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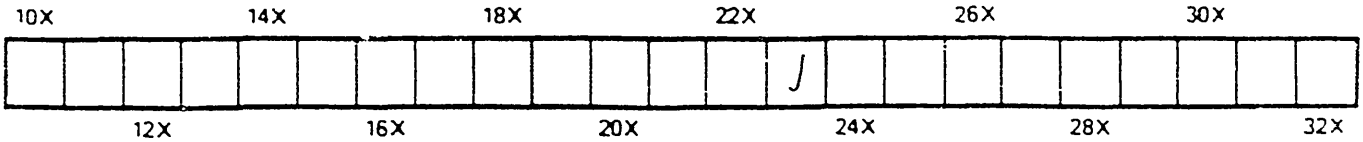

# THE CANADIAN JOURNAL.

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## THE ARIZONA COPPER MINE.


BY JAMES GILBERT.


*Read before the Canadian Institute, 13th December*, 1856.

Various causes have combined to excite a greatly increasing interest in the mineral wealth of this continent; and while our own valuable, though still unwrought, Canadian copper region naturally forms the pre-eminent object of such interest, as pertaining to ourselves and constituting a source of future enterprise and wealth, it will not probably prove unacceptable to the Members of the Canadian Institute to learn somewhat of the mineral wealth of the south-western regions of this continent of North America, as illustrated by the Arizona mine, one of the richest copper mines hitherto noted in the mineral regions of California. At the same time the history of this mine, while it directs our attention to other depositories of unwrought mineral treasure, abundantly illustrates the obstacles which had to be overcome before such could be turned to profitable account.

The information contained in the following brief notice was acquired during a recent visit to California. The Arizona Copper Mine, is situated in the Gadsden Purchase in latitude 32° north, and longitude 111°45′ west; being about 110 miles S. E., from Fort Yuma, and 35 miles from the river Gila.

The Arizona Mining Company was formed with the object of opening certain silver mines, existing in the region of the Arizona moun-

tains, and which according to history had been worked by the Mexicans, at an early period, with extraordinary success. One in particular, known as the Planche de la Plata mine, had a wide reputation, having yielded masses of pure silver, weighing more than twenty arrobas, a Spanish weight of twenty-five pounds. Necessity, however, arising from remoteness of situation, and the war whoop of the savage, had long since occasioned the abandonment of this mine; and it was gradually sinking into oblivion, when attention was directed to it by Count Rousset. This daring Frenchman, having obtained from Santa Anna a grant of the mine in question, made an expedition to Sonora, intending to explore the Arizona mountains in search of silver, and to take possession and work the mine ceded to him.

Great and unforseen difficulties were encountered, and his followers becoming disheartened, after months of toil and privation, he was reluctantly forced to suspend, though not entirely to abandon the enterprise. Meanwhile fresh troubles befel him, which it would be foreign to our present object to enter upon; getting embroiled with the Mexican authorities, his capture, trial and execution were the consequences.

Aware of these circumstances the Arizona Company set out from San Francisco, immediately after its preliminary organization, in the latter part of 1854, with the view of taking possession of the noted silver mine; the Frenchman's right to which, it was assumed, had been confiscated by the manner of his death. Arrived in the Gadsden Purchase, the little band of adventurers, numbering twenty men, well armed, separated into detachments, one of which under Mexican guidance, succeeded in making its way to the location pointed out as the Planche de la Plata mine. There were, however, unmistakable signs of the nearness of hostile Indians, consequently, after spending a little time in examining the plain, which bore evidence of having been superficially dug over, and picking up a lump of virgin silver weighing 21 lbs. they returned to their camp, satisfied that the Planche de la Plata mine was a reality; but, at the same time, convinced that its appropriation was for the present impracticable, from its remoteness with respect to supplies, and from the hostility of the surrounding Indians. Another portion of the company, arriving at Sonorita, heard of a copper mine forty miles to the north, in a barren and unknown country; proceeding thither, and being struck with indications of the great richness of the mine, they resolved to keep possession; the remainder of the company at length joining them, the further search for silver mines was abandoned. One of the explorers

returned to San Francisco, in February, 1855, with specimens of the ore, and the company was incorporated, under the title of the "Arizona Mining Company;" hence, curiously enough, the endeavours of the association to occupy and open old silver mines, were terminated by the unexpected discovery and possession of a rich copper mine.

In the midst of mountain ridges, principally of porphyry, which rise abruptly from plains dotted here and there with grass, lies the Arizona mine. The green colour of the ore, outcropping on the dark red rock, is perceptible at the distance of a mile; numerous specimens of the cactus—one kind of which, the *cereus giganteus*, the savarre of the Mexicans, frequently attains the height of forty feet,—together with mezquit and iron wood form the principal vegetable growth. Some of the mountains bear evidence of tremendous igneous action, whilst others are void of all traces of plutonic force. The soil is light and porous, with a superabundance of disintegrated granite. Altogether the scene is lonely and desolate in the extreme; though the perpetual but scanty vegetation prevents it from meriting the appellation of a desert. Water is obtained from natural reservoirs found in the dark mountain recesses, supplied by the rains, which occur with some regularity during the months of July, August, December, January, and February.

The ores extracted are the gray, black and red oxide, the latter richly impregated with virgin copper. Persons conversant with copper mining admit the ore to be the richest, in the average, of any yet discovered. So far as examined the veins increase in richness and quantity as they remove from the surface. For instance, a vein of red oxide four inches wide at the surface, had, at the depth of fifty feet, reached the thickness of four feet, and became almost exclusively pure copper which lay in a soft rock and was easily worked.

Dr. Webster, a resident of San Francisco, largely interested in the mine, and to whose kind services I am indebted for specimens of the ore, informed me of the existence of a peculiar feature in its vicinity; a high hill known as the iron mountain, but which, more accurate observation and analyzis has since proved to be composed of the black oxide of copper, existing in immense quantities.

The knowledge of the Arizona mine was confined to a few Papago Indians, previous to 1851. In the commencement of that year some Mexicans sent a party of seven labourers to work it; six of whom were surprised and murdered by the Apache Indians. Subsequently several foreigners endeavoured to form companies and settle in its

vicinity, but obstacles, incidental to its situation, obliged them to desist. Now, however, that the energetic American has acquired a knowledge of these spots, so great in mineral wealth, and the accents of the English language have been heard in the mountain gorges, and on the plains, amid which such mineral wealth abounds, it seems natural to anticipate that the war whoop of the savage will die away. The Indian will disappear here as elsewhere, after witnessing in vain the advantages of civilization and combined industry, and thus ere long this formidable impediment will cease to baffle the exertions of science and commerce, in turning to account so rich a deposit of mineral wealth.

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## NARCOTIC USAGES AND SUPERSTITIONS OF THE OLD AND NEW WORLD.

BY DANIEL WILSON, LL.D.,
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*(Continued from p. 264.)*

Amid the endless variety which characterises the form of the ancient Mound Builders' pipes, one general type is traceable through the whole. "They are always carved from a single piece, and consist of a flat curved base, of variable length and width, with the bowl rising from the centre of the convex side. From one of the ends, and communicating with the hollow of the bowl, is drilled a small hole, which answers the purpose of a tube; the corresponding opposite division being left for the manifest purpose of holding the implement to the mouth." The authors of the "Ancient Monuments of the Mississippi Valley," express their conviction, derived from the inspection of hundreds of specimens which have come under their notice, during their explorations of the ancient mounds, that the instrument is complete as found, and was used without any such tube as is almost invariably employed by the modern Indian, and also by the modern perfume-loving oriental when he fills his chibouk with the odorous shiraz or mild latakia. The modern pipe-head of each has a large aperture for the insertion of the tube, whereas in

the ancient examples referred to, the perforation is about one sixth of an inch in diameter, and the mouth-piece flattened, and adapted to the lips, so that we can scarcely doubt the mouth was applied directly to the implement, without the addition of any tube of wood or metal. It is otherwise with examples of pipe-heads carved out the beautiful red pipe stone, the most favourite material for the pipe sculpture of the modern Indian. It would seem, therefore, that the pipe-tube is one of the characteristics of the modern race; if not distinctive of the northern tribes, from the Toltecan and other essentially diverse ancient people of Central and Southern America.

The use of tobacco, from the earliest eras of which we can recover a glimpse, pertained to both; but the pipe-head would appear to be the emblem of the one, while the pipe-stem gives character to the singular rites and superstitions of the other. The incremated pipe-heads of the ancient mound builders illustrate the sacred usages of the one; while the skill with which the Indian medicine-man decorates the stem of his medicine-pipe, and the awe and reverence with which—as will be presently shown,—the whole tribe regard it, abundantly prove the virtues ascribed to that implement of the Indian medicine man's sacred art. May it not be, that in the sacred associations connected with the pipe by the Mound Builders of the Mississippi Valley, we have the indications of contact between the migrating race of Southern and Central America, among whom no superstitious pipe usages are traceable, and the tribes of the north where such superstitions are most intimately interwoven with all their sacred mysteries?

In one, though only in one respect, a singular class of clay pipes, which has come under my notice, agrees with the ancient examples, and would seem thereby still further to narrow the area, or the era of the pipe-stem. During the summer of 1855, I made an excursion in company with the Rev. George Bell, to some parts of County Norfolk, Canada West, within a few miles of Lake Erie, for the purpose of exploring certain traces of the former natives of the locality. We found at various places along the margins of the smaller streams, and on the sloping banks of the creeks, spots where our excavations were rewarded by discovering relics of the rude arts of the Aborigines. These included awls or bodkins, and large needles, made of bone,*

* Implements of bone, precisely corresponding to some of these, are figured and described by Messrs. Squier and Davis, (page 220,) among the disclosures of the ancient mounds. Such implements, however, have pertained to the rude arts of primitive races in all ages, and where found with other samples of the same pottery in the States, have been supposed to be the implements for working the ornamental patterns on the soft clay.

several stone implements, and a considerable quantity of pottery. The specimens of rude native fictile ware considerably interested me, on account of the close resemblance they frequently bore, not only in material, but in ornamentation, to the ancient pottery of the British barrow .

The potters' art appears to have been practised to a great extent, and with considerable skill, by the ancient races of this continent; nor was it unknown to the Red Indians at the period when their arts and customs were first brought under the notice of Europeans. Adair says of the Choctaws and Natchez, that "they made a prodigious number of vessels of pottery, of such variety of forms as would be tedious to describe, and impossible to name;" and DeSoto describes the fine earthware of the latter tribe, in the seventeenth century, as of considerable variety of composition and much elegance of shape, so as to appear to him little inferior to that of Portugal. The specimens found by me in County Norfolk, and elsewhere in Canada, are heavy and coarse, both in material and workmanship, and neither these nor the objects now to be described, admit of any comparison, in relation to artistic design or workmanship, with those relics of the Mound Builders' arts, or the more recent productions of Indian skill which suggest a resemblance to them.

Accompanying the rude fictile ware, spoken of, were also discovered several pipe-heads, made of burnt clay, and in some examples ornamented, like the pottery, with rude chevron patterns, and lines of dot-work, impressed on the material while soft. But what particularly struck me in these, and also in others of the same type, including several specimens found under the root of a large tree, at the Mohawk reserve on the Grand River, and presented to me by the Indian Chief and Missionary, the late Peter Jones, (Kahkewaquonaby,) was the extreme smallness of the bowls, internally, and the obvious completeness of most of such examples as were perfect, without any separate stem or mouth piece; while if others received any addition, it must have been a small quill, or straw. They at once recalled to my mind the diminutive Scottish "Elfin Pipes," and on comparing them with some of these in my possesion, I find that in the smallest of the Indian pipes the capacity of the bowl is even less than the least of those which, from their miniature proportions have been long popularly assigned to the use of the Scottish Elves. Both the pipes and the accompanying pottery totally differ, as Mr. Kane assures me, from any of the manufactures which have come under his notice among the tribes of the North West, with whom, indeed, the potter's art appears to be wholly unknown.

The pottery thus found along with these diminutive Indian clay pipes, is obviously therefore a relic of former centuries, though exhibiting no such evidence as would necessarily suggest a remote antiquity. Similar examples found to the south of the Great Lakes, are thus described by Mr. Squier, in his Aboriginal Monuments of the State of New York: "Upon the site of every Indian town, as also within all the ancient enclosures, fragments of pottery occur in great abundance. It is rare, however, that any entire vessels are recovered. Those which have been found, are for the most part gourd-shaped, with round bottoms, and having little protuberances near the rim, or oftener a deep groove, whereby they could be suspended. A few cases have been known in which this form was modified, and the bottoms made sufficiently flat to sustain the vessel in an upright position. Fragments found in Jefferson County seem to indicate that occasionally the vessels were moulded in forms nearly square, but with rounded angles. The usual size was from one to four quarts; but some must have contained not less than twelve or fourteen quarts. In general there was no attempt at ornament; but sometimes the exteriors of the pots and vases were elaborately, if not tastefully ornamented with dots and lines, which seem to have been formed in a very rude manner with a pointed stick or sharpened bone. Bones which appear to have been adapted to this purpose are often found. After the commencement of European intercourse, kettles and vessels of iron, copper, brass, and tin, quickly superseded the productions of the primitive potter, whose art at once fell into disuse."*

In an able summary of the "Archæology of the United States," embodying a resumé of all that has been previously done, Mr. Samuel F. Haven remarks: "In order to estimate correctly the degree of skill in handicrafts possessed by the people who were found in occupation of the soil, we must go back to a time antecedent to the decline in all domestic arts which resulted immediately on intercourse with the whites. So soon as more effective implements, more serviceable and durable utensils, and finer ornaments, could be obtained in exchange for the products of the chase, their own laborious and imperfect manufactures were abandoned."† But just as this reasoning must unquestionably prove in many cases, it fails of application in relation to the absence of the potter's art among the Indians of the North West, for the substitutes found for it are of native manufacture, and present a much greater dissimilarity to the pro-

* Aboriginal Monuments of the State of New York. Page 75.
† Smithsonian Contributions. Vol. VIII. Page 155.

ducts of European art. Among the Chinooks, for example, inhabiting the tract of country at the mouth of the Columbia River, the only domestic utensils remarked by Mr. Paul Kane, as creditable to their decorative skill were carved bowls and spoons of horn, and baskets and cooking vessels made of roots and grass, woven so closely as to serve all purposes of a pitcher in holding and carrying water. In these they even boil the salmon which constitute their principal food. This is done by placing the fish in one of the baskets filled with water, into which they throw red hot stones until the fish is cooked. Mr. Kane observes that he has seen fish dressed as expeditiously by this means, as if boiled in the ordinary way in a kettle over a fire.

Keeping in view the evidence thus obtained, it will probably be accepted as a conjecture not without much probability in its favor, that the rude clay pipes referred to, found along with other Canadian relics, and especially with specimens of fictile ware no longer known to the modern Indian, furnish examples of the tobacco pipe in use in the region of the Great Lakes when the northern parts of this continent first became known to Europeans. The application of the old Indian potter's art to the manufacture of tobacco-pipes is a well established fact. Ancient clay pipes of various types and forms have been discovered and described; and in a "Natural History of Tobacco" in the Harleian Miscellany,* it is stated that: "the Virginians were observed to have pipes of clay before even the English came there; and from those barbarians we Europeans have borrowed our mode and fashion of smoking."

Specimens of another class of clay pipes of a larger size, and with a tube of such length as obviously to be designed for use without the addition of a pipe-stem, have also been repeatedly met with, and several from Canadian localities are in my own possession. In the Edinburgh Philosophical Journal, February, 1848, Dr. E. W. Bawtree describes a series of discoveries of sepulchral remains, accompanied with numerous Indian relics, made in the district to the south of the River Severn, between Lake Simcoe and Georgian Bay. These included specimens of the large *pyrulæ*, or tropical shells of the Florida Gulf, copper kettles, arrow heads, bracelets and other personal ornaments, of copper, beads of shell and red pipe-stone, and also various examples of the larger clay pipes: which no doubt belong to an era subsequent to intercourse with Europeans, as the same discoveries included axe-heads and other relics of iron. Another ex-

* Vol. I. Page 535. Quoted in Notes and Queries, vol. VII. Page 230.

ample of this larger form of clay-pipe figured in Dr. Schoolcraft's "History of the Indian Tribes;"* was also found within the Canadian frontier, in the peninsula lying between Lakes Huron and Erie. It was discovered in an extensive sepulchral ossuary in the township of Beverly, which contained numerous Indian relics, and among others, specimens both of the *pyrula perversa* and *pyrula spirata*. Mr. Paul Kane possesses another pipe of the same class, trumpet shaped at the bowl, and unusually well baked, which was dug up in the vicinity of the Sault St. Marie, at the entrance to Lake Superior; so that this class of relics of the nicotian art, appears to be peculiarly characteristic of the Canadian frontier. Some, at least, of these Canadian pipes are of no very remote antiquity, but it is curious to note that in form they bear a nearer resemblance than any figured or described among American antiquities, to such as are introduced in ancient Mexican paintings;† nor are examples wanting of a more antique style of art. One specimen figured by Mr. Squier in his "Aboriginal Monuments of the State of New York,"‡ is thus described: "It was found within an enclosure in Jefferson County. It is of fine red clay, smoothly moulded, and two serpents rudely imitated, are represented coiling round the bowl. Bushels of fragments of pipes have been found within the same enclosure. Some appear to have been worked in the form of the human head, others in representations of animals, and others still in a variety of regular forms. · · · Some pipes of precisely the same material and of identical workmanship with those found in the ancient enclosures, have been discovered in modern Indian graves in Cayuga County. One of these in the form of a bird, and having eyes made of silver inserted in the head, is now in the possession of the author."

Pipes of baked clay of a character more nearly approximating to the sculpture of the mounds, are figured in Messrs. Squier and Davis's work. In style of art, however, they are greatly inferior. Of two of these (Figs. 76, 77, page 194,) it is remarked: "They were ploughed up in Virginia at a point nearly opposite the mouth of the Hocking river, where there are abundant traces of an ancient people, in the form of mounds, embankments, &c. One represents a human head, with a singular head-dress, closely resembling some of those worn by the idols and sculptures of Mexico. The other represents some animal coiled together, *and is executed with a good deal*

* Vol. I. Plate VIII. Figs. 5 and 6.
† Lord King-borough's Mexican Antiquities. Vol. IV. Plates 17, 57.
‡ Plate 76. Fig. 9.

*of spirit.*" The latter remark, however, is scarcely borne out by the accompanying illustration, and it seems by no means improbable that these objects furnish specimens of the Indian arts of Virginia in the time of Raleigh. They certainly present no such marked characteristics as to justify their classification with the ingenious sculptures of the Mound Builders. The same remarks apply to examples procured by Schoolcraft, Squier, and other writers; and among such may be included two clay pipes, one of them found in a mound in Florida, and the other in South Carolina, and both described in the "Ancient Monuments of the Mississippi Valley."* Most of the ancient clay pipes that have been discovered are stated to have the same form; and this, it may be noted, bears so near a resemblance to that of the red clay pipe used in modern Turkey, with the cherry-tree pipe-stem, that it might be supposed to have furnished the model. The bowls of this class of ancient clay pipes are not of the miniature proportions which induce a comparison between those of Canada and the early examples found in Britain; neither do the stone pipe-heads of the Mound Builders, suggest by the size of the bowl, either the self denying economy of the ancient smoker, or his practise of the modern Indian mode of exhaling the fumes of the tobacco, by which so small a quantity suffices to produce the full narcotic effects of the favorite weed. They would rather seem to confirm the indications derived from other sources, of an essential difference between the ancient smoking usages of Central America and of the Mound-Builders, and those which are still maintained in their primeval integrity among the Indians of the North West.

