Do. 8.	Clear.
7	.101	.106	30.126	40.7	49.0	40.7	.210	.290	.210	.79	.80	.81	W b S	W b S	S b E	4.66	6.21	8.10	S 11 W	...	...	Cir. Str. 6.	C. St. 4.	Cir. Str. 10.
8	29.886	29.670	29.970	46.0	62.0	37.2	.282	.421	.218	.86	.75	.91	S by W	S	W	11.06	20.11	30.50	W 33 N	0.360	...	Do. 4.	Cul. Str. 9.	Clear.
9	30.050	30.022	30.008	25.6	32.2	24.0	.123	.153	.121	.81	.76	.90	S E	W	N W b W	8 72	1.37	8.42	W 33 N	...	...	Do. 4.	Do. 9.	Do.
10	.127	.227	.101	16.7	31.1	20.0	.084	.141	.089	.73	.70	.68	N E by N	N W b W	S S W	1.73	2.37	0.40	W 40 N	...	...	Clear.	Clear.	Do.
11	.078	30 035	.009	17.1	53.7	26.9	.184	.153	.129	.73	.74	.80	N W	S E	E N E	0.80	1.07	0.00	E 23 N	...	...	Do.	Do.	Cir. Str. 10.
12	29.967	29.948	29.950	27.6	34.5	31.3	.119	.186	.168	.71	.83	.86	E N E	W S W	W by N	—	—	0.15	W 33 S	...	...	Cir. Str. 6.	C. Str. 9.	Do. 2.
13	.090	.943	30.001	28.9	43 5	30.1	.144	.194	.160	.83	.74	.86	N E	S W b W	S S E	0.21	2.07	—	W 23 N	...	...	Cir. Str. 2.	Do. 6.	Do. 10.
14	.996	29.982	29.916	26.5	31.6	22.9	.147	.152	.115	.90	.78	.82	N W b W	E N E	E N E	4.80	6.23	6.60	E 23 N	...	...	Cir. Str. 10.	Str. 4.	Light Cum. 1.
15	.889	.710	.664	24.0	32.3	21.0	.086	.187	.116	.82	.81	.84	E N E	W N W	W by N	0.33	6.05	5.97	W 15 N	...	...	Clear.	Clear.	Clear.
16	.516	.465	.431	23.1	44.3	31.5	.136	.251	.191	.90	.80	.90	W N W	S by E	N E b N	0.16	0.80	1.78	S 23 W	...	0.40	C. Str. 10.	C. Str. 6.	Cir. Str. 10.
17	.447	.492	.591	26.0	26.7	22.5	.107	.146	.120	.82	.81	.82	S W	W N W	W N W	6.15	4.43	6.96	W 23 N	...	Inp	Cir. Str. 2.	Do. 10.	Do. 10.
18	.638	29.760	.870	23.1	34.1	26.3	.106	.178	.129	.74	.83	.80	W N W	W N W	W N W	13.10	11.93	11.90	W 23 N	...	...	Cul. Str. 4.	Do. 9.	Do. 10.
19	.917	.904	.099	29.1	31.8	21.1	.152	.260	.117	.85	.88	.80	W N W	W N W	W	8.09	5.21	0.60	W 12 N	...	...	Str. 1.	Clear.	Clr. Zod. Lgt.
20	.156	.171	.177	20.0	27.0	17.7	.078	.137	.088	.60	.82	.73	W	S W	S W	0.46	0.47	2.80	W 23 S	...	...	Str. 10.	C. Str. 4.	Do. Aur. Bor.
21	.157	.052	.872	20.1	25.0	21.0	.078	.133	.108	.70	.79	.77	S S W	E N E	E N E	2.22	1.14	8.75	E 23 N	...	...	Cir. Str. 10.	Do. 10.	Cir. Str. 10.
22	.690	.740	.914	38.5	46.0	39.2	.226	.254	.199	.89	.70	.76	S	W S W	W S W	18.25	7.21	9.67	S 23 W	1.860	...	Rain.	Do. 8.	Do. 6.
23	30.012	.991	.892	33.0	42.1	35.1	.187	.208	.203	.90	.73	.91	S W	N W	S E	3.26	9.81	1.97	W 34 S	...	...	Clear.	Do. 8.	Do. 10.
24	29.748	.796	.951	33.7	39.1	34.1	.195	.229	.261	.90	.85	.94	N E	N E	E by N	5.71	5.52	0.16	E 33 N	...	...	Cir. Str. 6.	Do. 9.	Do. 10.
25	30.105	30.009	.846	35.3	35.9	32.0	.187	.170	.174	.90	.79	.89	E S E	N E by E	N E b E	0.27	4.92	6.10	E 33 N	...	...	Do. 6.	Do. 9.	Snow.
26	29.831	29.385	.673	33.1	39.0	33.0	.187	.214	.199	.90	.84	.91	N E	W N W	N W	10.60	4.03	8.75	W 20 N	3.910	1.30	Rain.	Do. 8.	C. Str. 10.
27	.694	.597	.651	46.8	30.1	33.8	.177	.187	.112	.95	.87	.67	N W b W	S W by S	N W	19.16	0.41	10.45	W 26 N	...	Inp	Cir. Str. 4.	Str. 10.	Clear.
28	.710	.791	29.864	79.1	20.0	23.0	.107	.119	.085	.82	.81	.88	N N W	N W	N by E	10.81	4.22	5.66	W 43 N	...	...	Clear.	Clear.	Do.
29	.672	.462	.484	74.2	12.3	15.7	.090	.071	.091	.91	.88	.87	N E by E	N E by E	W b S	6.00	8.20	7.90	E 33 N	...	3.00	Cir. Str. 10.	Cir. Str. 10	Snow.
30	.659	.714	.987	78.6	13.3	23.5	.677	.108	.083	.79	.72	.78	W by S	W N W	W by N	12.98	5.27	13.30	W 33 N	...	0.30	Clear.	Do. 6.	Cir. Str. 10.

REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR OCTOBER.

Barometer	Highest the 15th day	30.254
	Lowest the 28th day	29.310
	Monthly Mean	29.833
	Monthly Range	.944
Thermometer	Highest the 10th day	86°6
	Lowest the 25th day	20°6
	Monthly Mean	46°04
	Monthly Range	66°00

Greatest Intensity of the Suns Ray's .... 99°4

Lowest Point of Terrestrial Radiation .... 18°9

Mean of Humidity .... .809

Amount of Evaporation .... 2.17 inches

Rain fell on 10 days, amounting to 5.220 inches; it was raining 50 hours and 5 minutes.

Most prevalent wind, W S W. Least prevalent wind, E by S.

Most windy day, the 29th day; mean miles per hour, 16.55.

Least windy day, the 5th day, mean miles per hour, 0.23

Most windy hour, from 10 to 11, A. M., 29th day; velocity 31.00 miles.

There were 226 hours and 47 minutes calm.

There were 9 cloudless days in the month.

Total amount of miles of wind, 3732.10 miles, which being resolved into the Four Cardina Points, gives N 843 miles. S 371 miles, W 2270.10 miles, and E 248 miles.

Aurora Borealis visible on 5 nights.

Eclipse of the Moon on the 13th day visible.

The electric state of the atmosphere has been marked by moderate intensity.

Ozone was in moderate quantity.

REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR NOVEMBER.

Barometer	Highest, the 6th day	30.238
	Lowest, the 4th day	29.057
	Monthly Mean	29.820
	Monthly Range	1.171
Thermometer	Highest, the 8th day	62°.1
	Lowest, the 29th day	12°.1
	Monthly Mean	30°.40
	Monthly Range	50°.0

Greatest intensity of the Sun's Rays .... 89°.7

Lowest point of Terrestial Radiation .... 11°.6

Mean of Humidity .... .835

Rain fell on 8 days, amounting to 6.995 inches; it was raining 31 hours.

Snow fell on 7 days, amounting to 3 inches; it was snowing 19 hours 30 minutes.

Most prevalent Wind was WNW—.1664 miles.

Least prevalent Wind was NNE—.1 mile.

Most windy day, the 5th; mean miles per hour, 26.62.

Least windy day, the 12th; mean miles per hour, 0.05.

Most windy hour from 3 to 4 a. m., on the 8th, 36.40 miles.

There were 149 hours calm during the month.

There were 3 days cloudless.

The whole distance traversed by the wind was 4644 miles; resolved into the Four Cardinal Points, gives N 653; S 650; W 2386; E 975 miles.

Aurora Boreais visible on 2 nights.

The Zodiacal Light first seen on the 19th day, and was very bright on the 20th day.

A Rainbow was visible on the morning of the 7th, at 7.30 which was followed by Rain.

Snow Birds first seen on the 26th day.

The electrical state of the Atmosphere has been marked by very moderate intensity.

Ozone was in moderate quantity.

MEAN RESULTS OF METEOROLOGICAL OBSERVATIONS AT HAMILTON, C. W., FOR THE YEAR 1856.

1856.	THERMOMETER.					BAROMETER.			Days.			YEARS.
MONTHS.	Mean at 9 A. M.	Mean at 9 P. M.	Mean of both.	Highest.	Lowest.	Mean height.	Highest.	Lowest.	Rainy.	Slight Showers.	Dry.	Mean Temperature of.
	°	°	°	°								°
January	15.32	16·9	16.11	42	–16	29·639	30·23	29·15	4	7	20	1846...50·215
February	15.00	18·00	17·50	42	–16	·47	·00	28·70	2	7	20	7...48 163
March	24 03	24·55	24·29	45	–10	·558	·00	·96	4	7	20	8...49·295
April	40.86	44·96	44·41	78	21	·615	·00	29·14	4	7	19	9...48·105
May	63.1	53·22	34·16	90	28	·628	29 95	·22	7	5	19	50...48·732
June	67.5	54·4	65·95	94	46	·6175	·87	·35	4	7	19	51...48·756
July	75.742	74·806	75·274	98	52	·680	·91	·37	0	5	20	2...48·248
August	69.1	67·9	68·5	91	48	·612	29·93	·25	2	7	22	3...49·474
September	60.833	59·4	60·616	86	41	·656	30·00	·20	5	7	18	4...49·013
October	47·7	48 9	48·3	79	28	·7292	·14	·25	1	4	26	5...47·316
November	39·9	39·7	39·8	66	26	·632	29·97	·10	5	8	17	
December	25·1	24·4	24·75	45	–10	·645	30·35	28·63	5	8	18	Mn. 43·73
Mean Temperature of year			44·888			29·6242			43	79	244	

REGISTER, THERMOMETER, BAROMETER, &c.; HAMILTON, 1856.

DATE.	THERMOM. 9 A.M.	THERMOM. 9 P.M.	BAROM. 9 A.M.	BAROM. 9 P.M.	WEATHER.
	°	°			
December 1	31	27	29.80	29.70	Partly cloudy, some snow A. M.
2	32	32	.63	.25	Cloudy, snowing heavily at night, stormy.
3	36	28	28.68	·02	Partly cloudy, snowing A. M., sleighing.
4	29	30	29.50	·70	Do. do.
5	30	23	.75	·83	Fair and clear.
6	23	22	.80	·81	Do. do.
7	27	24	.80	·76	Partly cloudy.
8	27	29	.81	·90	Do. do., a little snow in the morning.
9	28	25	30.00	30·09	Fair and clear.
10	28	28	29.96	29·70	Do. do.
11	38	40	.20	·20	Rain, sleighing gone.
12	33	34	.45	·62	Partly cloudy.
13	34	34	.85	·60	Do. do., some snow at night.
14	36	26	28.63	28·90	Rainy A. M., snowing P. M., stormy.
15	22	23	29.52	29·70	Partly cloudy, sleighing.
16	21	21	·70	·68	Do. do.
17	15	10	30·60	30·13	Do. do.
18	–2	6	·35	·33	Do. do. a little snow P. M.
19	13	28	·05	29·55	Mostly cloudy, some rain at night forming ice.
20	42	18	29·25	·55	Cloudy, rainy A. M.
21	17	18	·80	·70	Fair and clear.
22	20	17	·40	·52	Mostly cloudy, snowing A. M
23	13	13	·72	·80	Partly cloudy.
24	15	12	·65	·50	Do. do.
25	16	23	·45	·53	Do. do.
26	25	30	·63	·72	Do. do.
27	23	25	·82	·75	Cloudy.
28	30	32	·40	[illegible]	Do., drizzling rain forming ice.
29	28	26	·55	·65	Mostly cloudy.
30	25	25	·71	·70	Do. do., a little snow at night.
31	23	27	·85	·90	Fair and clear.
Means	25·1	24·4	29·638	29·652	

Mean Temperature of the Month .... 24·75°
Highest .... 45°
Lowest .... 4°
Average of ten preceding years .... 30·76°