Great variety of form and material distinguishes the pipes of the modern Indians; arising in part from the local facilities they possess for a suitable material from which to construct them; and in part also from the special style of art and decoration which has become the traditional usage of the tribe. The favourite red pipe-stone of the *Couteau des Prairies*, has been generally sought after, both from its easiness of working and the beauty of its appearance. The region of its celebrated quarries is connected with curious Indian traditions, and the locality appears to have been consecrated for many generations, as a sacred neutral ground whereon parties of rival tribes might freely assemble to supply themselves with the material requisite for their pipe manufacture, as secure from danger as when the peace-pipe has been smoked, and the tomahawk buried by the Chiefs of the Indian nations. A pipe of this favourite and beautiful

* Smithsonian Contributions. Vol. I. Page 191. Fig. 80.

material, found on the shores of Lake Simcoe, and now in my possession, measures five and three quarter inches in length, and nearly four inches in greatest breadth, yet the capacity of the bowl hollowed in it for the reception of tobacco is even less than in the smallest of the "Elfin Pipes." In contrast to this, a modern Winnebago pipe recently acquired by me, made of the same red pipe stone, inlaid with lead and executed with ingenious skill, has a bowl of large dimensions illustrative of Indian smoking usages modified by the influence of the white man.

From the red pipe stone, as well as from limestone and other harder rocks, the Chippeways, the Winnebagos, and the Siouxs, frequently make a peculiar class of pipes, inlaid with lead. Mr. Kane has in his possession an ingeniously carved red stone Sioux pipe, in form of a human figure, lying on the back, with the knees bent up towards the breast, and head thrown forward. The hollowed head forms the bowl of the pipe, while the tube is perforated through the anus; as is the case with another, but much ruder example of pipe sculpture, carved from a light colored sandstone found on the Niami River, Ohio.*

The Chinook and Puget Sound Indians, who evince little taste in comparison with the tribes surrounding them, in ornamenting their persons or their warlike and domestic implements, commonly use wooden pipes. Sometimes these are elaborately carved, but most frequently they are rudely and hastily made for immediate use; and even among these remote tribes of the flat head Indians, the common clay pipe of the fur trader begins to supersede such native arts.

Among the Assinaboin Indians a material is used in pipe-manufacture altogether peculiar to them. It is a fine marble, much too hard to admit of minute carving, but taking a high polish. This is cut into pipes of graceful form, and made so extremely thin, as to be nearly transparent, so that when lighted the glowing tobacco shines through, and presents a singular appearance when in use at night or in a dark lodge. Another favourite material employed by the Assinaboin Indians is a coarse species of jasper also too hard to admit of elaborate ornamentation. This also is cut into various simple but tasteful designs, executed chiefly by the slow and laborious process of rubbing it down with other stones. The choice of the material for fashioning the favourite pipe, is by no means invariably guided by the facilities which the location of the tribe affords. A suitable stone for such a purpose will be picked up and carried hundreds of miles. Mr.

* Monuments of the Mississippi Valley. Page 247. Fig. 146.

Kane informs me that, in coming down the Athabaska River, when drawing near its source in the Rocky Mountains, he observed his Assinaboin guides select the favourite blueish jasper from among the water worn stones in the bed of the river, to carry home for the purpose of pipe manufacture, although they were then fully five hundred miles from their lodges. Such a traditional adherence to a choice of material peculiar to a remote source, may frequently prove of considerable value as a clue to former migrations of the tribe.

Both the Cree and the Winnebago Indians carve pipes in stone, of a form now more frequently met with in the Indian curiosity stores of Canada and the States than any other specimens of native carving. The tube, cut at a sharp right angle with the cylindrical bowl of the pipe, is ornamented with a thin vandyked ridge, generally perforated with a row of holes, and standing up somewhat like the dorsal fin of a fish. The Winnebagos also manufacture pipes of the same form, but of a smaller size, in lead, with considerable skill.

Among the Cree Indians a double pipe is occasionally in use, consisting of a bowl carved out of stone without much attempt at ornament, but with perforations on two sides, so that two smokers can insert their pipe-stems at once, and enjoy the same supply of tobacco It does not appear, however, that any special significance is attached to this singular fancy. The Saultaux Indians, a branch of the great Algonquin nation, also carve their pipes out of a black stone, found in their country, and evince considerable skill in the execution of their elaborate details. In the curious collection of pipes now in the possession of G. W. Allan, Esq., and including those obtained by Mr. Kane among the Indians of the north-west, are two Chippeway pipes carved by the Indians bordering on Lake Superior, out of a dark close-grained stone, easily wrought and admitting of considerable minuteness of detail. One of these, (Plate II. Fig. 2,) measuring six and a half inches long, consists of a quadrangular tube, from which rises the bowl in the shape of a human head, of very sphynx-like aspect; and with white beads inserted for the eyes; behind this an Indian seated on the ground holds his hands to each side of the head, (colossal in proportion to him,) in front is another Indian seated on a chair, and before him stands a third figure neatly carved out of the red pipe stone, while between them is a miniature barrel cut from a white stone found chiefly on St. Joseph's Island. All the figures are well proportioned and carved with considerable minuteness of detail. Some of the details in this example—the chair and the barrel,—are obviously borrowed from European models,

but the general design is purely Indian; the figures are further completed with native head dresses of feathers, and the whole conception and execution well illustrate the usual style of the more elaborate Chippeway pipe sculptures.

One of the most celebrated of these Indian pipe sculptors is *Pabahmesad*, or the Flier, an old Chippeway still living on the Great Manitouanin Island in Lake Huron; but more generally known as *Pwahguneka*: the Pipe Maker, literally "he makes pipes." Though brought in contact with the Christian Indians of the *Mahnetooahning*, or Manitoulin Islands, Dr. O'Meara informs me that he resolutely adheres to the pagan creed and rites of his fathers, and resists all the encroachments of civilization. His materials are the *mukkuhda-pwahgunahbeck*, or black pipe-stone of Lake Huron, the *wahbe-pwahgunahbeck*, or white pipe-stone, procured on St. Joseph's Island, and the *miskopwahgunahbeck*, or red pipe-stone of the Couteau de Prairies. His saw, with which the stone is first roughly blocked out, is made by himself out of a bit of iron hoop, and his other tools are correspondingly rude; nevertheless the workmanship of *Pabahmesad* shows him to be a master of his art. One of the specimens of his skill has been deposited by Dr. O'Meara in the museum of Trinity College, Dublin, which, from the description I have received, appears to correspond very closely to the example figured on plate II. Another of the Chippeway black-stone pipes in Mr. Allan's collection is a square tube terminating in a horse's head, turned back, so as to be attached by its nose to the bowl of the pipe, and on the longer side of the tube two figures are seated, one behind the other, on the ground, with their knees bent up, and looking towards the pipe bowl. A different specimen of the Chieppeway pipe, brought from the north-west by Mr. Kane, is made from the root of a red deer's horn, inlaid with lead, as in the red pipe-stone and limestone pipes already referred to as made by the Chippeways, the Winnebagos, and the Siouxs.

But the most remarkable of all the specimens of pipe sculpture executed by the Indians of the north-west, are those carved by the Babeen, or big-lip Indians; so called from the singular deformity they produce by inserting a piece of wood into a slit made in the lower lip. The Babeen Indians are found along the Pacific Coast, about latitude 54° 40', and extend from the borders of the Russian dominions east-ward nearly to Frazer River. Some of the customs of the Babeen Indians are scarcely less singular than that from whence their name is derived; and are deserving of minute compari-

son with the older practices which pertained to the more civilized regions of the continent. This is especially the case in relation to their rites of sepulture, wherein they make a very marked distinction between the sexes. Their females are wrapped in mats, and placed on an elevated platform, or in a canoe raised on poles, but they invariably burn their male dead.

The pipes of the Babeen, and also of the Clalam Indians occupying the neighbouring Vancouver's Island, are carved with the utmost elaborateness, and in the most singular and grotesque devices, from a soft blue claystone or slate.

Their form is in part determined by the material, which is only procurable in thin slabs; so that the sculptures, wrought on both sides, present a sort of double bas-relief. From this, singular and grotesque groups are carved, without any apparent reference to the final destination of the whole as a pipe. The lower side is generally a straight line, and in the specimens I have examined they measure from two or three, to fifteen inches long; so that in these the pipe-stem is included. A small hollow is carved out of some protruding ornament to serve as the bowl of the pipe, and from the further end a perforation is drilled to connect with this. The only addition made to it when in use is the insertion of a quill or straw as a mouth piece. One of these shewn on Plate II., Fig. I., is from a drawing made by Mr. Kane, during his residence among the Babeen Indians. The original measured seven inches long. Plate III., is copied from one of the largest and most elaborate of the specimens brought back with him; it measures nearly fifteen inches long, and supplies a highly characteristic example of Babeen art.

Messrs. Squier and Davis conclude their remarks on the sculptures of the mounds, by observing: "It is unnecessary to say more than that, as works of art, they are immeasurably beyond anything which the North American Indians are known to produce, even at this day, with all the suggestions of European art, and the advantages afforded by steel instruments. The Chinooks, and the Indians of the north-western coast, carve pipes, platters, and other articles, with much neatness, from slate. We see in their pipes, for instance, a heterogeneous collection of pulleys, cords, barrels, and rude human figures, evidently suggested by the tackling of the ships trading in those seas. . . . . The utmost that can be said of them is, that they are elaborate, unmeaning carvings, displaying some degree of ingenuity. A much higher rank can be claimed for the Mound-sculptures; they combine taste in arrangement with skill in workman-

BABEEN PIPE

ship, and are faithful copies, not distorted caricatures, from nature. So far as fidelity is concerned, many of them deserve to rank by the side of the best efforts of the artist-naturalists of our own day."*

This descriptive comparison with the arts of the Indians of the north-west coast is based, as the illustrations given here (Plates II. and III.) suffice to show, on deductions drawn from the examination of specimens very different from those which have been brought from the same localities, or investigated in the hands of the native sculptors, and obviously constitute the true illustrations of Indian skill and artistic design. In addition to these, however, among the varied collection of Indian relics brought by Mr. Kane from the north-west coast, there is one of the ingenious examples of imitative skill referred to by Mr. Squier, which was procured on Vancouver's Island. But while this exhibits evidence of the same skillful dexterity as the other carvings in the blue pipe-slate of the Clalam and Babeen Indians, it presents the most striking contrast to them, alike in design and style of art. It has a regular bowl, imitated from that of a common clay pipe, and is decorated with twisted ropes, part of a ship's bulkhead, and other objects—including even the head of a screw-nail,—all equally familiar to us, but which no doubt attracted the eye of the native artist from their novelty. Very different from this are the genuine native pipes. They are composed of varied and elaborate devices, including human figures, some of them with birds' and beasts' heads, and frequently presenting considerable accuracy of imitative skill. The frog is a favourite subject, represented generally of the same size as the accompanying human figures, but with a very spirited and life-like verisimilitude. In some of the larger pipes, the entire group presents much of the grotesque exuberance of fancy, mingled with imitations borrowed direct from nature, which constitute the charm of the Gothic ecclesiastical sculptures of the thirteenth century. The figures are grouped together in the oddest varieties of posture, and ingeniously interlaced, and connected by elaborate ornaments; the intermediate spaces being perforated, so as to give great lightness of appearance to the whole. But though well calculated to recall the quaint products of the medieval sculptor's chisel, so far are these Babeen carvings from suggesting the slightest resemblance to European models, that when first examining them, as well as specimens in bone and ivory from the same locality,—and still more so, some ivory carvings executed by the Tawatin Indians on Frazer River,—I was struck with certain

* Monuments of the Mississippi Valley, p. 272.

resemblances to the peculiar style of ancient Mexican Art. Such resemblances may be fanciful or accidental. To me at least they were suggested by no preconceived theory of Mexican migration, as investigations in another direction have inclined me to adopt ideas even less suggestive of such than those generally set forth by American ethnologists. But while the sculptured Babeen and Clalam pipes cannot be compared to some of the more faithful imitations of objects of nature from the mounds, they furnish very noticeable proofs of imitative skill, and are well worthy of consideration as specimens of modern native art, which, if found in the ancient mounds, would have excited no less wonder and admiration than many of the relics figured from among their disclosures.

But there is another conclusion, of more general application, suggested to me by these Babeen sculptures. They are deserving of special consideration, from illustrating, in some respects, the just method of inductive history, as derived from ancient relics Struck with the discrepancy which every careful investigator of the subject must notice between the elaborate art of the finer sculptures, and especially the pipe-heads of the mounds, and any other traces of the skill and civilization of their builders, Mr. Haven assumes a foreign origin for all such sculptures, while others have inferred from them a native civilization in the Mississippi and Ohio Valleys, corresponding in all respects to these isolated examples of art; just as, from a rude but graceful Greek vase, we can infer the taste of a Callicrates or a Phidias. But it is important to note, that while the Babeen sculptor executes a piece of pipe-carving so elaborate and ingenious as justly to excite our wonder and admiration, it furnishes no test of his general progress in arts or civilization, for, on the contrary, he is ruder and more indifferent to the refinements of dress and decoration than many Indian tribes who produce no such special examples of ingenious skill. Some of the conclusions which such facts suggest will, I suspect, be found applicable to not a few of the deductions derived by European archæologists from isolated examples of primitive art.

The pipe, however, which presents so many and characteristic forms, among the Indian tribes of the far west, whatever may have been its importance in ancient times, is no longer the special object of sacred associations. It is to the pipe-stem that the modern Indian attaches that superstitious veneration which among the Mound Builders would appear to have pertained to the pipe itself. The medicine pipe-stem is the palladium of the tribe, on which

depends its safety in peace and its success in war, and it is accordingly guarded with all the veneration, and surrounded with the dignity, befitting so sacred an institution; while, in its use in the war-council, or in the medicine dance, so long as the proper and consecrated pipe-stem is employed, it matters not whether the pipe itself be of the richest carving of which the red stone of the *couteau des prairies* is susceptible, or be the begrimed stump of a trader's English "clay."

The medicine pipe-stem carrier is accordingly an office of great dignity in the tribe, and its holder is endowed with special, though somewhat burdensome, honors and privileges. A highly ornamental tent is provided for his use, and frequently he is required to have so many horses as renders the office even more onerous than honourable. A bear-skin robe is set apart for wrapping up the medicine pipe-stem, when carried, and for laying it on while exposed to view. When wrapped up in its covering, the pipe-stem is usually carried by the favourite wife of the dignitary, while he himself bears in his hands—and not unfrequently on his head—the medicine bowl, out of which he takes his food. But though the sacred pipe-stem is almost invariably borne by the wife of the Indian dignitary, it is never allowed to be uncovered in the presence of a woman, and should one even by chance cast her eyes on it when thus exposed, its virtues can only be restored by a tedious ceremony, designed to counteract the evil effects and to propitiate the insulted spirit. If the stem is allowed to fall to the ground, whether designedly or from accident, it is in like manner regarded as an omen of evil, and many elaborate ceremonies have to be gone through before it is reinstated in its former favor and beneficent influence. Mr. Kane met with a young Cree half-breed who confessed to him that, in a spirit of daring scepticism, he had once secretly thrown down the medicine pipe-stem and kicked it about; but soon after its official carrier was slain, and such misfortunes followed as left no doubt on his mind of the awful sacredness pertaining to this guardian and avenger of the honor of the tribe. The sacredness which attaches to the medicine pipe-stem pertains in part also to its bearer. Many special honors are due to him, and it is even a mark of disrespect, and unlucky, to pass between him and the fire.

At Fort Pitt, on the Sascatchewan River, Mr. Kane informs me that he met with Kea-keke-sacowaw, the head chief of the Cree nation, then engaged in raising a war party to make war on the Blackfeet. He had accordingly eleven medicine pipe-stems with

him, gathered from the different bands of the tribe who had already enlisted in the cause, and each committed to him by the medicine-man of the band. Armed with these sacred credentials, he proceeds through the encampments of his nation, attended by a few of his own immediate followers, but without the pipe-stem bearers, whose rights and privileges pass for the time being to the chief. Whenever he comes to an encampment he calls on the braves to assemble, tells them he is getting up a war party, recounts to them the unavenged wrongs of the tribe, recalls the names of those slain in former feuds with the Blackfeet, and appeals to them to join him in revenging their death. Throughout such an oration the tears stream down the cheeks of the excited orator, and this is styled "crying for war." On such occasions the medicine pipe-stems are not uncovered, but Mr. Kane having persuaded the Cree Chief to sit for his portrait, he witnessed the ceremony of "opening the medicine pipe-stem," as it is called, and during its progress had to smoke each of the eleven pipes before he could be allowed to commence his work. His spirited portrait represents the grim old chief, decorated with his war-paint, and holding in his hand the medicine pipe-stem, elaborately adorned with the head and plumes of an eagle.

In the grave ceremony of opening the medicine pipe-stem, the Crees make use of a novel addition to the tobacco. It is procured from the leaves or fibres of a species of cedar or spruce, which, when dried and burnt, yields a very pleasing fragrance. A handful of this was thrown on the fire in the middle of the room, and filled it with the fragrant smoke, and some of the same was sprinkled on the top of the tobacco each time one of the medicine pipe-stems was used.

All this ceremonial, and the peculiar sanctity attached to the pipe-stem, apart from the pipe, are special characteristics of the Red Indian of the North West, of which no trace is apparent in the singular memorials of the ancient Mound Builders, or in the sculptures and paintings of Mexico. Throughout the whole elaborate illustrations of Lord Kingsborough's great work it is difficult to discover a trace of Mexican usages connected with the tobacco-pipe, and in no one can I discern anything which appears to represent a pipe-stem. In volume IV, plate 17, of a series copied from a Mexican painting preserved at Pass, in Hungary, a figure coloured as a black carries in his hand a plain white pipe, already referred to as somewhat of the form of the larger clay pipes found in Canada and in the State of New York, and from the bowl rises yellow

flames. On plate 57 of the same volume, copied from a Mexican painting in the Borgian Museum, in the College of the Propaganda at Rome, may be seen another figure, holding what seems a small clay tobacco pipe, from whence smoke proceeds. One or two other pictures appear to represent figures putting the green tobacco leaf, or some other leaf, into the pipe, if indeed the instrument held in the hand be not rather a ladle or patera. But any such illustrations are rare, and somewhat uncertain; and it appears to be undoubted that the tobacco pipe was not invested in Central America with any of those singular and sacred attributes which we must believe to have attached to it among the ancient Mound Builders of the Mississippi Valley; and which under other, and no less peculiar forms, are reverently maintained among the native tribes of the North-West, constituting one of the most characteristic peculiarities of the American aborigines, and one well deserving of the careful study of the Ethnologist.

Assuming it as a fact, demonstrated by a variety of independent evidence, that the singular practice of smoking narcotics originated among the native tribes of America, and was communicated for the first time to the Old World, after its discovery by Columbus, it becomes a subject well worthy of consideration how rapid and universal was the diffusion of this custom throughout the world. Not only have Europe and Asia, in later times, disputed with America the origin of this luxurious narcotic art; but travellers who return from the mysterious tropical centre of old Africa find there, in like manner, the use of the tobacco pipe, among tribes to whom the sight of the first white man is strange and repulsive. Such facts are worthy of very careful consideration by the Ethnologist. They prove how fallacious is that mode of reasoning, which, in treating of the natural history of man, takes no account of the predominating influences of reason, intellect, and experience, as manifested even among the rudest savages; and seeks to apply the same law to man as the lower animals. They serve also to illustrate the indirect means by which the influences of a remote civilization may be extended, and thereby to explain some of the singular coincidences with which the Archæologist is familiar, in the traces of widely diffused primitive arts.

The daring traveller Charles John Andersson, the first explorer of the country of the Damaras, in his "Lake Ngami," furnishes the following interesting account of the African use of the weed:

"The Hill-Damaras subsist chiefly upon the few wild roots which their sterile

neighbourhood produces. Most of them, however, manage to raise a little tobacco, for which they have a perfect mania, and which they value nearly as much as the necessaries of life.

"They also cultivate 'dacka,' or hemp, not as with us, for its fibre, but for the sake of the young leaves and seeds, which they use as a substitute for tobacco, and which is of the most intoxicating and injurious character. It not unfrequently happens, indeed, that those who indulge too freely in the use of this plant are affected by disease of the brain.

"The manner in which the Hill-Damaras smoke is widely different from Hindu, Mussulman, or Christian. Instead of simply inhaling the smoke, and then immediately letting it escape, either by the mouth or nostril, they swallow it deliberately. The process is too singular to be passed over without notice. A small quantity of water is put into a large horn,—usually of a Koodoo,—three or four feet long. A short clay pipe, filled either with tobacco or dacka, is then introduced, and fixed vertically into the side, near the extremity of the narrow end, communicating with the interior by means of a small aperture. This being done, the party present place themselves in a circle, observing deep silence; and with open mouths, and eyes glistening with delight, they anxiously abide their turn. The chief man usually has the honor of enjoying the first pull at the pipe. From the moment that the orifice of the horn is applied to his lips he seems to lose all consciousness of everything around him, and becomes entirely absorbed in the enjoyment. As little or no smoke escapes from his mouth, the effect is soon sufficiently apparent. His features become contorted, his eye glassy and vacant, his mouth covered with froth, his whole body convulsed, and in a few seconds he is prostrate on the ground. A little water is then thrown over his body, proceeding not unfrequently from the mouth of a friend; his hair is violently pulled, or his head unceremoniously thumped with the hand. These somewhat disagreeable applications usually have the effect of restoring him to himself in a few minutes. Cases, however, have been known where the people have died on the spot, from overcharging their stomachs with the poisonous fumes. The Ovaoherero use tobacco in a similar manner, with this difference only, that they inhale the smoke simply through short clay pipes, without using water to cool it, which of course makes it all the more dangerous."

It would seem, alike from the American and the African modes of using the tobacco or other narcotics in smoking, and no less so from the Chinese and Malay employment of opium in a similar manner, that the primitive use of such among all races has been attended with gross intemperance. The inference, therefore, is probably not an illegitimate one, which ascribes the small size of the oldest British tobacco pipes, not to the economy or moderation of Elizabethan and Jacobite smokers, but rather to their practising the nicotian art in close imitation of its wild forest originators. This is nowhere more curiously and discriminatingly indicated than in its prescription for the cure of the mental disorder treated of by the quaint author of "The Anatomy of Melancholy," himself evidently a lover of the weed: "Tobacco, divine, rare, superexcellent tobacco,

which goes far beyond all the panaceas, potable gold, and philosopher's stones, a sovereign remedy to all diseases. A good vomit, I confess; a virtuous herb, if it be well qualified, opportunely taken, and medicinally used; but as it is commonly abused by most men, which take it as tinkers do ale, 'tis a plague, a mischief, a violent purger of goods, lands, health; hellish, devilish, and damned tobacco, the ruin and overthrow of body and soul!" Such a description of the extent to which tobacco was "commonly abused," in the early part of the seventeenth century (1621) is only explicable by such modes of partaking of it as still prevail among savage tribes, for scarcely even the grossest excesses of the modern smoker and chewer would admit of such terms of denunciation.

The growing size of the tobacco pipe, as it approaches the era of the Revolution, indicates the introduction of a contemporaneous nicotian revolution also, which adapted the pipe of the Indian medicine-man to the philosophical reveries of an English Newton; and within a century from Zacharie Boyd's association of tobacco with the dissipation of "The wine pint," enabled the devout author of the "Gospel Sonnets," to superadd to these his "Smoking Spiritualized: inserted as a proper subject of meditation to smokers of Tobacco; the first part being an Old Meditation upon smoking Tobacco; and the second a new addition to it, or Improvement of it."* In his "*improvement*" of his text the grave divine indulges in nicotian similes, such as, from less reverent hands, would seem profane; comparing the "naughty foreign weed" to "the plant of great renown," to "Jesse's flower" and "Sharon's Rose!" and "The smoke, like burning incense," to devout prayer: closing each stanza with the refrain:

"Thus think, and smoke Tobacco."

In this the fanciful moralist "improved" on an old song, which has been traced to the early part of the seventeenth century, and is still preserved on more than one Broadside of dates as early at least as 1670 and 1672. In the former of these it bears the initials "G. W." supposed to be those of George Wither, who is reputed to have found solace in the luxury it celebrates. This unlucky puritan poet, who died in 1667, is said by his unloving biographer, Anthony A'Wood, to have owed his life, on one occasion, to a bon-mot of a

* "Gospel Sonnets, or Spiritual Songs, in six parts, concerning Creation and Redemption, Law and Gospel, Justification and Sanctification, Faith and Sense, Heaven and Hell. By the late Reverend Mr. Ralph Erskine, Minister of the Gospel at Dunfermline." My copy is the 25th Edition. Edinburgh, 1797:—a sufficient evidence of the popularity which this work once had.

witty poetic rival, Sir John Denham. The royalist—as the author of the ATHENÆ OXONIENSIS relates—owed a grudge to the captive poet, some of his family estates having got into Wither's clutches. Nevertheless, he modestly prayed his Majesty not to hang him, for so long as Wither lived, he (Sir John Denham) would not be accounted the worst poet in England! Notwithstanding this slur on Wither's poetic repute, the song has evidently enjoyed great and enduring popularity, as is proved by numerous variations, and the gradual modernizing process it has gone through. The version of it which furnishes a text for the Rev. Ralph Erskine, betrays the touches of a modern hand; but in its general form it most nearly resembles the Broadside of 1672, with the antique flavour of which these "tobacco fumes" may fitly exhale their concluding whiff:

The Indian weed, withered quite,
Green at noon, cut down at night,
Shews thy decay:
All flesh is hay,
Thus think, then drink tobacco.

The pipe that is so lily white,
Shows thee to be a mortal wight;
Even as such,
Gone at a touch,
Thus think, then drink tobacco.

And when the smoke ascends on high,
Think thou behold'st the vanity
Of worldly stuff,
Gone at a puff;
Thus think, and drink tobacco.

And when the pipe grows foul within,
Think on thy soul defiled with sin;
And of the fire
It doth require;
Thus think, then drink tobacco.

The ashes that are left behind,
May serve to put thee still in mind.
That unto dust
Return thou must;
Thus think, then drink tobacco.

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Most of the foregoing pages were already thrown off when the *Gateshead Observer*, of June 6th, 1857, reached me, with the following notice of proceedings at a meeting of the Society of Antiquaries

of Newcastle-on-Tyne. It may very fitly be appended as a note to this sketch, as sufficing to show the latest views of my friend, Dr. Bruce, on the antiquity of pipes and tobacco. It will be seen that he still speaks of the miniature Elfin pipes as *medieval*; but subsequent remarks seem to indicate that by this term he means the era of Queen Elizabeth, if not indeed that of the Revolution, though neither of them would be generally recognised as pertaining to the province of the medieval historian.

"A PAPER—OF TOBACCO."

"Dr. Bruce said, when the circular convening the meeting was issued, there was no paper in prospect, and he had therefore written a short one, not anticipating the many interesting communications which had filled up the meeting so agreeably. His paper was on the subject of the clay-pipes occasionally found in situations where we should only expect to find remains of a time long anterior to that of Sir Walter Raleigh. To this subject his attention had been turned, within the last few days, by a letter received by the Treasurer (Mr. Fenwick) from a mutual friend—Dr. Daniel Wilson, of Toronto. The Doctor wrote:—'What says Dr Bruce to the Roman tobacco-pipes now? Tell him I have got a crow to pluck with him for that. I get quoted from his pages, and held responsible for much more than I ever thought, said, or meant to say. Let him look-out for a missive from the land of tobacco.' The passage referred to, in his (Dr. Bruce's) second edition of 'The Roman Wall,' had, curiously enough, and vexatiously enough, been more quoted and translated, perhaps, than any other. It asked if smoking pipes must be numbered among Roman remains—such pipes, (some of the ordinary size, others of pigmy dimensions, with intermediate sizes,) having been found in Roman stations, in close association with remains of undoubted Roman origin. Dr. Wilson was quoted on the subject, where, in his Archæology of Scotland, he speaks of "Celtic,' "Elfin," or "Danes'" pipes, occasionally found under circumstances raising the supposition that tobacco was only introduced as a superior substitute for older narcotics. Dr. Bruce produced several specimens—one, a tiny bowl, dug from a depth of ten feet, in 1854, at the back of the Assembly Rooms of Newcastle, where, when a sewer under the Vicarage House was in course of construction, he was on the look-out for remains of the Roman Wall. In the Antwerp Museum, such pipes are exhibited as Roman antiquities; and some were found near the foundations of the Wall of Roman London, when laid bare in 1853. Still, to Dr. Wilson's Transatlantic inquiry: 'What says he to the Roman tobacco pipes now?' he had to reply, that he feared they were but medieval, and, moreover, of a late date. He would briefly state the grounds of this conclusion:—1. They were only met with, here and there, in connection with Roman remains; while in every Roman station, all the kinds of pottery used by the Romans were invariably found.—2. No traces of the practice of smoking presented themselves in classic authors.—3. Ancient herbals contained no notice of any vegetable used for smoking with pipes.—4. These old pipes, laid together, exhibited a regular gradation in size, from the fairy bowl to the pipe of the present day.—5. Elfin pipes were found some few years ago at Hoylake, in Cheshire, on the site where the troops of William III. were encamped previous to their embarkation for Ireland; on the battle-field of Boyne, at Dundalk, and in other parts of Ireland where William's

troops were quartered. 'With respect,' said one of his (Dr. Bruce's) reviewers, 'to the little tobacco pipe bowls, we may observe that their comparatively diminutive size may be well explained by the fact that, in the time of Queen Elizabeth tobacco was sold at five guineas the ounce, and that, in aftertimes, those who indulged in the expensive luxury of smoking tobacco, were accustomed, in buying it, to throw five shilling pieces into the opposite scale.' He (Dr. Bruce) feared, then, that the Elfin pipes—the Fairy pipes—the Danes' pipes—must be placed in the same category with—'Severus' Wall!'

"At the conclusion of the paper, Mr. E. Spoor stated that he had seen turned up, in *building operations, hundreds of pipes together, smaller than any of those on* the table, near the town walls of Newcastle."

From this it appears that the learned author of "THE ROMAN WALL," no longer accords to his mural Legionary the luxury of a pipe; and the defence of this venerable classic institution must be resigned to the more chivalrous archæologists of the Continent, and especially to the Antiquaries of Antwerp, where Elfin tobacco-pipes are still exhibited as Roman relics; and among whom, we trust, still survives some collateral descendant of the venerable and praiseworthy Aldobrand Oldenbuck, the happy progenitor of the Laird of Monkbarns!

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## CANADIAN ENGLISH.

BY THE REV. A. CONSTABLE GEIKIE.

*Read before the Canadian Institute, 28th March,* 1857.

It is a growing opinion that the English tongue is destined to become, for many purposes at least, the language of the world. But supposing such an extension of our vernacular to be probable, will the world speak "English undefiled," or English very defiled indeed? I know nothing of the tendencies in Australia, New Zealand, or at the Cape; but certainly, the English we *often hear spoken*, and see written, in the United States and Canada, is by no means an improvement on the original. That the American retains some obsolete words, or uses current words in obsolete ways, cannot fairly be objected to, though the very same reasons justify the language of modern Quakerism. But this process will account for a small fraction of the peculiarities of his language. He is daily inventing

words which are neither English in character, nor needed to supply any deficiency in the language; and even where peculiar circumstances may make such a coinage, or such perversion of words from their primary significance pardonable, the circumstances are continually disregarded, and they are applied in cases where no such need exists, to the exclusion of the proper phrase, and to the injury of the language.

Canada inevitably partakes of the same influences. Her language is largely affected by such lawless and vulgar innovations. New words are coined for ourselves by a process similar to that which calls them into being in the neighbouring States; still more, they are imported by travellers, daily circulated by American newspapers, and eagerly incorporated into the language of our Provincial press. The result is that, with that alacrity at sinking which belong to human nature, we are in a fair way of appropriating what is worthless in the word coinage of our neighbours, in addition to all which our peculiar position may generate among ourselves.

It is not necessary to attempt any methodic classification of words or phrases; the purpose of this paper will be sufficiently accomplished by noticing a few of the most characteristic novelties as they occur to me. Neither shall I make any distinction between obsolete words and modern inventions. It is enough if it can be shown that words, unrecognized by good authors, are daily used; that words duly recognized are used in improper ways; or that extraordinary creations, and combinations of letters and phrases, are extensively circulated without supplying a recognized want, or contributing in any sense to the enrichment of the language. To refer, then, to a few examples of such transatlantic innovations on the English language: when Englishmen wish to mark their sense of the services of some public personage, by a suitable testimonial, they are said to *give* or *present* something to him, and the thing so *given* or *presented* is called a *gift* or *present*. But with us it is becoming fashionable to speak of such a gift as a *donation*, and still more of a thing *donated*. A minister is, with peculiar delicacy, dragged up before two or three hundred people and a band of music, to receive a *present* from his congregation, of a horse, it may be, or a purse of money,—and this gift, dubbed a *donation*, is *donated* to him at what is called a *donation-meeting*. Webster says, that *donation* is usually applied to things of more value than *presents*; but while such may be true in the States, I have known it applied here to a basket of musty cakes. I suppose that *donation*, has a certain meaning in law. Its most ordinary English application is to a single gift in money, in contra-distinction to the periodical

payments of a fixed sum as subscription. When applied to a *present*, public or private, I apprehend such an application of the term has its origin in mere pomposity. The language stands in need of no *such expression so long as we have our old Saxon gift.*

In England, when one man accommodates another with the use of money for a time, he lends it. The sum is called a *loan*, but he who provides it is said to *lend* or to have *lent*. Here, however, it is becoming usual to speak of having *loaned* to another. Webster says that *to loan* is rarely used in England, and I may say that I never heard it there. What advantage then does it possess over the more familiar form of the verb that it should supersede it here? Surely the phrase "money to lend," is sufficiently intelligible. To talk of *loaning* money, would suggest to an unsophisticated Englishman, the idea of some unknown process at the mint.

Again, let a clergyman study his sermon, a professor his lecture, a member of Parliament his speech, or a merchant the state of the markets and the rate of exchange: an educated or uneducated Englishman would probably say, "*the man is master* of his subject," and than this, more need not and cannot be said. In the States and Canada, however, a new phrase is current. A member of our Assembly makes a luminious speech, say about that great *institution* of modern civilization, the gallows,—and writers forthwith remark, that "he is *posted-up* on it." A Professor of Anatomy gives a lecture on some abtruse branch of his department of medical education, and his admiring pupils exclaim that "he is well *posted-up* on his subject." A metaphysician once more grapples with the old problem how many angels can stand on the point of a needle, and he, too is *posted-up* on it." A clergyman is *posted-up* in theology, a blacksmith in iron, a milliner in crinoline, a mother in nursery government, and an undertaker in the art of "performing" funerals, and coffining his customers. But, while ledgers may and should be "posted," it has not hitherto been the English practise to treat men so, unless they be black-legs.

A man in England possesses notable capacity, and people style him *capable*, or *able*, or *great*. In Canada he is designated *first-class*. To speak of a *first-class* carriage, or a *first-class* prize, or even a *first-class* prize ox, may be right enough, but why apply phrases with such poor associations to men of splendid intellect? Is it not enough that a man be *great?* Will he seem any greater when indissolubly associated with a railway van? The originators of such expressions no doubt thought so, but if the victim of such a nick name be what it is supposed to imply, he will not thank his admirers for the compliment.

A man in Britain buys a house, or farm, and it is said to be *in*, or more precisely, *situated in* such a street, or district, or county. Here, nobody or thing is *situated* anywhere; all are *located*. Our farms, our houses, our congregations, our constituencies, all are *located*. We admir a mansion occupying a healthy, or commanding site, and we are told that "the *location* is good;" a clergyman is congratulated on his incumbency, which is styled a comfortable *location;* and so on *ad infinitum*. To *locate* is a purely technical term, belonging to land-surveyors and their profession, and it is difficult to perceive any gain to the language by its application being extended beyond its original technical significance.

Ask an Englishman how much he has accomplished of a given work, and he will reply if getting on well, "a good deal." Ask the same question in our own colony, and if in a like position, the answer will be, "*considerable*." Now, *considerable* means, "worthy of consideration." Thus: "a man has a *considerable* fortune." We can understand when, in answer to the question, "how are you getting on with your mathematics?" the student replies *considerable*, or, still more elegantly, "considerable much." He means to say, "very well" and it is to be regreted that he should not say so. Or to give another specimen of the novel mode of applying this word *considerable:* a newspaper editor recently illustrating by comparison the telegraph-cable designed to unite Canada with the States, by being laid in the bed of the River St. Clair, from Detroit to the Canadian shore, says of it: "it is larger by considerable than the Atlantic submarine cable."

A man *concludes* a bargain, and he *resolves* on a certain course of action. A man also comes *to a conclusion* after having considered a matter. But there is a difference between coming to a conclusion and resolving. To do the former, merely implies that he has formed an opinion, to do the latter implies that he has determined on a course of action. So we understand it, and so the words are used in English literature But it is becoming common in Canada to confound *conclude* and *resolve*, and to speak of conclusions when resolutions are intended. Thus:—"I *conclude* to go." is put for, "I have *resolved* or made up my mind to go;" surely a very needless confusion of ideas or vocables.

A *territory* is defined by Webster to be "a tract of land belonging to, or under the dominion of a prince or state, lying at a distance from the parent country, or from the seat of government." It is also used for the *whole lands* belonging to any kingdom or state. On

this continent, it is often applied in its first signification, thus :— "the *territory* of Wisconsin," and indicates then, either all the lands of a state or nation, or certain distant or outlying possessions. *Region* and *district* again indicate a portion only of a kingdom, province, or territory. But a *district* may indicate a very minute portion of a state, county, or even of a city; whereas a *region* describes so wide an extent of country, as almost to be synonymous with that word. Beginning, then, with the latter, we say *district* means the smallest measure, *territory* a large measure, and *region* the largest of all. But in the States and Canada, the three words are often confounded; *territory* is put for *region*, and *region* for *district*, until neither word has any exact or specific meaning left. It is inevitable, indeed, in a new country, settled under peculiar circumstances, so different from those of the mother country, that new terms should be devised. Hence our Gores, Townships, Concessions, broken-fronts, water-lots, &c. But all of these are definite, universally understood with the same significance, and so contribute to the precision of language, instead of detracting from it, and as such, some of them at least, will be permanently incorporated into the English language.

People who speak English, say of a jury when it returns to court, and expresses its judgment, that "it *renders* its verdict," and this act is called "the *rendering* of a verdict," or technically "its finding." All this appears intelligible, and we are slow to imagine anything plainer. But people who, whatever their shortcomings, try to speak the language of Swift and Addison, are little aware of the progress of the age. With many among us, juries never *render* verdicts, but make *rendition* of them; and such, in lieu of speaking of *a finding* or *rendering*, refer to what they style *a rendition*, a mode of expression which, whatever it may be, is not English in such a connection. There is such a word as *rendition*, but it means *surrender* or *yielding possession*. it is a diplomatic, or law term, more than anything else. Let us apply the true meaning of the word to the action of a jury. Thus :—"the jury returned to court in the course of half-an-hour, and surrendered or yielded possession of their verdict." I submit that such bodies of men give, or express, but do not *surrender* opinions. Indeed, one would like to know how any man could surrender an opinion? A man may make *rendition* of his property, but he only *expresses* his sentiments. As the men of Derry said, so say I, "no surrender." But the most absurd use of this abused word may be illustrated by its mode of introduction in a newspaper notice of a concert recently given in Toronto.

The writer seems to have been pleased with some tune, and he accordingly speaks of "the beauty of its *rendition*" Musical people do speak in a certain sense of "*rendering* tunes," but the author of this critique has the honour of originating the idea of a tune being capable of *rendition*. The unsophisticated reader would be sorely tempted to ask how in all the world could a man *surrender* a tune? Doing so implies a measure of coercion. But can a singer be forced to sing, or even, having done so, does he thereby surrender the tune? By force you may take the notes out of his hand, but how can you take them out of his throat?

In England it occasionally happens that great offenders are *hanged*, but in the States and Canada, criminals are never *hanged*; they are all *hung*. In England, beef is *hung*, gates are *hung*, and curtains are *hung*, but felons are *hanged*; in Canada, felons, beef, gates, and curtains, are all treated in the same way.

But our English is not only wayward and independent, it is also so exceedingly modest, that we are in danger, not only of altering our vernacular, but of forgetting how our bodies are constructed. If we know anything of English conversation or letters, we speedily find out, even if stone-blind, that British men and women have both arms and legs. But in Canada, a stranger who could not see, would find it difficult to discover much about our conformation. He would learn that both sexes had *limbs* of some sort, but from any information which our language would give, he could not tell whether their *limbs* were used to stand on or hold by.

Among British domestic fowls there are many styled *gallinaceous*; and among these are cocks and hens, male and female. But a blind naturalist could never fancy that we have the same distinctions in Canada. He would, indeed learn that we have hens; but he would wonder in vain what had become of their mates. That there existed an unknown creature called a *rooster*, he would early discover, but unless he made particular enquiry, he might return after a year's residence among us, thoroughly convinced that there were no cocks in the province. Still greater, perhaps, would be his surprise, on making the discovery, to learn that in using the old familiar English name for the hero of the barn-yard, he had been using a very immodest word. This sort of thing is preeminently disgusting, and speaks ill, not merely for the taste, but for the morals of those with whom such a refinement originated. In Canada, such a garment as trowsers is unknown. What do we wear? Pantaloons is the reply; or more familiarly *pants*, with the feminine elegancy *pantalets!*

But is this the fact? Certainly it is not. At least it has never been my fortune to meet with one in this country who wore them. Pantaloons are an article of dress, out of fashion for fifty years. In more familiar vernacular they were wont to be called skin-tights, and while answering a similar purpose, are very different from trowsers in their shape. The origin of such a misnomer is sufficiently obvious. Such prudish euphemisms are by no means peculiar to Canada or the States. They find their complete parallel in the English synonymes: *unmentionables* or *inexpressibles*, and the like familiar shiboleths of immodest prudery, which belong exclusively to no class or county, but are none the less to be avoided by all who would regulate their mode of thought and expression by purity and true refinement.

In England, good housewives and the lieges at large, are sometimes horrified by the apparition of a loathsome insect, yclept a *bug*. Gardeners also find creatures of the same *genus* on their plants, and zoologists are familiar with numerous varieties of them. But, however great the variety, and however diverse the habits of different *species*, few words associated with insect life are so universally avoided, or are, from certain associations, more revolting than this monosyllable. And yet, we hear people on this side of the Atlantic, who, to say the least of it, are quite as familiar with this insect-pest as those on the other,—applying this nauseous title to the beautiful firefly which makes our fields so glorious on a warm summer night. Canadians call it the "lightning-*bug*!" Here, we have, not simply an abuse of language, but a breach of good taste, which it might be thought no person of refinement could ever perpetrate. As well might they dignify a vase of sweetly scented roses by making it share with the offensive and suffocating missile occasionally employed in naval warfare, the euphonious epithet of "stink-pot!" Moreover as this term *bug* is universally employed both in Canada and the States as a synonym for *insect*, the further result is a loss of precision, such as, in the commonest use of terms at home, discriminates at once between a fly, a beetle, and a grub. In England the term *fly* is also applied occasionally to a light vehicle, and it is on the same principle I presume that a four wheeled gig receives here the elegant name of *buggy!*

Turning again to another class of words; there is a curious disposition manifested among our manufacturers of improved English, to convert our regular into irregular verbs, for the sake of gaining what some modern grammarians have styled the strong preterite.

In England, when a swimmer makes his first leap, head foremost, into the water he is said to *dive*, and is spoken of as having *dived*, in accordance with the ordinary and regular construction of the verb. Not so however, is it with the modern refinements of our Canadian English. In referring to such a feat here, it would be said, not that he *dived*, but that he *dove*. Even Longfellow makes use of this form,—so harsh and unfamiliar to English ears,—in the musical measures of his "Hiawatha:—

> "Straight into the river Kwasind
> Plunged as if he were an otter,
> *Dove* as if he were a beaver," &c.

As we say drive, drove, driven, we may look for the completion of the verb *to dive*, on its new model, and find the next poet's hero having "*diven* as if he were a beaver" or any other amphibious native of the new world. Though as yet unsanctioned by such classic authority, the verb *to give* not unfrequently assumes among us the past form of *he gave*, *rose* becomes *ris*, *chid—chode*, *delved—dolve*, *helped—holp*, or *holped*, *swelled—swoll*, &c. Yet so lawless and systemless are the changes, that, along with such alterations, which might seem to aim at a universal creation of strong preterites, we have the process reversed, and *froze* becomes *freezed* or *friz*, *felt-feeled*, &c. That some of these are as yet mere vulgarisms is not to be denied, but when the older examples receive the sanction of the highest literary authorities we may reasonably dread that the adoption of the remainder is a mere question of time.

When an Englishman speaks at random or without sufficient authority, he *guesses*. When he expresses an opinion, he *thinks*. *Guess* and *think* are not synonymes, but refer to two opposite states of mind. Far otherwise is it in the neighbouring republic, and with too many here; for, with Americans and their imitators, *guess* and *think* have an identical signification. A "Clear-grit" *guesses* that the person beside him who does not spit on the floor, is a tory and a contemptible aristocrat, while a tobacco-moistening "Hoosier" *guesses*, and for like reasons, that a Boston merchant must be a federalist. Now if they only knew it, neither of these discerning and refined individuals *guesses* at all. Contrariwise, each feels confident in the matter pronounced upon. The general conduct of the persons of whom they thus judge, together with the subdued action of their salivary glands, has satisfied both that the political tendencies of the others must be the antithesis of their own. They are in *no uncertainty*, and a *guess* is impossible. The ordinary American use of this word justly

subjects its users to ridicule, unless the precision which our English tongue once boasted of is no longer a feature worth preserving.

But a volume might be written about the evils glanced at here. In closing this paper, therefore, I can only indicate a few more of the indigenous elegancies which are already meeting with such general acceptance, and thereby corrupting, not simply the speech of the Province, but such literature as we have. It cannot, we fear, be justly affirmed that such expressions as the following are so entirely confined to the vulgar and uneducated as to be undeserving of notice as an element likely to affect permanently the language of the Province:—

"Are you better to-day?" inquires Britannicus. "*Some*," replies Canadiensis. "Were there many people present?" asks B. "*quite* a number," answers C., meaning thereby "a number," for how can a number be otherwise than *quite a number?* B:—"Where did you go to-day?" C:—"*down town*," that is, he walked through, or in the city. B:—"are you going by this train?" C:—"yes, I'm just *on board*." B:—"where is your master?" C:—"the *boss* is out." B:—"How many horses have you?" C:—"a *span*," which word he substitutes for "a *pair*." B:—"what is that man's character?" C:—"he's a loafer," that is, in plain English, "a good for nothing fellow." B:—"how do you vote?" C:—"I go the Hincks *ticket*." B:—"has there been a committee meeting?" C:—"yes, they had a *caucus* last night." B:—"can that wheel revolve now?" C:—"yes, I guess it can do nothing else, for I've *fixed* it." B:—"did you mend my shoe." C:—"yes, I've *fixed* it." B:—"when will your sister be ready?" C:—Jane is just *fixing* her hair." B:—"what do you eat to venison?" C:—"jelly *fixings*." B:—"what have you done with your other horse?" C:—"I've *dickered* him." B:—"what kind of a speaker is W— ?" C:—"a *stump-orator*." B:—"how did he get his present office?" C:—"by *chiselling*." B:—"is there much jobbing in the house?" C:—"no end of *log-rolling*." B:—"did he run away?" C:—"yes, he *sloped*," or "*he made tracks*." B:—"how do you feel to-day?" C:—I'm quite *sick*." B:—"sick! why don't you take something to settle your stomach?" C:—"my stomach isn't unsettled. Its my toe that aches!" &c.

Nor is it in solitary words or phrases alone that we are thus aiming at "gilding refined gold," in our improvements on the English language. So far has this process already been carried that it would not be difficult to construct whole sentences of our Canadian

vernacular which, to the home-bred ear, would stand nearly as much in need of translation, as an oration of one of the Huron or Chippeway Chiefs whom we have supplanted from their ancient hunting grounds on the shores of the great lakes. Let us take a brief example. A Canadian who has enjoyed the advantages of the American vocabulary will thus describe a very simple transaction:—"I traded my last yorker for a plug of honey dew, and got plaguy chiseled by a loafer whose boss had dickered his lot and betterments for notions to his store;" some of the words introduced here are genuine Americanisms, such as *betterments, i.e.* improvements on new lands; *lot*, or division of land; *town lots*, sites within the area designed for a village or town; *boss* (Dutch) the euphemism for the unpalatable word *master;* and *store*, the invariably term for a shop. Others again, such as *yorker*: a shilling york currency, or sixpence sterling, are no less genuinely Canadian; and the whole, will become intelligible for the first time to the inexperienced English ear when thus translated:—"I exchanged my last sixpence for a packet of tobacco, and got thoroughly cheated by a disreputable fellow whose employer had bartered a piece of improved land to obtain small wares for his shop."

These and a thousand other examples which might be produced, fully justify the use of the term "Canadian English," as expressive of a corrupt dialect growing up amongst our population, and gradually finding access to our periodical literature, until it threatens to produce a language as unlike our noble mother tongue as the negro patua, or the Chinese pidgeon English. That the English language is still open to additions no one can doubt, or that it assimilates to itself, when needful, even the racy vernacular of to-day, to enrich itself, where synonymes are wanting. Hence, whenever a single word supplies the place of what could only be formerly expressed by a sentence, — unless the word be singularly uneuphoneous,—the language gains by its adoption. But if *chiseling* only means *cheating;* and *log-rolling,—jobbing;* and *clearing out*, or *making tracks,—running away;* then most men of taste will have little hesitation in their choice between the oldfashioned English of Shakespeare, Milton, Swift, and Addison, and such modern *enrichments* of the old "well of English undefiled." Such words-of-all-work, again, as *some*, and *quite*, and *fix*, and *guess*, having already a precise and recognized acceptance in classical English, it is probable that good writers and educated speakers will still recognize them in such sense, and when they *fix* a wheel immovably, they will say they have fixed it; but

when they mend or repair the same wheel, they will find no inconvenience in using one of the latter terms as equally apt and less ambiguous. And so also when they make a *guess* at some fact beyond their certain knowledge they will say so; but when they speak of what they actually do know, they will state it as a fact, and not guess about it.

An amusing illustration of the manner in which such misuse of words can obscure the sense of their true meaning even in the minds of educated men, is furnished by a critical comment in the "Shakespear's Scholar," of Richard Grant White, A.M.,* on the following passage in "Richard III." Act IV, Scene IV:—

STANLEY. Richmond is on the seas.
K. RICHARD. There let him sink—and be the seas on him.
White livered runnagate;—what doth he there?
STANLEY. I know not, mighty sovereign, but by guess.
K. RICHARD. Well, as you guess?

A better illustration of the correct use of the word could no where be found. Stanley says he does not know, he only guesses; and the king replies; well tell me what your guess or suspicion is. But hear the American critic:—"If there be two words for the use of which, more than any others, our English cousins twit us, they are 'well,' as an interrogative exclamation, and 'guess.' Milton uses both, as Shakespear also frequently does, and exactly in the way in which they are used in America; and here we have them both in half a line. Like most of those words and phrases which it pleases John Bull to call Americanisms, they are English of the purest and best, which have lived here while they have died out in the mother country." To such "*English of the purest and best!*" are we fast hastening, if some check is not put on the present tendencies of our colloquial speech, and the style adopted in our periodical literature.

It may be assumed that enough has now been said to shew the truth of the complaint with which this paper began. How then is the evil to be remedied? One or two suggestions occur to me which may not seem unworthy of some attention, as means calculated to check in some degree this growing evil. The first is that, educated men in private stations should carefully guard against the errors indicated, and others germane to them, and use their influence to check them when introduced. The second is, that our common school teachers should not only do likewise, but should correct the children under their care, whenever they utter slang or corrupt English, not

* Shakespear's Scholar; being historical and critical studies of his text, characters and commentators, &c. By R. G. White, A.M. Appleton & Co., New York: 1854.

only in the school, but in the play-ground, and on the streets; and the third is that, our newspaper and other writers should abstain from the attempt to add new force to the English tongue by improving the language of Shakespeare, Bacon, Dryden, and Addison. It is true that these are antiquated names; and it may be that some among us rather know them by the hearing of the ear than the sight of their works; still, weak though it may seem, and—to cull once more, for the sake of illustration, one of the choicest phrases of Canadian letters,—"old fogyish" though it may appear, I cannot get rid of the impression, that those men understood English fully as well as any American or Canadian author, and that, though they never wrote slang, no one either on this side of the Atlantic, or on the other, has written, or is likely to write, either with augmented force, or greater clearness.

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## ON THE ORIGIN AND METAMORPHOSIS OF SOME SEDIMENTARY ROCKS.

BY T. STERRY HUNT,
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The progress of Geological investigation has shown that many masses formerly regarded as primitive and even as hypogene rocks, belong to formations, which in other parts of their geographical distribution appear in the form of sedimentary strata, destitute of crystalline character, and distinguished by their organic remains as pertaining to various geological epochs. Thus the researches of Sir William Logan have shown conclusively that the serpentines, tales, diallages and pyroxenites of the Green Mountains are portions of altered Silurian Strata, and I have already suggested that these rocks have been formed by the metamorphosis of certain beds of silicious and ferruginous dolomites and magnesites which occur in the Quebec division of the Hudson River Group, and are found in its unaltered portions interstratified with pure fossiliferous limestones, sandstones, and graptolitic shales.

Dolomites have, until recently, been regarded for the most part as altered rocks, and the mode of their formation is but little understood. When carbonated waters, containing lime and magnesia in solution, are

exposed to the air, the former base alone is at first deposited, and the magnesian carbonate is only separated by evaporation. When carbonate of soda is added in small quantities to a liquid, such as sea water, containing chlorides of these two bases, the precipitate formed in the cold consists chiefly of carbonate of lime, and the liquid, by evaporation, deposits a large quantity of carbonate of magnesia with a little lime, and then contains only chloride of magnesia (with soda salts) in solution. It is well known that the precipitate formed by carbonate of soda in a solution of chloride of magnesium is soluble in an excess of either of these salts. We have in Canada a great number of saline springs, which rise from Lower Silurian rocks, and appear to be formed by the mingling of the bittern-like waters, destitute of earthy carbonates, and derived from the lower limestones, with the carbonated alkaline waters of some of the associated strata. These saline springs, such as Plantagenet, St. Léon, and Sainte-Geneviève, deposit by evaporation, at a gentle heat, large quantities of earthy carbonates, of which the carbonate of magnesia forms from 50 to 95 per cent.; they sometimes contain but a trace of carbonate of lime. The spontaneous evaporation of basins of similar waters would give rise to the formation of dolomites or magnesites which would assume the form of detached or interrupted beds or lenticular masses among the pure limestones and other non-magnesian deposits of the region. Such are precisely the conditions in which the magnesian rocks occur in the Hudson River Group. Many of them may, however, be the result of a direct precipitation which may take place in deep sea water, from the infusion of alkaline carbonates.

Mingled as these magnesian deposits naturally are with sand and clay, we have in the silica, magnesia, lime, alumina, and oxide of iron of the sediment, the elements of serpentine, talc, pyroxene, hornblende and chlorite. For the production of these minerals it is necessary to dissolve the silica, and cause it to unite with the bases present, expelling the carbonic acid. The agent in this reaction has doubtless been an alkali. A solution of carbonate of soda at 212° F. will slowly dissolve silica, even in the form of quartz, and the silicate of soda thus formed, is at once decomposed at this temperature by the carbonates of lime, magnesia, or iron, with the production of a silicate of these bases, and the regeneration of the alkaline carbonate, which is then free to operate upon a new portion of silica. In this way a small amount of alkali may serve as the medium for the silicification of a large amount of carbonates. I have verified all these reactions by experiment, and have found that a silicate of magnesia is formed when quartz is boiled with carbonate of magnesia, and a solution of carbonate of soda.

A silicate of protoxide of iron, unalterable in the air, may be formed by an analogous process. The reactions of alumina, and of silicate of alumina under similar conditions have yet to be examined.

It appears to me that by this extension which I have given to the reaction between carbonate of lime and soluble glass, already pointed out by Kuhlmann, we have a key to the mode of formation of most of the silicates of the metamorphic stratified rocks. The subject will be found still farther developed in the forthcoming Report of Progress of the Geological Survey.

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## NOTES ON THE NATURAL HISTORY OF NEW ZEALAND.

BY S. P. STRATFORD, M.D., OF AUCKLAND, NEW ZEALAND.

*Read before the Canadian Institute, 28th February*, 1857.

Having been fortunate enough to secure a favorable opportunity for transmitting a package to Canada, I have availed myself of it to forward, for the Museum of the Canadian Institute, some specimens of the geological formations and objects of natural history belonging to this part of the world, which I hope may possess some interest for the members of the Institute.

Among the geological specimens will be found vesicular scoriæ, lava, volcanic ashes and cinders. These abound in almost all parts of New Zealand, and in the neighbourhood of Auckland are particularly marked. Auckland, indeed, is a spot especially favorable to the study of volcanic action, and I only regret that professional engagements prevent my paying such attention to the subject as I would wish. It may not, however, prove unacceptable, if I accompany the specimens with a few remarks upon the subject, or at least note, for my Canadian friends, some facts connected with the traces of volcanic action in this neighbourhood.

In the immediate vicinity of Auckland we have volcanic cones of various dimensions, from the height of a few feet to upwards of one thousand feet. They are grouped together in clusters, so that from the top of Mount Eden, two miles from this city, eighteen or twenty may be counted. It must not, however, be imagined, that the vol-

canoes in the immediate vicinity of Auckland are the highest. Tongeraro, an active volcano in the centre of the island, is extremely high, rising far above the level of the perpetual snow line. It is in almost continual action, and is surrounded by mountains with altitudes approaching its own, and which exhibit clear indications of a volcanic origin; indeed, the whole country shows that the volcanic influence is general, and I imagine that the incandescent material approaches the earth's surface in an unusual manner. Solfataras, or volcanic vents, are met with, and accompanying these, abundant exudations of sulphur, of nitrate of potash, &c. Hot springs and mineral waters abound; indeed, the hot springs of *Rotumakana*, at which the natives cook their food, and which, from their volume, are more like cataracts than springs, fall into Lake Tampo, and heat the waters of the lake for a considerable distance around. I do not doubt that these remarkable springs will hereafter become objects of no slight interest to the geologist.

Sulphur springs are numerous, and an efflorescence of sulphate of alumina is found spreading over extensive surfaces of the earth, while the volcanic fire, which I imagine to be the remains of an enormous lava current not yet cooled, is so near the surface that a red heat may be seen in the interior, through openings in the earth; indeed, it is said that the crust sometimes breaks through, and exposes a considerable extent of burning matter. Sometimes bogs or swamps of boiling water are met with, covered by a thin crust of earth. A short time since a Missionary travelling in this volcanic region of New Zealand, ventured to cross such a surface. He broke through into the scalding water, and had his extremities dreadfully injured. It would take a long time to investigate all that is novel and interesting in this part of the country, as it is covered by an interminable forest of great density, such as a tropical climate could alone equal. It is characterised by dense vegetation, and with an immense number of climbers and vegetable parasites of great and varied luxuriance.

Auckland is distant some 500 or 600 miles from the mountain region of New Zealand; and as I have not yet penetrated to that elevated district, I cannot speak of it from personal observation. But as the Waikatu river, which rises in Lake Tampo, takes a northerly direction for 300 miles, emptying itself into the sea on the west coast of the Island, and as settlements have already been commenced along its shores, which are in direct connection with Auckland, the time is not far distant when a visit to the highlands of New Zealand will be

mainly included in a pleasure trip up the Waikatu river in a steamer. The whole valley of the Waikatu is of the most luxuriant description, abounding in excellent pasture lands; admirably adapted for grazing, and holding out many inducements to the agricultural settler.

As I have before mentioned, some eighteen or twenty volcanic cones or craters of eruption may be counted within a few miles of Auckland. Taking Mount Eden as an example; it is about 800 feet high, with a crater 300 feet deep and from 400 to 500 feet wide. The upper part consists of very light ashes, its lip is very uneven, while hillocks of ashes may be seen at different points around it. The unevenness of the lip of the crater would seem to be caused by the influence of the wind, the deposits occurring on the points towards which the wind generally blows. In some instances it would appear to depend on the sudden cooling and falling in of the lava current, as I find that the depression of the lip is often immediately over the direction which the lava took when it forced its way through the sides of the crater.

Judging solely by their external appearance, some of these cones appear to be only mounds of volcanic ashes, being flat or nearly so on the surface, but as they are distant from any other rent, and surrounded by lava and other indications of volcanic action, their true origin cannot be doubted. In some cases the craters are filled with water, forming beautiful little lakes.

I find that the lava currents of Mount Eden have taken for the most part a N. E. or N. W. direction; when they forced their way through the ashes they ran down the sides and spread themselves over the country, leaving at these spots a marked depression of the crater lip. I think I can distinguish several distinct layers of lava, and one has evidently preceded the other by a considerable period; thus the hard stony matter may be observed to have exuded in a certain direction, ending in some instances in a rounded surface, in a manner that—to use a homely simile—reminds one of hasty pudding which has almost ceased to run; a surface that has begun to cool and solidify, but is yet pushed forward by the fluid beneath. The more general appearance of the lava currents, however, is a surface broken up, cracked and split in all directions, the leaves are extreme-uneven, and we find rugged surfaces of rock piled on each other in extreme confusion. The lavas about Mount Eden are of a bluish gray colour like trap, as will be observed in a specimen which I have sent. At the extremity of the lava current there is generally

found a stream of water, in which most commonly splendid watercresses abound, along with many beautiful aquatic plants which remain green throughout the year. Among them may be mentioned the celebrated Rapo or *Typha augustifolia*, which is used by the natives and by new settlers as a convenient building material. They form the walls and roofs of their houses of bunches of it, and tie them together with the Mangi-mangi or climbing fern, *Lygedium articulatum*. Very warm and convenient houses are thus constructed, impervious to rain or wind. I have seen the inside lined with cotton, and then covered with figured paper; and thus finished it is exceedingly comfortable, and makes a very respectable appearance.

The New Zealand flax, *Phormium tenax*, grows on the margins of the streams, its leaves often measuring six feet in height, surmounted by the flowers on an elevated foot stalk. Its dark green leaves and its tuft-like appearance render it a most graceful object. Again the observer will meet with a cluster of the New Zealand fern tree, *Cyathea medullaris*, the noble palm tree, *Areca sapida*, or the curious grass tree, surmounted by tall luxuriant ferns. These present a pleasant picture, a combination of grace and beauty not to be surpassed, I believe, in any other part of the world.

In the layers of volcanic matter I could easily count three successive streams of lava which are now piled one above the other in wild confusion. These eruptions tended towards the N. E. Towards the N. W. the expanse of erupted matter is more extended, rugged and broken, but does not appear to be the result of so many distinct volcanic actions. If the course of the lava current is traced, it sometimes appears to dip, or penetrate the earth for certain distances, again appearing upon the surface. In some instances a smooth dome like surface of the lava will be met with which has cooled without fracture. This presents unmistakeable evidence upon its surface of having flowed slowly, or cooled as it flowed, for marks like wrinkles may be observed, on percussion it sounds hollow, and it has plainly been a spot where the fluid lava was arrested for a short period and its surface cooled, while the internal fluid lava continued its course to the lower levels of the plain. At other points in the same current it may be observed that these domes have given way, and now form deep, rugged and dangerous cavities into which animals sometimes fall, and can seldom get out without assistance, although they may penetrate to some considerable distance along the course of the current. Some of these cavities contain water, and in many instances they are almost concealed by the thick foliage and beautiful ever-

greens which grow from them. In many examples where the lava current leaves the crater and passes into the open air, cavities of this description may be observed, and indeed the adventurous explorer may pass for miles underground along these *caves* as they are called. Most of such caves appear to have been the retreat of vanquished tribes, as human bones are often found in them in very great quantities.

At other points of the lava current, may be found as it were miniature volcanoes--points at which the lava current has been detained while still fluid, and where the confined gases have exploded with great violence, blowing up the lava as out of a crater, and spreading the matter in pieces over the surrounding surface. I conceive that the gases may have been produced, in part at least, by the decomposition of water which the lava met with in its course under the surface of the earth.

Around the mountain are to be found innumerable loose stones, some of enormous size, which have been ejected from the crater. These have often passed to a great distance, and are in some directions thickly covered with sand. A person unacquainted with this fact, would almost despair of being able to employ the land for agricultural purposes, but the stones are only on the surface, showing that the present soil existed before they were ejected. They are used for making permanent fences. Some of them consist of solid lava, others of vesicular scoriæ, most of them are round and appear to have assumed this shape from having been projected to a great height into the air while still in a fluid or semi-fluid condition.

The rough angular surface of the lava, which is fractured into deep chasms presenting abrupt angles, and looking to the eye as a chaotic mass, heaped up in wild confusion, instead of the even surface it presented while still liquid, is evidently owing to the changes of temperature which it has undergone, and the contraction of the particles consequent thereon. The enormous cracks and disjointed fractures are evidence of the intense heat which once pervaded the molten mass, and now make it difficult to believe that it ever presented an even surface.

I send you some of the earths which abound in the neighbourhood, convinced that they have all issued from the volcano in the form of mud or ashes, and as the constituents, and the peculiar condition of such may involve questions interesting to the geologist, I thought you would probably be pleased to receive them, and might cause them to be analysed. I am fully convinced that not one of the layers of

earth which I find about Auckland and its neighbourhood is of sedimentary origin, and I believe a chemical analysis will clearly show this fact.

The peculiar shape and conformation of the land also tends to prove the same, the lay of the land generally indicates spurs or buttresses, which seem to start from the volcano, and extend as rays from a centre, the base of the ray is to the mountain, and it tapers off until it is lost, and in most instances it takes such a shape as might have been assumed by a thick fluid mass flowing down the hill.

The vast number of volcanic rents in this neighbourhood, which have all in their time poured out liquid mud and fluid lava, serve to produce great confusion and complexity in the arrangement of these formations, but by care and perseverance we can generally trace the course of each current of mud. In some of them we find the round masses of vesicular scoria which have been incorporated in the mud and hurried down into the plain below.

In carefully analysing these avalanches of mud it is seen that each has its precise location according to the period of volcanic action. I believe that their difference depends in a great degree upon the depth from which the matter has come. If near the surface it possesses certain characters, but it changes as the combustion penetrates deeper into the central mass of the earth, and lastly fluid lava is forced out upon the surface. We are ignorant of many of the laws which regulate volcanic action, and I am certain that a noble field is open in this neighbourhood for that study, for we have rudimentary volcanoes in all stages of development until we arrive at Pongauro, which presents evidences of great age and continual activity.

The question which is naturally asked is, at what period were the volcanoes about Auckland in active operation. No reliable record has been preserved of that period by the inhabitants; the natives have a kind of tradition that Rangatoto, the highest of the volcanic vents about Auckland, was in operation during the last century; the name itself would seem to confirm this statement, as when translated it signifies "Blood-red sky," a common effect of the eruption of a volcano when seen by night. The discovery of lignite, evidently the remains of ferns and trees now growing in New Zealand, in all directions and under layers of great thickness, would lead to the conclusion that the process of formation had been recent; among the layers of earth I have sent, you will find lignite taken at a great depth, viz., from a well 50 feet deep. I was enabled easily to distinguish among the earth, fern roots and partially decomposed wood, besides which pieces of Kauri

gum were found, showing that not only had ferns grown there but also the noble pine—Dammara Australis. Although covered with a great volume of clay, these remains were enveloped in fine volcanic ashes, showing that such had preceded the eruption of mud. From another well equally deep, near the barracks, I have seen lignite brought up, but this was covered with volcanic cinders several feet thick, besides the clay I have before mentioned. Indeed all the evidence appears to be favorable to the idea of recent eruptions from these volcanic vents, and should it happen that several of them go into operation simultaneously, the inhabitants of Auckland will witness a terrific spectacle. In all probability full notice of the event will be given, in the form of earthquakes and subterranean noises, none of which have been noticed hitherto in sufficient intensity to excite any fear, at least during the last sixteen years.

I have mentioned that there are numerous pieces of rock lying about, but these are plainly scoriæ and derived from volcanoes in the immediate vicinity, not the water worn boulders seen so plentifully in Canada. Our latitude is about 36° south, but I have not seen any evidence of boulders conveyed by ice, and should their total absence be confirmed, I should regard it as a strong evidence of the recent formation of land in these parts.

In the strata formed in the Island of Rangatoto, and in various other parts of our neighbourhood, and which in some cases attain a considerable elevation, and have evidently been exposed to disturbing agencies, many shells and vegetable remains may be discovered. These shells are such as can be found on the shores at present in a living state, and the plants are such as still grow on the island.

These plants and shells have evidently been covered by eruptions of liquid mud or ashes. Cracks have been formed during the drying, and these are sometimes filled with carbonate or oxide of iron.

Such facts prove very clearly that the Islands of New Zealand are of quite a new formation, which is still further shown by the paucity in the variety of the vegetation, the almost total absence of animals, and the complete freedom from venomous reptiles. Although there are scarcely any native plants and animals, yet almost every species of plant and animal thrives well. The English pheasant and the guinea fowl has become wild, and the hogs left by Cook are now spread over the whole island.

The climate is most equable; during my twelve months residence, I have scarcely seen six really wet days, I have seen ice and the temperature has been as high as 75°, but these are the extremes, and occur very rarely.

The natives are a fine race of men, and very apt at learning. They soon become good navigators; some own large schooners and sail them themselves; their canoes are excellently made and will stand any sea. They own many mills and cultivate the land largely, the women doing most of the labor. Their character is kind and hospitable, and in war they are by no means to be despised. Their fortifications exhibit considerable ingenuity.

Among the specimens of natural curiosities will be found the vegetable caterpillar—the *Sphæria sinules* or *Robertia* as it is called. It is very abundant in New Zealand, especially upon the west coasts, where it is said that tons might be collected. I am in hopes it may become an article of trade with China, where the fungus is prized very highly and is used as a medicine. The Sphœria Robertia although bearing much resemblance to a caterpillar is evidently a plant, the mode of its production is said to depend upon the growth of a sporule of the fungus germinating within the body of the animal while yet alive. Aware of the disease, the caterpillar seeks the shelter of the Rata tree, and lays itself up to die under it, in due season the fungus shoots out its stem, flowers, seeds, and dies. From the specimen I have sent, abundant evidence of its fungus nature will be manifest. The butterfly that produces this caterpillar is said, by an intelligent friend from Hohinaga, to be the Hepialus Sericeus; when the eggs are hatched, the caterpilar seeks the Kahikaton tree, bores into it to a great depth, and then covers its hole over with bark and web, so as to hide itself from the depredations of the Waita, a species of flea nearly as large as a mouse. I shall try my best to obtain correct information upon this matter with a view to communicate it to the Institute when I write again.

Along with the other specimens now forwarded, illustrative of the Natural History of New Zealand, I have sent a Hippocampus which was taken upon the little Barras island in the Gulph of Hourica, not far from Auckland.

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## REVIEWS.

*Catalogue of Human Crania in the Collection of the Academy of Natural Sciences of Philadelphia; based upon the third edition of Dr. Morton's "Catalogue of Skulls," &c.* By J. Aitken Meigs, M.D., Librarian of the Academy of Natural Sciences of Philadelphia, &c. Philadelphia: J. B. Lippincott & Co., 1857.

No purely scientific American work has more firmly, though slowly, established its claims to a permanent place among the valued contribu-

tions to the materials of progressive science, in relation to some of the most important questions of our day, than the *Crania Americana*, the work of the late Dr. Samuel George Morton, of Philadelphia. Valuable, however, as it is, it cannot detract from the merit of its author's zealous and persevering labors to say, that it has furnished materials destined to lead others to still more comprehensive and exact results than any he arrived at. Nor did it complete his labors; he was a worker until the last, and every production of his pen has a further value in relation to his chief contribution to ethnological science. Such is felt, in an especial manner, to be the case, in reference to the catalogue originally prepared by himself, and now carefully edited and enlarged so as to embrace the greatly augmented collection of skulls formed originally by its author. It furnishes many details, indispensable as addenda to the *Crania Americana*. Without it, for example, all the additional examples included in the "Table of Anatomical Measurements," in that work, are scarcely available for the general purposes of analysis and comparison. Of these it supplies, in relation to nearly all of them, the requisite facts as to sex, age, special characteristics, &c., most desirable to be ascertained. Had its careful and pains-taking editor, Dr. Meigs, added, in the case of those not included in the *Crania Americana*, some, at least, of the most essential measurements, such as the longitudinal, vertical and parietal diameters, and the horizontal circumference, he would have greatly increased its usefulness. In lieu of this he has followed Dr. Morton in giving the *facial angle* and the *internal capacity* of each; but to neither of these measurements can we attach much value. Beyond such aid as it gives in testing the prognathous character of the superior maxilla, the facial angle is valueless. It rarely takes into account the forehead, while it is liable to be greatly affected by comparatively insignificant variations in the maxilla and position of the teeth, and is so indefinite and uncertain that two accurate and experienced observers will frequently vary considerably in their measurements, executed with the same facial goniometer. So, also, the *internal capacity*, given as it is in this catalogue, without reference to the attempts made by Dr. Morton to discriminate between the comparative occipital, parietal, coronal, and frontal developments, can at most be available only for some general averages. In the great majority of the averages which Morton and later writers have struck, the number of examples is greatly too small while, to do justice to the actual value of comparative cranial and cerebral capacity, the relative size of skull and skeleton must needs be ascertained, otherwise a small-headed and small-brained giant, with intellectual

powers considerably below the average, may compare advantageously in cerebral capacity with some Milton or Newton.

The Catalogue of Crania, as now edited by the intelligent librarian of the Academy of Natural Sciences of Philadelphia, is extensively illustrated with wood-cuts, executed for the various works to which it supplies an important supplement. In some respects it is expressly set forth in emendation of measurements and other data furnished in the *Crania Americana;* and for all facts in relation to the important cranial collection which supplied the materials for that great work, it is—as the latest authority, embodying the final corrections of its author, as well as the careful additions of the editor of this catalogue, —indispensable to the American ethnologist. The rapid progress which the Philadelphian collection of human crania is now making is shewn by the very discrepancies between the earlier and later sheets of the catalogue. On page 50 an addition of seven Esquimaux and two Loo Chooan skulls is recorded, the gift of Dr. B. Vreeland, U.S.N., who procured the former at Godhavn, Disco Island, on the coast of Greenland. Again, on page 102, the skull of an idiotic negress, of remarkable character, is noted as a still later addition; and the whole collection, at the date of the final correction of the catalogue, during the present summer, embraces a total of 1,045 human skulls, including specimens from so many localities, and selected with reference to such remarkable peculiarities of site, form, mode of sepulture, and the like, as to constitute it one of the most interesting and valuable series of ethnographic materials for study either in the New or the Old World.

D. W.

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*Progress of Mathematical and Physical Science. The Encyclopædia Britannica. Eighth edition. Dissertation Sixth: exhibiting a general view of the progress of Mathematics and Physical Science, principally from* 1775 *to* 1850. By James David Forbes, D.C.L., F.R.S., Sec. R. S. E., Professor of Natural Philosophy in the University of Edinburgh, and Corresponding Member of the Institute of France. Edinburgh: Adam and Charles Black, 1856.

There are few undertakings which involve more formidable difficulties and require higher intellectual qualifications than the attempt to present, in a manner at once popularly intelligible and scientifically exact, the history of the progress of philosophy through any epoch.

For, in the first place, to write the history of any particular branch, the historian must have himself thoroughly mastered it; no mere dilettante or second-hand knowledge will save him from error on the one hand, or plagiarism on the other: however difficult or complicated the process by which an idea has been developed or result arrived at, it is essential that he go through it in all its details before he can venture to deviate from the form of words in which his predecessors or the author himself may have presented it. He is conscious also that his performance must bear the criticism of those who have made that department their especial study, and his knowledge is thus to be guaged by the standard, not of the average, but of the highest. When we consider the vast range and variety of direction, in which modern philosophy is sweeping, this requirement assumes alarming proportions, and, if to it we superadd the further difficulty of expressing scientific results in such language that he who runs may read—of stating in familiar words what is perhaps hard enough to understand in its proper technical form, we can hardly wonder that so few attempts have been made at thus writing the histories of even the separate physical sciences—much less that of the whole of them—and that scarcely any have been successful.

If the universal suffrage of the British scientific world had been taken, we believe it would have unanimously pointed out Professor Forbes of Edinburgh, as the man of all others (excepting only the illustrious author of the "History of the Inductive Sciences") most eminently fitted for the task, and the Dissertation, above cited, would have been a triumphant confirmation of their vote. Holding a prominent position in his University, and distinguished for original research in some special departments, Professor Forbes has been long known for one of the very few who have kept up their knowledge to the level of the general advance of philosophy throughout its whole extent, so far as may be done within the limits of human life and power. The work before us is in every respect worthy of his reputation, and we should find it hard to express our opinion of it in terms of praise which would not appear extravagant to persons whose perception of the excellence of the performance is not enhanced by a full appreciation of its difficulty. Regarding the work in its strictly scientific aspect, it becomes a reviewer to speak with diffidence, nor do we affect to be able to criticise all that is set down: we would only say, that in the departments with which we are most familiar, we have tracked our author minutely and rigorously, and that we have detected no inaccuracy of statement, no ambiguity of phrase by which a difficulty might be conveniently slurred over, none of those little slips which so often in "popular"

works enable the adept at once to say, "this man does not understand what he is writing:" all is exact, full, and genial as if the author enjoyed what he is describing; everywhere the subject is treated up to its very latest stage, nor have we noted a single omission of importance. On debatable points, whether of principle or history, its almost judicial clearness and impartiality are admirable, and even where we sometimes dissent from our author's opinion or decision, we have no fault to find with the manner of stating the case. In a literary point of view also, the work is excellently performed; the style is at once vigorous and elegant, reminding us of Herschel and Arago in their best efforts, and sometimes rising into eloquence as welcome as unexpected; while for deep and exhaustive reflection, and acute and happy generalisation, it abounds in passages which make it on the whole one of the most instructive as well as delightful books we have ever read. We suppose we ought to feel shame in confessing to the hope that some dishonest publisher on this side the Atlantic will reproduce it as soon as possible, for although it is "supplied to subscribers *gratis*," that is small comfort to those whose pockets are not deep enough for that whole Encyclopædia Britannica, and whose inclinations are decided for having the pennyworth of bread without the sack.

The range of period over which this dissertation extends, is somewhat limited, including only the last preceding three quarters of a century; this selection having been determined, as Professor Forbes informs us, by the fact of the previous ground having been already occupied in the Encyclopædia by the dissertations of Playfair and Sir J. Leslie. We think this is a matter to be regretted, for we cannot endorse the laudation which Professor Forbes somewhat ostentatiously bestows on his predecessors' productions. That of Sir John Leslie is often inaccurate, not seldom unjust, and, viewed by the light of modern science, altogether incomplete: and if the same objections cannot be urged against that of Playfair, still it is encumbered by masses of heavy technicalities which he has attempted to popularise, but has only succeeded in rendering tedious for the *savan* and mostly unintelligible to the general reader. We sincerely wish that the publishers had cancelled these ineffective essays and induced Professor Forbes to re-write the history of that most important epoch which includes Galileo, Kepler and Newton. The following is the programme which Professor Forbes has set out to be performed, so condensed and yet so lucid that we have not the heart to abridge it, long as it is for our space.

I have adopted the period from about the year 1775 to 1850 as the general limit of my review. We may imagine this period, of three quarters of a century

preceding the present time, to be divided into three lesser intervals of 25 years each, which have also some peculiar features of their own.

From 1775 to 1800, many branches of science still continued in the comparatively inert state which characterised a great part of the eighteenth century. There were, however, two or three notable exceptions. One was the continued successful solution of the outstanding difficulties of the theory of gravity applied to the moon and planets, a task in which the continental mathematicians had no rivals or even coadjutors on this side of the channel; another was the foundation of sidereal astronomy; and the last was the commencement of a system of chemical philosophy based on new and important experiments, and including the laws of heat in combination with matter, which at that period very naturally ranged themselves within the province of the chemist. I do not, of course, mean to affirm that other branches of science were not cultivated with success within the exact period of which we speak. Electricity, for instance, first statical, afterwards that of the pile, had a share in the discoveries and speculations of the time. But these were rather the extension of what had been previously thought of, or the first dawn of future important results, whose development fills a large space in the succeeding story.....

The first quarter of the present century attained a higher and more universal celebrity. Scarcely a branch of physical science but received important and even capital additions. Physical astronomy indeed no longer filled so large a space in the page of discovery, simply because the exhaustive labors of the geometers of the former period had brought it to a stage of perfection nearly co-ordinate with the means of observation, and because, by the publication of the *Mécanique Céleste*, Laplace had rendered available and precise the masses of scattered research accumulated by the labors of a century since the close of Newton's career of discovery. It was in some sense a new book of "Principia,"—not, indeed, the work of one, but of many; nor of a few years, but of two generations at least. Still there it was, a great monument of successful toil, which, like its prototype, was for many years to be studied, even by minds of the highest order, rather than to be enlarged.

But the other branches of natural philosophy were now to make a stride, such as perhaps no preceding time had witnessed. The science of optics was speedily expanded almost two-fold, both in its facts and in its doctrines. Galvanic electricity disclosed a series of phenomena not less brilliant and unexpected in themselves, than important from the new light thus thrown on the still dawning science of chemistry, and from the power of the tool which they placed in the hands of philosophers. Before the first quarter of the present century closed, the important and long-suspected connection between electricity and magnetism was revealed, and its immediate consequences had been traced out with almost unparalleled ingenuity and expedition. The basis of the science of radiant heat, slightly anticipated by the philosophers of the eighteenth and even the seventeenth centuries, was finally laid in a distinct form, assigning to the agent, *heat*, an independent position dissociated from grosser matter, such as *light* had long enjoyed Astronomy, though enriched on the very first night of the new century by the discovery of a small planet, the herald of so many more of the same class, made perhaps less signal progress; but chemistry, besides the aid it received from the invention of the pile, had a triumph peculiarly its own in the addition of the comprehensive doctrine of definite-proportions, destined to throw at some later time a

steady light on the vexed question of the constitution of matter. The great number of scientific names of the first order of merit concerned in these numerous discoveries marks the extraordinary fertility of the period.....

Of the twenty-five years just elapsed, it is not so easy to speak with precision. The voice of criticism may be fairly uttered with that reserve which every one must feel in speaking of his immediate contemporaries. Yet it may perhaps be stated without just cause either of offence or regret, that it has not on the whole been characterised by the full maturity of so many commanding minds. Of the great discoverers of the former period, several survived and continued their efficient labors during no small portion of the latter; and a few happily still remain to claim the respect and veneration of their disciples and successors. But the vast steps so recently made in optics, in electricity, in magnetism, in thermotics, and in chemical principles, tended of necessity to call forth such an amount of laborious detail in the defining and connecting of facts and laws, and the deduction of the theories started to explain them, as seemed to render fresh and striking originality somewhat hopeless, whilst they occasioned a vast amount of useful employment to minds of every order of talent. The undulatory theory of light, nobly blocked out by the massive labors of Young and Fresnel, has afforded still unexhausted material to the mathematician on the one hand, and to the experimentalist on the other; and ably have they fulfilled the double task, adding at the same time discoveries whose importance and difficulty would have made them still more prominent, had they not been the legitimate consequences of a still greater discovery already in our possession. Nearly the same might have been said for the sciences of electricity, electro-magnetism, and electro-chemistry, had not the comparative newness of the whole doctrine of these sciences, and the suddenness of their first rise, and, perhaps, still more, the appearance of a philosopher of the very highest merit, Mr. Faraday, who fortunately attached himself to this special department, made the last thirty years an almost unbroken period of discovery. Radiant heat, too, has been successfully advanced by labors comparable perhaps to those which marked its first rise as a science, and some other topics connected with heat have risen into great and practical consequence. Astronomy has been prosecuted with a systematic assiduity and success, especially at the British and Russian national observatories, which yields to that of no former period, whilst physical astronomy has been cultivated by methods of still improved analysis, and has achieved one triumph which France need not grudge to England, nor England to France,—so signal as to be placed by common consent in a position superior to any since the first publication of the theory of gravitation, more than a century and a half before. This was the prediction of the position in space of a planet whose existence was unknown except by the disturbance which it produced in the movements of another. Terrestrial magnetism has, for the first time, aspired to the rank of an exact science. In an illustrious philosopher of Germany, it has found its Kepler, and the combination of national efforts in collecting reliable data from the remotest corners of the globe is characteristic of the practical energy of the age. Pure chemistry has been cultivated with extraordinary assiduity; but though some general principles have emerged, none are comparable, from their importance, to the discovery of Dalton.....

It seems to me impossible to exclude from a review, however slight, of contemporary progress in the exact sciences, the advances which have accrued to them, both directly and, as it were, reflexively, by the astonishing progress of the me-

chanical arts. The causes, indeed, which called them forth are somewhat different from those which are active in more abstract, though scarcely more difficult studies. Increasing national wealth, numbers, and enterprise, are stimulants unlike the laurels, or even the golden medals of academies, and the quiet applause of a few studious men. But the result is not less real, and the advance of knowledge scarcely more indirect. The master-pieces of civil engineering,—the steam engine, the locomotive engine, and the tubular bridge,—are only experiments on the powers of nature on a gigantic scale, and are not to be compassed without inductive skill as remarkable and as truly philosophic as any effort which the man of science exerts, save only the origination of great theories, of which one or two in a hundred years may be considered a liberal allowance. Whilst then we claim for Watt a place amongst the eminent contributors to the progress of science in the eighteenth century, we must reserve a similar one for the Stephensons and Brunels of the present: and, whilst we are proud of the changes wrought by the increase of knowledge during the last twenty-five years on the face of society, we must recollect that these very changes, and the inventions which have occasioned them, have stamped perhaps the most characteristic feature—its intense practicalness—on the science itself of the same period.

It may be doubted whether the above does full justice to the period last mentioned, that in which we are now working. Judging by the history of the past, it is dangerous, perhaps presumptuous, to decide on the real value of labors which we view only in progress, or to estimate the magnitudes of intellectual characters when our very proximity to them confuses the judgment. The Principia was for years a sealed book to most of Newton's contemporaries, and few fellows of the Royal Society recognised in their unpretending secretary, Dr. Thomas Young, the man whom the lapse of a quarter of a century would proclaim the worthy inheritor of Newton's crown. So it may be, that we do not yet seize the full importance of such investigations as those of Oersted and Thomson; that we do not foresee the results to which such principles as Joule's Mechanical Equivalence of Heat may lead, or that we fail to observe the significance of those obscure utterances of Faraday in the midst of the brilliant discoveries for which we gladly applaud him. Still more do we think Professor Forbes has underrated our progress in pure mathematics—further on he writes: "No new calculus or great general method in analysis has resulted from these persevering labors, whether of British or foreign mathematicians, but an increased facility and power of applying the existing resources of mathematics to the solution of large classes of problems, previously intractable, or resolved only indirectly or by approximation."

Now we think that the method which is known by the imperfect title of the "separation of symbols," constitutes a really great and distinct step in analysis, not so much on account of what has been achieved by it directly, but in that it has led to a reconsideration of

the base on which our laws of symbolical reasoning are founded, and thence to a total reconstruction of the whole system of abstract analysis. Pushed in various directions, it has resulted in a new geometry, through the quaternions of Sir William Hamilton; in a new and effective method of solving differential equations, in the hands of Professor Boole; and, still more strangely, in an application of analysis, by the same gentleman, to the formal laws of thought; while several different systems, suited to attacking particular physical problems, have been proposed by various analysts. So many and varied are the ways in which this most fertile principle appears capable of development, that at present the difficulty seems to consist in discovering which will be best to choose. It is perhaps not too much to say, that here the differential calculus has at length generated a successor more powerful than itself, and which will ultimately absorb it. Nor should we forget our acknowledgments to the late Duncan Gregory, who was, if not precisely the inventor, certainly the first to perceive the importance of this method. We venture also to think that Professor Forbes has done scant justice to the progress of analytical geometry; the school, of which Plücker may be considered the founder, constitutes as great an advance upon the geometry of Descartes as his was upon that of the ancients.

That this epoch has not been distinguished "by the full maturity of so many commanding minds" is compensated, and partly accounted for, by the very large increase in the number of cultivators of science. Contrasted with that dreary period in British science which intervened between the death of Newton and the rise of that illustrious band of which Sir J. Herschel may be taken as the type,* the present day presents itself under a most hopeful aspect; where we can count one British name that emerges above the level for that period, we may count a dozen now, and if their elevation appear less, it may be because the level has risen. In great part this is due to the exertions of those illustrious men above spoken of, whose claim is not only to have done so much themselves, but to have produced a generation worthy to succeed them, and whose glories they justly share; partly also is it due to the improvement in our national seminaries, and the early introduction in them of scientific training, and also partly to the increased demand for scientific qualifications by the advance of engineering and the kindred arts; but we would fain believe that there is also a real improvement in the average mathematical faculty of the age, and that

* Herschel, Airy, Peacock, Whewell, Babbage, Lubbock.

the powers as well as the thoughts of men are "wid·ed with the process of the suns."

Although this dissertation is headed "A General View of Mathematical and Physical Science," into one important branch thereof, namely, the abstract part, or pure mathematics, Professor Forbes has declined to enter. He says—

The mechanical and experimental sciences alone constitute a body of knowledge so large that it is a responsibility sufficient for one person to attempt to grasp them all, and to set forth in order the steps of progress and improvement which have been so rapid and even so startling. Since some of these have scarcely as yet been historically digested, and the broad features of contemporary discovery have not been gradually separated by the judgment of an impartial posterity from those slighter though praiseworthy details, which lapse of time and advance of knowledge will throw into the shadows of distance,—this most laborious task falls principally upon the reviewer. The length and breadth of the subject of natural philosophy, and the cumbrous and scattered depositories of knowledge in which its records must be sought, combine to render not only the undertaking an arduous one, but the result of it a good deal more bulky than might be desired, or than was easily possible, in dealing with the glorious, but compact, history of Newton's age. It might be compared to the difference between writing a history of the Jews or Romans and that of the whole of modern Europe.

The mere magnitude of the undertaking, then, might well excuse me from entering upon the cognate, but exceedingly distinct, subjects of the logic of inductive discovery and the progress of the pure mathematics. But an equally sound reason might be found in my consciousness of inadequacy to undertake, whatever had been the dimensions of my work, a threefold scheme of such magnitude and difficulty. I do not think that any one person could be found to treat the whole as it ought to be treated, and I am certain that I am not that person.

Against such a plea, so urged, nothing can be said, yet it is impossible to help regretting that it should be so. It is true that analysis must always always be subordinate to philosophy, and its very nature is dictated by the requirements of its application to physics; true also that a physical problem has sometimes suggested the general method in analysis which includes its solution as a particular case, and the practical value of a process is proportional to the number and importance of the problems to which it applies; yet we should remember that every epoch of great physical discovery has been immediately preceded by some grand extension of analysis, and that philosophy has too often long lain helpless till the analyst furnished her with the means of moving. Without the algebra of Descartes and Newton's method of series, Newton's Mechanics would have been barren of consequences, and without the integral calculus modern science would be reduced to a skeleton. Just as the immense development of our engineering and commercial enterprise was due to the invention of the slide-rest and the improvements of machinery consequent on this; just

as every enlargement of the domain of experimental discovery may be traced to some refinement of instruments or modes of observing; so has the progress of physical science been related to that of analytical. At the present time the two appear to have, unhappily, somewhat parted company; analysis is going its own way without seeming to heed its companion, and philosophy is dragging heavily from the desertion: or, to quit metaphor, most of our sciences have now reached that point where the problems pressing for solution involve no doubt or difficulty as to the principles to be employed, but are irreducible simply from the enormous difficulty and complication of the analytical processes which at present are at our command. Whether the deadlock is to be got over by the laborious calculations of algorithms—such as tabulating the values of numerous definite integrals—or whether our known methods are to give rise to a new one, which shall at once include and supersede them—who can tell?

Apart from its rendering the history incomplete, Professor Forbes's determination is the more to be regretted from the biographical form which he has adopted, as an apparent injustice arises to individuals whose analytical labors (apart from merit on their own abstract ground) should claim, though indirectly, a share in the triumphs of science. The man who invents a theorem may be, even by its practical outcome, more praiseworthy than he who has made a successful experiment or even determined a natural law.

In filling in the outline which we have already quoted, Professor Forbes has had before him the "History of the Inductive Sciences," and the "Kosmos," works of which praise would be an impertinence; he has, however, wisely evaded coming into competition with these by the plan he has adopted of connecting the history of each science with the biographies of those who contributed to its rise and progress. Whatever is thus lost in the continuity of the history is atoned for by the human interest with which it becomes invested. Some one has remarked that the life of a man of science rarely presents any incidents of interest apart from his science; reciprocally, it is here shewn that the history of science can only be thoroughly understood by aid of the lives of those who have spent themselves in her service. In addition to the physical sciences, Professor Forbes has included the mechanical and kindred arts, and we cannot resist quoting the following eloquent passage, which justifies (if justification were necessary) his course:—

> My chief reason for including such subjects as the steam-engine, the strength of materials, and some great examples of construction, and the electric telegraph, is that these important practical improvements are both historically and logically interwoven with the progress of pure and abstract Physics. They have besides

impressed upon the character of scientific discoveries of the last hundred years a peculiar stamp which it would have been absurd to ignore while endeavoring, within a moderate compass, and in the plainest language, to convey a vivid though comprehensive sketch of the advancement of natural philosophy during this and the preceding, or, rather, two preceding generations.

It is not to be imagined that the difficulty of the problems which occupy the speculative philosopher, or the comprehensiveness of mind required for their solution, diminishes in any degree as we descend from the regions of pure science to the walks of every-day life—from the vast periods and majestic motions which astronomy enables us to explain and predict, to the common details of the work-shop and the railway. In fact, the former are to be regarded as the *simpler* investigations, whilst our terrestrial agents have their effects modified by the diversified states of aggregation and various mechanical properties of matter, and by the numerous modifications of force arising from heat, electricity, or magnetism, to which it may be exposed. We have as yet made an insignificant advance towards that completer system of natural philosophy of which Newton's will form but one section, in which all the properties of matter and their consequences shall be as well understood as the particular property of gravity is at present. Many of these are to be learned by daily observation of the effects which occur in the ordinary progress of civilisation amongst us. We are continually performing experiments on a great scale and on purely commercial principles, which no individual philosopher or merely scientific society could have ventured to attempt. And in the midst of these appeals to experience, unexpected results are frequently occurring which send us back once more to the study of first principles, which, indeed, while they confound the empiric, do but establish the reputation of the philosophic engineer, who seldom fails to turn them to good account, both in his theory and practice.

We have already expressed our opinion of the manner in which Professor Forbes has performed his task, and so much pleasure have we derived from this performance that we almost feel convicted of ingratitude when the suggestion rises, that our author, in his selection of names for biographical record, has not been quite free from a spice of nativism, or (shall we say?) of that local partiality from which the modern Athens is no more exempt than was the ancient. Certainly, we think the space devoted to one or two individuals might have been curtailed without injury to the work. This, however, is but a small matter, and does not affect its sterling value. To give any abstract or condensation of the subject does not seem feasible within our limits, and we prefer that our readers should take our word that this dissertation is alike essential to the historical student and to him who wishes to take in at one view the many featured image of modern science. If we were to single out particular portions for praise, we should select the biography of Laplace, the history of the discovery of Neptune, the wonderfully curious establishment of the undulatory theory of light by Young and Fresnel, and the glowing descriptions of the dis-

coveries of Davy and Faraday. Perhaps the least satisfactory portion is that on sidereal astronomy. The account of Sir W. Herschel's labors might have been elaborated with more detail, and now that the author of the "Plurality of Worlds" has rendered the "nebular hypothesis" orthodox, we may venture to say that a better account (barring Comte's mistake) than the one Professor Forbes refers to is to be found in that tabooed work, "The Vestiges." We see no reason why the remarkable experiments of Plateau should not have been mentioned in connection with it.

One of the not least advantages of Professor Forbes's arrangement is the interesting contrasts which the personal characters of these heroes—sometimes martyrs—of science present. Consider, for instance, Cavendish, "the descendant of one of England's noblest families, and the possessor of enormous wealth, yet neither of these powerful temptations could withdraw him even for an hour from the course of study which he had marked out, and which constituted for him at once labor and relaxation, the end of living, and almost life itself." He lived for four-score years almost isolated from human intercourse, showing an entire indifference to the ordinary passions and ambitions of mankind; indifferent even to scientific fame, and so strangely incommunicative as to leave much of the nature of his long studies only to discovered from his manuscript remains. Dr. George Wilson has described him, with characteristic eloquence, as a "wonderful piece of intellectual clock-work. As he lived by rule, so he died by it, predicting his death as if it had been the eclipse of some great luminary, . . . . and counting the very moment when the shadow of the unseen world should enshroud him in its darkness." Contrast with him Davy, the apothecary's apprentice of Penzance, rising in early manhood not only to be the acknowledged leader of chemical science, but also a star of fashion in aristocratic circles; gifted with an ardent and impulsive genius, which enabled him to take theories by storm, and with a fervor of imagination which threw round his great discoveries a poetic glow that dazzled the external world; disdaining to realise money from his inventions, many of which were singly worth a fortune, careless of health and life itself in untried experiments, and in all stages of his short but varied life "acquitting himself gracefully and well." Add to these Wollaston, whose discoveries in chemistry were of hardly less practical value than those of Davy, and who was moreover an original and successful observer in almost every department of philosophy; yet he was quite unknown to the world at large, and appreciated even by few of his contemporary brethren in science. We borrow the following graphic comparison from the dissertation:—

While Davy was delighting crowded audiences with his eloquence, his discoveries, and their wonderful results, Wollaston was pursuing his solitary experiments on a scale so small that scarcely three persons could witness them at once. While Davy was firing his potassium with ice, and making mimic volcanoes heave by the oxidation of his new metals, Wollaston was extracting, by minute analysis, from the refractory and unoxidable ores of platinum, substances previously undetected, which, neither by their quantity nor their characters, could ever interest any but a man of science. While Davy was charging his prodigious battery of 2500 pairs—the largest which has ever been constructed (a homage to his genius, provided by his numerous admirers)—Wollaston was proving, after his fashion, how similar effects could be produced by the very same agency on a small scale; and with no greater apparatus than a sheet of zinc, a few drops of acid, and an *old thimble*, he would gratify his friends by exhibiting the mimic glow of an almost microscopic wire of platinum.* Davy seemed born to believe, Wollaston to doubt. Davy was a poet; Wollaston a mathematician, or, at least, capable of becoming a great one. Davy announced his discoveries in fiery haste, and presented all their consequences and corollaries as a free gift to mankind; Wollaston (estimating more truly the rarity of the inventive faculty,) hoarded every observation, turned it over and over, polished it, rendered it exact beyond the reach of criticism, and then deliberately laid it before the world. He had the coldness and the accuracy of Cavendish, but he lacked the spur of his genius, and the wide grasp of his apprehension. Among other legitimate results of discovery, Wollaston was not unwilling to claim for his own the material benefits which such researches sometimes, though rarely, yield; whilst Davy, as we have seen, spurned every possible attribution of an interested motive. Davy never made a shilling in his life, save as an author or a lecturer, (except as paid assistant to Dr. Beddoes); Wollaston realised a fortune by his art of working platinum. Davy was admired by thousands at home and abroad; Wollaston was little known except to a small circle who could appreciate the resources of a mind rarely opened in confidence to any one, and of which the world was only partially informed. The composure of his death-scene rivalled that of Black and Cavendish. His disorder was one of the brain. When he had lost the power of speech, his attendants remarked aloud that he appeared unconscious. Making a sign for a pencil and paper, he wrote down a column of figures, added them up correctly, and expired.

A still different type is presented by Dalton; born in humble circumstances, a consistent Quaker through life, scantily educated, and laboring under disadvantages of person and manner: he maintained himself in a grade barely above poverty by private teaching, and without friendly encouragement, with deficient means, and apparatus rudely constructed by his own hands, we find him making discoveries by which the world now ranks him as the very first in the annals of Chemistry, yet which were at the time but coldly acknowledged; nor was it till towards the close of a long life that scientific honors were

* So wonderful was his skill in dealing with the minutest quantity of a substance, that it used to be said—give him a scrap of mineral only visible in the microscope, and he will tell you not only what it is, and where it came from, but also the name of the person who quarried it!

awarded to him, and the burden of his daily labor for a livelihood lightened by a small pension from Government. We might go on quoting instance after instance to show how the divine gift of Philosophy is indifferently contained in vessels of every mould and substance, but shall only give one more—the last and perhaps the greatest (one only excepted) the world has yet received—Thomas Young. Like Dalton, born a Quaker, but, unlike him, in easy circumstances and soon throwing off the technical characteristics of his sect: self-educated, he became in early life "an accurate classical scholar; perfectly familiar with the principal European languages; well acquainted with mathematics, and with almost every department of natural philosophy and natural history; profoundly versed in medical and anatomical knowledge, and in possession of more than ordinary personal and ornamental accomplishments."* It is only within the last few years (though Young died in 1829) that the value of his extensive labors has been fully appreciated; to enter into them would require a separate article; we can only endorse Professor Forbes's belief that "since Newton (*or before him*) Thomas Young stands unrivalled in the annals of British (*or any other*) Science."

It is interesting to notice the very different tracks along which the course of discovery has moved. Sometimes, though not often, the exact Baconian method has been followed, a method which it has long been the fashion to applaud as the only one, but which Bacon's latest editor justly characterises as more adapted to the exclusion of error than the detection of truth; more frequently, an idea, instinctively seized upon, has been worked out to its full establishment as a natural law; sometimes, a single fortunate experiment has given rise to a whole series of discoveries; while in other cases, some simple law has long been hidden, though involved in numerous experiments, from the eyes of observers, and has only been dragged to light by one coming after them, reaping the fruit which they had sown. It is not uncommon to hear of the large share which accident, so called, has had in the progress of scientific discovery, but an attentive consideration of this progress dispels such a notion. Accidents, it is true, do happen, and are happening every moment: it is only when one happens at the right time and place that results ensue: the seeds of science lie scattered everywhere; where the soil and circumstances are suited to them, they grow. As the German proverb says—"The world is the same to all, but each eye sees only what it brings with it the power of seeing." We cannot resist quoting Professor Forbes's account (as a model of research) of the invention of the Davy Lamp, often told before but never so well.

* Peacock—Life of Young.

The lamentable loss of life occurring in coal mines from explosions of fire-damp or inflammable air disengaged from the workings, had for many years attracted the attention and sympathy of the public, and had likewise been carefully considered by scientific men. The explosive gas was known to be the light carburetted hydrogen. Two plans alone seemed to present themselves for diminishing the danger:—the one, to remove, or chemically to decompose the fire-damp altogether; the other, to provide a miners' lamp which, by its construction, should be incapable of causing explosion. The former of these modes of protection it was soon seen, could only be palliative; the only efficient form which it took was that of a more effectual ventilation; but the terrific rapidity with which a mine may be suddenly invaded by fire-damp, from channels opened by a single blow of the pickaxe, must prevent it from ever acting as a *cure*. The latter plan had as yet yielded nothing more effectual than the *steel mill* long used by miners, which produced an uncertain and intermitting light, by the rotation of a steel wheel against a flint, the scintillations of which were incapable of inflaming the fire-damp. The insufficiency of the light prevented it from being used, except in circumstances of known danger. The celebrated Baron Humboldt, Dr. Clanny, and several others had invented safety lamps on different principles, but they were all clumsy and more or less ineffectual.

At last, in the summer of 1815, the Rev. Dr. Gray, (afterwards Bishop of Bristol,) then Chairman of a committee appointed by a benevolent association at Bishop Wearmouth for the prevention of colliery accidents, applied to Davy, who was then on a sporting tour in Scotland, requesting his advice and assistance. Sir Humphry answered the call with promptitude. On his southward journey, in the latter part of August, he visited the collieries, ascertained the circumstances of the danger which he had to meet, and was provided by Mr. Buddle with specimens of the inflammable air for examination. Within a fortnight after his return to London, he had ascertained new and important qualities of the substance, and had already four schemes on hand for the prevention of accident. Before the end of October, he had arrived at the following principles of operation in connection with a safety-lamp:—"First. A certain mixture of azote and carbonic acid prevents the explosion of the fire-damp, and this mixture is necessarily formed in the safe-lantern. Secondly. The fire-damp will not explode in tubes or feeders of a certain small diameter. The ingress to, and egress of air from any lantern," he adds, "is through such tubes or feeders; and, therefore, when an explosion is artificially made in the safe-lantern it does not communicate to the external air." The effect of narrow tubes in intercepting the passage of flame is due to the cooling effect of their metallic sides upon the combustible gases of which flame is composed;* and one of his first and most important observations was the fortunate peculiarity that fire-damp, even when mixed with the amount of air most favorable to combustion (1 part of gas to 7 or 8 of air), requires an unusually high temperature to induce combination. Olefiant gas, carbonic oxide, and sulphuretted hydrogen are all inflamed by iron at a red heat, or ignited charcoal, but carburetted hydrogen does not take fire under a perfect white heat. The earliest safety-lamp consisted of a lantern with horn or glass sides, in which a current of air to supply the flame was admitted below by numerous tubes of small diameter

* This prime fact Davy had obtained from a committee of the R. S. which had been appointed to examine the possibility of gas-explosions being caused by the flame running back through the piping into the gasometer.

or by narrow interstices between concentric tubes of some length; or finally, by rows of parallel partitions of metal, forming rectangular canals extremely narrow in proportion to their length. A similar system of escape apertures was applied at the top of the lantern.

With characteristic ingenuity, Davy did not stop here. He continued to reduce at once the apertures and length of his metallic guards, until it occurred to him, that *wire gauze* might, with equal effect, and far more convenience, act upon the temperature of flame, so as to reduce it below the point of ignition, and thus effectually stop its communication. The experiment was successful, and by the 9th November, 1815, or within about ten weeks after his first experiments, an account of the safety lamp defended by wire gauze was presented to the Royal Society. About two months later he produced a lamp entirely enveloped in metallic tissue.

There are none of Davy's researches which will stand a closer scrutiny than those which terminated thus successfully. No fortuitous observation led him to conceive a happy idea and to apply it to practice. A great boon to humanity and the arts was required at his hands; and, without a moment's delay, he proceeded to seek for it under the guidance of a strictly experimental and inductive philosophy. Without, perhaps, a single false turn, and scarcely a superfluous experiment, he proceeded straight to his goal, guided by the promptings of a happy genius, aided by no common industry. The chemical, the mechanical, and the purely physical parts of the problem were all in turn dealt with, and with equal sagacity. It may be safely affirmed that he who was destitute of any one of these qualifications, must have failed in attaining the object so ardently desired, unless by the aid of some rare good fortune.

In comparing the biographies of foreign celebrities with those of British origin, we cannot help being struck with a difference that manifests itself in the treatment they receive from their respective countries. Abroad, we find that the successful cultivators of science are raised to places of dignity and trust in the State, adorned with distinctions of crosses and ribands, and liberally provided for, when necessary, by honorable pensions; not a few of them accomodated with titles of nobility in acknowledgment of their services. At home, on the contrary, with the exception of a few knighthoods (rather indiscriminately conferred), and now and then a solitary baronetcy, or perhaps a small pension grudgingly bestowed, we find no official recognition of the status of a man of science. This has sometimes, by foreigners, been made the ground of illiberal comparison, yet surely without due consideration. The indiscriminate bestowal of such honors as are extended to men of science in England, sufficiently proves how incapable are the political advisers of the Crown to form a court of honor for her intellectual peerage. A Royal Society presidency, or a Wollaston medal, constitute far fitter honors for a Newton or a Lyell than the legislative honors and functions which supply the highest reward for the successful soldier or lawyer; while the loss is that of the

exclusive order of hereditary legislators and not of the men of science. The order of England's peerage would certainly have sustained no degradation, had it been able to reckon among its noble descents, those who counted kin with the Lincolnshire farmer's boy, or with the son of the German drummer who added so largely to the domain of knowledge by his brilliant genius and varied talents; but it may be doubted if either Newton or the Herschels would have been the gainers by their transference from the ranks of England's untitled nobles, to those of her hereditary peerage. Foreign sneerers and domestic grumblers may consider these things and learn wisdom, or, at the least, gather the comforting conviction, that if British science has gone on so well and long without the bedizenment of aristocratic trappings, these latter may not be essential to her still further progress. We earnestly hope that Professor Forbes may live to record, for the next quarter-century, even greater achievements than those which he has here so admirably set forth.

J. B. C.

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## SCIENTIFIC AND LITERARY NOTES.

### PHYSIOLOGY AND NATURAL HISTORY.

#### ABNORMAL INDIAN CORN.

Dr. H. Boys, of Barrie, in a letter to Professor Croft, of date 29th July, thus writes: "In the last number of the Canadian Journal, at p. 309, Professor Wilson is stated to have read before the Institute some remarks on a specimen of Indian corn, having male and female flowers developed on the same stalk. In reference to this I send you a rough sketch I made some years back of a similar anomaly, which fell under my own observation. You will perceive this case offered more deviations from nature than are mentioned in the Journal as being noted by Professor Wilson. I consider the subject one involving points of the greatest interest to animal and vegetable physiologists. In thus noting the deviations occurring in the simple structure of vegetables, an opportunity may be afforded of investigating such phenomena, with a fair chance of leading to important results. I hope the subject will not be allowed to drop. All I can promise to do is to look out for fresh instances, and should I be so fortunate as to observe such this season, I shall endeavour to make more careful drawings and more minute and accurate remarks, and shall send you the result."

In the sketch which accompanies the letter of Dr. Boys, the branched spike of male florets is seen with a considerable group of the female introduced among

them, and in this group still further anomalies are noticeable. While the greater number of the florets are females, some of them are hermaphrodite, and others in the same flower have a male and female floret, each with its distinct calyx within the same glumes. The ovum is therefore, in this plant, exhibited in every form of development, and its sex is so capriciously distributed as to favor the idea of some phytologists that the sex is not determined at the origin of the ovum, but by subsequent casual circumstances.

COLEOPTERA.

In the last number of the Proceedings of the Academy of Natural Sciences, of Philadelphia, Dr. Leconte has added to his invaluable series of monographs of North American Coleoptera one on the Pselaphidæ. The paper contains an enumeration of the species and descriptions of those which are new. Of Dyschirius, twenty-eight; Acephorus, one; Ardistomis, four; Aspidoglossa, one; Clivina, twenty-seven; Schizogenius, six.

NEUROPTERA.

Uhler has described seven new species of Libellula, inhabiting the United States.

MOLLUSCA.

Lea describes a number of new species of Naiades, principally Uniones, from Alabama, North Carolina, and other parts of the States. Under the rather curious heading of "Gnotic Species," he describes the following:

*Unio Canadicnsis.* Testâ lævi, triangulari, subcompressa inæquilaterali, posticè obtusè angulatâ, valvulis subcrassis, anticè crassioribus; natibus subprominentibus; epiderme luteâ, postice radiatâ; dentibus cardinalibus parvis, erectis crenulatisque; lateralibus longis, curvis lamellatisque; margaritâ albâ et iridiscente. *Hab.* St. Lawrence River, near Montreal.

THE CANADIAN HUMMING BIRD.

During the present summer we were visited by Mr. John Gould, the distinguished Naturalist, whose chief object in his tour through Canada was for the purpose of studying the habits and manners of the species of *Trochilus* frequenting this portion of the North American Continent. Shortly after his return to England, at a meeting of the London Zoological Society, Mr. Gould detailed some of the results of his observations. He arrived in Canada just before the period of the migration of these beautiful little birds from Mexico to the north, and had ample opportunities for observing them in a state of nature. Their actions he described as very peculiar and quite different from those of all other birds; the flight is performed by a motion of the wings so rapid as to be almost imperceptible; indeed, the muscular power of this little creature appears to be very great in every respect, as independently of its rapid and sustained flight, it grasps the small twigs, flowers, &c., upon which it alights with the utmost tenacity. It appears to be most active in the morning and evening, and to pass the middle of the day in a state of sleepy torpor. Occasionally it occurs in such numbers that fifty or sixty may be seen in a single tree. When captured it so speedily becomes tame that it will feed from the hand or mouth within half an hour. Mr. Gould having been successful in keeping one alive in a gauze bag attached to his breast button for three days, during which it readily fed from a small bottle filled with a syrup of brown sugar and water, he determined to make an attempt to bring some

living examples to England, in which he succeeded; but unfortunately they did not long survive their arrival; had they lived, it was his intention to have sent them to the Zoological Society's gardens, where they would doubtless have been objects of great attraction.

Mr. Gould exhibited a highly interesting species of *Ceriornis*, which he had found in the collection of Dr. Cabot, of Boston, who, with great liberality, permitted him to take it to England for the purpose of comparison and description. For this new bird, forming the fourth species of the genus, Mr. Gould proposes the name of *Ceriornis Caboti*.

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## CANADIAN INSTITUTE.

FIFTEENTH ORDINARY MEETING.—*4th April*, 1857.

Professor E. J. CHAPMAN, Vice-President, in the Chair.

*The following Gentlemen were elected Members:*

WILLIAM ANDERSON, Esq., Toronto.
W. H. BOULTON, Esq., Toronto.

*The following Reports of Committees were then read:*

1. The BARON DE ROTTENBURG submitted to the meeting, the Report of the Committee on Mr. Ketchum's offer of two acres of land on Yonge Street, for an Astronomical Observatory, recommending the acceptance of the gift, and an application to the Government for aid to accomplish the object in view.

On motion of Professor Croft, seconded by J. G. Hodgins, Esq., the Report was approved of, and it was resolved, that Mr. Ketchum's offer be accepted, and that a copy of the report be transmitted to him, with a special vote of thanks of the Institute for his generous donation.

2. Professor WILSON submitted to the meeting, the Report of the Building Committee, detailing the steps which have been taken by the Committee towards the erection of the proposed new building for the Institute, on the site presented by G. W. Allan, Esq., for that purpose, on Pembroke Street.

On motion of A. H. Armour, Esq., seconded by Dr. George Beattie:
It was resolved, that the Report be adopted.

*The following papers were then read:*

1. By the BARON DE ROTTENBURG:

"On the Planetary appearance of stars of the 1st and 2nd magnitudes, on the night of the 12th March, and the occultation of Spica Virginis by the moon, on the morning of the 13th March, 1857."

2. By Professor CHAPMAN:

A communication from Dr. G. D. Gibb, of London, England: "On calcareous concretions from Buckinghamshire, England, which have excited considerable attention recently, from certain examples figured and described in the *Illustrated London News*, as vegetable fossils."

Professor Chapman exhibited, and commented on a collection of these English concretionary bodies, presented to the Institute, through Dr. Gibb, by Mr. Stowe of Buckingham: and also exhibited and presented to the Institute, specimens of some peculiar silicious concretions,—hitherto, he believed unnoticed,—from the Black River Limestone, of the Lake of St. John, near the Indian village of Rama, lying to the north-east of Lake Simcoe, Canada West.

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SIXTEENTH ORDINARY MEETING,—18*th April*, 1857.

Col. BARON DE ROTTENBURG, Vice-Presid , in the Chair.

*The following Donations for the Library were announced, and the thanks of the Institute voted to the Donors:*

1. From the Geological Society of Dublin:
"Vols. 1, (wanting part 1,) 2, 3, 4, 5, 6, and part 1 of vol 7, of the Journal of the Geological Society of Dublin."

2. From the Author:
"Observations on the construction of an Hospital for the Insane. (Pamphlet.) By B. R. MORRIS, B.A., M.D.,:
"Theory as to the cause of Insanity, (Pamphlet.) By B. R. Morris, B.A., M.D.'

*The following Gentlemen were elected Members:*

OLIVER WELLS, Esq., Crown Land Department, Three Rivers, C. E.

CHARLES B. CHALMERS, Esq., F.R.A.S., Barrie, C.W.

*The following papers were then read:*

1. By Prof. CHERRIMAN, M.A., :
"On Vision."

2. By J. HIRCHFELDER, Esq.,:
"Observations on bedding out plants."

3. By Professor CHAPMAN:
"On the occurrence of the Genus Cryptoceras in Silurian Rocks."

This being the last meeting of the Session, T. W. Birchall, Esq, and Samuel Spreull, Esq., were appointed Auditors, in accordance with the laws. The Chairman, after congratulating the members on the prosperous state of the Institute, and the valuable communications from time to time submitted to the meetings, by which their attraction have been maintained with undiminished interest, invited the attention of the members to such subjects of scientific value as might come under their notice during the summer recess, with a view to communications to be brought under the notice of the Institute, either through the medium of the Journal, or at the meetings of next session, and adjourned the meeting till November.

# MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—JUNE, 1857.

*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 | 10PM | ME'N | Mean Temp. +or— of the Average | 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. | Resultant Direction. | Velocity of Wind. 6 A.M | 2 P.M | 10PM | Resul't. | ME'N | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 29.259 | 29.241 | 29.216 | 29.2373 | 52.7 | 63.5 | 56.1 | 57.62 | + 0.67 | .368 | .448 | .361 | .391 | .94 | .79 | .81 | 84 | Calm. | S E b S | Calm. | S 19 W | 0.0 | 9.6 | 0.0 | 2.73 | 3.62 | 0.010 | ... |
| 2 | .222 | .234 | .300 | .2582 | 54.1 | 56.6 | 47.6 | 52.82 | — 4.43 | .304 | .278 | .254 | .284 | .74 | .62 | .77 | .72 | W b S | W b S | Calm. | S 65 W | 12.0 | 14.5 | 0.0 | 6.96 | 7.44 | 0.025 | ... |
| 3 | .235 | .269 | .340 | .2923 | 49.8 | 62.5 | 48.9 | 53.02 | — 4.53 | .309 | .337 | .315 | .319 | .88 | .61 | .92 | .81 | N W b N | S b W | S W | S 88 W | 0.2 | 8.0 | 7.4 | 5.30 | 7.21 | 0.440 | ... |
| 4 | .487 | .539 | .593 | .5457 | 46.2 | 53.0 | 47.2 | 49.10 | — 8.75 | .240 | .222 | .191 | .220 | .79 | .56 | .59 | .64 | W b N | S S W | N b W | N 75 W | 10.8 | 9.8 | 9.0 | 5.46 | 7.85 | ... | ... |
| 5 | .603 | .588 | .555 | .5868 | 40.9 | 52.8 | 48.4 | 48.35 | — 9.80 | .196 | .262 | .172 | .215 | .77 | .67 | .51 | .64 | W N W | N W b W | S W b W | N 77 W | 5.0 | 16.0 | 2.2 | 6.52 | 7.66 | 0 016 | ... |
| 6 | .519 | .425 | .296 | .4028 | 44 7 | 64.6 | 53.2 | 55.03 | — 3.42 | .219 | .200 | .301 | .260 | .75 | .33 | .76 | .63 | W | W b S | S W | S 71 W | 4.5 | 17.2 | 1.6 | 7.29 | 8.07 | 0.080 | ... |
| 7 | .223 | .294 | — | — | 49.2 | 60.1 | — | — | — | .321 | .383 | — | — | .93 | .75 | — | — | E b S | S E b E | N E b N | N 77 E | 1.5 | 10.6 | 5.0 | 5.39 | 6.08 | Inap | ... |
| 8 | .417 | .434 | .406 | .4188 | 54.5 | 54.5 | 58.1 | 55.38 | — 3.68 | .298 | .378 | .442 | .380 | .72 | .90 | .93 | .88 | N E b E | E N E | E N E | N 68 E | 11.6 | 12.8 | 8.8 | 10.40 | 10.46 | 0.350 | ... |
| 9 | .475 | .536 | .573 | .5280 | 53.0 | 57.7 | 55.9 | 55.08 | — 4.40 | .384 | .409 | .403 | .397 | .97 | .88 | .92 | .93 | E N E | E b S | S W | S 79 E | 6.4 | 6.6 | 0.4 | 2.36 | 3.45 | 0.035 | ... |
| 10 | .556 | .425 | .279 | .4092 | 56.6 | 67.1 | 57.1 | 60.48 | + 0.70 | .430 | .492 | .411 | .449 | .96 | .76 | .90 | .87 | S W b S | S | E N E | N 80 E | 1 0 | 5.4 | 8.2 | 2.96 | 6.61 | ... | ... |
| 11 | 037 | 28.974 | .088 | .0220 | 58.8 | 57.5 | 55.0 | 57.32 | — 2.67 | .468 | .379 | .286 | .363 | .96 | .82 | .68 | .78 | N N E | N W | W N W | N 48 W | 9.8 | 21.4 | 11.5 | 13.18 | 15.41 | 0.605 | ... |
| 12 | .176 | 29.052 | .191 | .1455 | 50.9 | 65.7 | 52.7 | 57.08 | — 3.18 | .243 | .445 | .357 | .365 | .66 | .72 | .91 | .79 | W b N | S S W | S W b S | S 39 W | 11.2 | 17.0 | 1.8 | 5.46 | 6.52 | 0.220 | ... |
| 13 | .233 | .257 | .448 | .3303 | 57.4 | 70.2 | 56.0 | 60.97 | + 0.38 | .387 | .320 | .264 | .332 | .81 | .44 | .60 | .65 | Calm. | W | N W | N 78 W | 0.0 | 19.0 | 8.6 | 9.17 | 10.87 | Inap | ... |
| 14 | .591 | .643 | — | — | 49.8 | 62.4 | — | — | — | .248 | .345 | — | — | .71 | .63 | — | — | W b N | S b E | N b W | S 85 W | 4.4 | 6.2 | 5.5 | 2.14 | 6.23 | ... | ... |
| 15 | .695 | .683 | .620 | .6547 | 51.8 | 55.7 | 51.6 | 54.45 | — 6.68 | .273 | .287 | .275 | .288 | .72 | .66 | .74 | .69 | N b W | N E b E | E b N | N 70 E | 3 8 | 9.2 | 7.6 | 8.34 | 8.54 | 0.030 | ... |
| 16 | .512 | .524 | .399 | .4717 | 53.7 | 54.5 | 51.2 | 52.67 | — 8.68 | .387 | .289 | .326 | .322 | .96 | .69 | .88 | .83 | E b N | E b N | E b N | N 75 E | 17.2 | 14.7 | 19.0 | 17.21 | 17.22 | 0.195 | ... |
| 17 | .355 | .400 | .438 | .3953 | 49.6 | 62.8 | 52.7 | 54.85 | — 6.80 | .325 | .459 | .368 | .383 | .93 | .83 | .91 | .90 | E b N | N E | E | N 75 E | 12.2 | 3.4 | 9.5 | 7.77 | 8.00 | 0.005 | ... |
| 18 | .398 | .305 | .318 | .3390 | 54.1 | 59.7 | 53.0 | 55.03 | — 6.92 | .392 | .438 | .364 | .388 | .96 | .87 | .93 | .91 | E b N | E N E | S S W | S 66 E | 10.0 | 8.0 | 5.8 | 3 61 | 6.24 | 0.085 | ... |
| 19 | .323 | .302 | .382 | .3392 | 54 7 | 60.7 | 51.9 | 55.83 | — 6.30 | .359 | .384 | .339 | .353 | .86 | .75 | .89 | .81 | S b E | S | S W b S | S S W | 10.0 | 17.0 | 8.0 | 10.00 | 10.18 | ... | ... |
| 20 | .415 | .353 | .418 | .3962 | 53.2 | 54.8 | 52.7 | 53.58 | — 8.87 | .342 | .396 | .373 | .362 | .86 | .94 | .96 | .90 | S S W | E | E b N | S 89 E | 1.3 | 5.0 | 0.5 | 3.60 | 4.63 | 0.880 | ... |
| 21 | .475 | .498 | — | — | 52.7 | 59.7 | — | — | — | .338 | .438 | — | — | .87 | .87 | — | — | E b N | S b E | E S E | S 22 E | 0.4 | 4.2 | 4.2 | 1.10 | 4.50 | 0 145 | ... |
| 22 | 384 | .363 | .476 | .4107 | 54.8 | 58.8 | 53.4 | 55.25 | — 7.70 | .354 | .380 | .380 | .372 | .84 | .78 | .95 | .87 | N b W | N N W | N W | N 34 W | 11.5 | 14.8 | 16.7 | 13.70 | 14.52 | 0 395 | ... |
| 23 | .584 | .602 | .661 | .6167 | 51.4 | 65.1 | 53.0 | 56.83 | — 6.32 | .296 | .327 | .326 | .316 | .80 | .54 | .83 | .71 | W N W | N W | S W b W | N 62 W | 8.0 | 10.4 | 1.2 | 5.67 | 6.75 | ... | ... |
| 24 | .695 | .653 | .653 | .6610 | 47.6 | 63.9 | 61.0 | 58.98 | — 4.37 | .284 | .406 | .288 | .338 | .88 | .70 | .55 | .69 | S W b W | S W b S | N N W | S 75 W | 1.4 | 7.6 | 6.0 | 2.52 | 4.50 | ... | ... |
| 25 | .693 | .622 | .598 | .6375 | 53.7 | 72.2 | 66.2 | 64.32 | + 0.77 | .337 | .449 | .376 | .395 | .83 | .58 | .60 | .68 | W N W | S W b S | N W b N | S 69 W | 2.4 | 10.2 | 7 0 | 3.04 | 5.16 | ... | ... |
| 26 | .648 | .638 | .601 | .6320 | 65.0 | 71.8 | 65.0 | 68.42 | + 4.53 | .364 | .370 | .421 | .422 | .61 | .49 | .71 | .63 | N W b N | E b S | S b W | S 20 W | 0.5 | 1.2 | 1 3 | 1.00 | 2.95 | 0.105 | ... |
| 27 | .647 | .593 | .565 | .5953 | 62.4 | 73.1 | 63.7 | 66.47 | + 2.40 | .485 | .537 | .445 | .501 | .88 | .68 | .78 | .80 | N W b W | E b S | N b E | N 72 E | 3 2 | 6.8 | 6.0 | 1.92 | 3.58 | ... | ... |
| 28 | .544 | .476 | — | — | 62.1 | 73.6 | — | — | — | .467 | .581 | — | — | .86 | .73 | — | — | Calm. | E b S | W S W | N 67 E | 0.0 | 6.4 | 1.5 | 2.47 | 44 | 0.265 | ... |
| 29 | .405 | .397 | .386 | .3945 | 64.6 | 68.6 | 61 7 | 64.52 | + 0.07 | .559 | .523 | .345 | .457 | .95 | .77 | .63 | .77 | N | N | N W | N 36 W | 7.0 | 13.0 | 9.5 | 10.45 | 10 86 | 1.070 | ... |
| 30 | .368 | .397 | .378 | .3807 | 55.2 | 60.8 | 52.5 | 56.43 | — 8.15 | .271 | .308 | .332 | .307 | .63 | .59 | .86 | .69 | W N W | W b S | S W b W | S 82 W | 17.5 | 16.0 | 0.8 | 8.12 | 9.60 | ... | ... |
| M | 29.4362 | 29.4156 | 29.4302 | 29.4267 | 53.52 | 61.85 | 54.84 | 56.92 | — 4.11 | .341 | .374 | .335 | .353 | .83 | .69 | .79 | .77 | ..... | ..... | ..... | ..... | 6.26 | 10.93 | 5.84 | ..... | 7.60 | 5.960 | ... |

Highest Barometer . . . . . 29.707 at 8 a.m. on 25th } Monthly range=
Lowest Barometer . . . . . 28 ·52 at 8 a.m. on 11th } 0.755 inches.

Self-registering Ther.
Maximum temperature . . . . 76·0 on p. m. of 28th } Monthly range=
Minimum temperature . . . . 35·0 on a.m. of 5th } 41°0
Mean maximum temperature . . 65°48 } Mean daily range = 16°49
Mean minimum temperature . . 48°99 }
Greatest daily range . . . . . 24°4 from a. m. to p. m. of 6th.
Least daily range . . . . . 7.6 from p. m. of 16th to a. m. of 17th.

Warmest day . . 26th ... Mean Temperature . . . 68°42 } Difference=20°07.
Coldest day . . . 5th ... Mean Temperature . . . 48.35 }

Maximum. { Solar . . . . . 93°5 on p. m. of 28th } Monthly range=
Radiation. { Terrestrial . . . . . 26.0 on a. m. of 5th } 67°5

Aurora observed on 1 night, viz.: 11th at 9 p.m, (faint); possible to see Aurora on 14 nights; impossible to see Aurora on 16 nights.

Raining on 21 days; depth, 5.060 inches; duration of fall, 66.0 hours.

Mean of cloudiness=0.69; most cloudy hour observed, 8 a. m., mean=0.83: least cloudy hour observed, 10 p. m.; mean=0.55.

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

| North. | South. | East. | West. |
|---|---|---|---|
| 1743.47 | 1193.80 | 1669.75 | 2293.65 |

Resultant direction of the wind, N 49° W; Resultant Velocity, 1.15 miles per hour.

Mean velocity of the wind 7.60 miles per hour.
Maximum velocity . . . 28.6 miles per hour, from noon to 1 p.m. of 11th.

Most windy day . . . . . 16th—Mean velocity, 17.22 miles per hour.
Least windy day . . . . . 26th—Mean velocity, 2.95 do

Most windy hour 1 to 2 p.m.—Mean velocity, 11.26 do } Difference
Least windy hour 2 to 3 a. m.—Mean velocity, 5.38 do } 5.88 miles.

3rd—Very perfect rainbow at 7 p.m.
5th—Slight hoar frost at 5.30 a. m.
15th—Particles of snow stated to have fallen at 1 p. m., in King Street.
18th—Very dense fog during most of the day.
22nd—Large and very perfect rainbow at 8 p. m.; prismatic colours well defined.
24th—Large and perfect solar halo at 5.30 a. m. Wild pigeons numerous.
25th—Fire-flies first noticed, at 9 p. m., in the ravine near the Observatory.
27th—A considerable quantity of Pollen fell with the rain which occurred at 5.50 a.m.

Temperature—This was the coldest June, and shews also the lowest maximum temperature since 1842.

Rain—The number of rainy days exceeded that of any previous June, and the depth of rain, 1.897 inches above the average, is the greatest recorded for June since 1842.

Wind—The mean velocity of the wind was greater than any before recorded for the month of June.

The resultant direction and velocity of the wind for the month from 1848 to 1857 were N 87° W 0.51 miles per hour.

COMPARATIVE TABLE FOR JUNE.

| YEAR. | TEMPERATURE. Mean. | Difference from Average. | Maximum observed. | Minimum observed. | Range. | RAIN. No. of days. | Inches. | SNOW. No. of days. | Inches. | WIND. Resultant Direction. | Resultant Velocity. | Mean Velocity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | | | | | | | |
| 1840 | 59.8 | — 1.4 | 78.5 | 37.1 | 41.4 | 11 | 4.860 | ... | ... | — | — | — |
| 1841 | 65.6 | + 4.4 | 92.8 | 45.7 | 47.1 | 9 | 1.560 | ... | ... | — | — | 0.36 lbs |
| 1842 | 55.6 | — 5.6 | 73.9 | 28.0 | 45.9 | 15 | 5.735 | ... | ... | — | — | 0.71 " |
| 1843 | 58.4 | — 2.8 | 81.3 | 28.5 | 52.8 | 12 | 4.595 | ... | ... | — | — | 0.27 " |
| 1844 | 59.9 | — 1.3 | 82 8 | 33.1 | 49.7 | 9 | 3.535 | ... | ... | — | — | 0.19 " |
| 1845 | 61.0 | — 0.2 | 83.6 | 40.9 | 42.7 | 11 | 3.715 | ... | ... | — | — | 0.27 " |
| 1846 | 63.3 | + 2 1 | 83.3 | 41.5 | 41.8 | 10 | 1.920 | ... | ... | — | — | 0.32 " |
| 1847 | 58.4 | — 2.8 | 78.3 | 36.7 | 41.6 | 14 | 2.625 | ... | ... | — | — | 0.30 " |
| 1848 | 62.9 | + 1.7 | 92.5 | 38.3 | 54.2 | 8 | 1.810 | ... | ... | N 61 W | 1.90 | 4.51 mls |
| 1849 | 63.2 | + 2.0 | 84.9 | 45.2 | 39.7 | 7 | 2.020 | ... | ... | S 71 E | 0.49 | 3.32 " |
| 1850 | 64.3 | + 3.1 | 83.2 | 49.0 | 34.2 | 10 | 3.315 | ... | ... | S 60 W | 0.38 | 4.54 " |
| 1851 | 59.2 | — 2.0 | 79.2 | 41.2 | 38.0 | 11 | 2.695 | ... | ... | S 2 W | 1.26 | 4.42 " |
| 1852 | 60.8 | — 0.4 | 86.1 | 43.6 | 42.5 | 10 | 3.160 | ... | ... | S 76 W | 1.49 | 4.69 " |
| 1853 | 65.5 | + 4.3 | 86.3 | 43.3 | 43 0 | 9 | 1.550 | ... | ... | N 14 W | 0.27 | 3.67 " |
| 1854 | 64.1 | + 2.9 | 88.7 | 47.4 | 41.3 | 9 | 1.460 | ... | ... | N 21 E | 0.86 | 4.12 " |
| 1855 | 59.9 | — 1.3 | 90.7 | 40.6 | 50.1 | 17 | 4.070 | ... | ... | N 69 W | 1.33 | 5.70 " |
| 1856 | 62.1 | + 0 9 | 82.6 | 48.3 | 34.3 | 13 | 3.200 | ... | ... | S 21 W | 0.90 | 5.39 " |
| 1857 | 59.9 | — 4.3 | 75.1 | 40.9 | 34.2 | 21 | 5.060 | ... | ... | N 49 W | 1.15 | 7.60 " |
| Mean | 61.16 | ... | 83.55 | 40.52 | 43.03 | 11.4 | 3.163 | ... | ... | — | — | 4.73 |

# MONTHLY METEOROLOGICAL REGISTER AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—JULY, 1857.

*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°. | | | | Temp. of the Air. | | | | Mean Temp. + or − of the Average | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Result'l. Direction. | Direction of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M. | 2 P.M. | 10 P.M. | M'N | | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 P.M. | 10 P.M. | Result. | M'N | | |
| | | | | | ° | ° | ° | ° | | | | | | | | | | | | | | | | | | | | |
| 1 | 29.396 | 29.495 | 29.568 | 29.4963 | 52.4 | 67.1 | 54.6 | 51.65 | −10.12 | .313 | .384 | .316 | .360 | 88 | 84 | 85 | 86 | E N E | E b N | N E b E | N 66 E | 5.4 | 15.5 | 16.2 | 13.92 | 14.08 | 0.030 | ... |
| 2 | .644 | .720 | .720 | .7042 | 54.1 | 69.2 | 53.4 | 56.45 | − .55 | 352 | 334 | 302 | 329 | 86 | 64 | ... | 74 | N E b E | E | E N E | N 76 E | 14.4 | 11.0 | 1.5 | 6.06 | 6.15 | Inap | ... |
| 3 | .678 | .626 | .619 | .6400 | 55.0 | 67.0 | 59.7 | 61.68 | − 3.47 | 342 | 371 | 329 | 359 | 81 | 57 | 65 | 67 | Calm. | S S W | S W b S | S 55 W | 0.0 | 5.2 | 1.5 | 1.45 | 3.93 | ... | ... |
| 4 | .667 | .672 | .718 | .6875 | 58.3 | 69.5 | 61.3 | 63.82 | − 1.48 | 339 | 488 | 475 | 451 | 71 | 70 | 90 | 78 | N b W | S S W | N N W | N 74 W | 1.0 | 7.5 | 7.9 | 2.75 | 5.48 | ... | ... |
| 5 | .790 | .783 | — | — | 60.0 | 70.2 | — | — | — | 311 | 432 | — | — | 61 | 60 | — | — | N N W | S W b S | S b W | S 30 W | 6.1 | 7.0 | 1.5 | 1.81 | 3.41 | Inap | ... |
| 6 | .756 | .705 | .730 | .7043 | 59.7 | 71.5 | 58.1 | 64.12 | − 1.48 | 341 | 431 | 409 | 403 | 68 | 57 | 84 | 70 | E S E | S E | Calm. | S 69 E | 4.4 | 6.0 | 0.0 | 2.61 | 2.69 | ... | ... |
| 7 | .620 | .545 | .638 | .6010 | 61.3 | 76.9 | 65.9 | 67.78 | + 2.08 | 473 | 580 | 519 | 537 | 90 | 65 | 81 | 82 | E b S | S W b S | N W b N | N 60 W | 2.0 | 8.2 | 6.0 | 3.21 | 7.14 | 0.215 | ... |
| 8 | .707 | .733 | .754 | .7350 | 60.7 | 69.7 | 61.3 | 64.92 | − 0.87 | 427 | 456 | 361 | 424 | 82 | 64 | 68 | 70 | N b W | S b E | W S W | S 27 W | 11.0 | 7.9 | 4.1 | 1.41 | 4.71 | ... | ... |
| 9 | .817 | .827 | .812 | .8227 | 61.0 | 74.5 | 60.5 | 66.42 | + 0.43 | 398 | 352 | 331 | 370 | 76 | 12 | 61 | 59 | N N W | E | N E | N 57 E | 0.5 | 8.5 | 3.4 | 3.07 | 5.15 | ... | ... |
| 10 | .827 | .815 | .801 | .8143 | 62.8 | 73.6 | 65.3 | 68.50 | + 2.42 | 366 | 531 | 478 | 463 | 65 | 66 | 78 | 68 | N | S | S E | S 41 E | 3.8 | 5.5 | 0.4 | 1.91 | 2.68 | ... | ... |
| 11 | .821 | .757 | .741 | .7667 | 66.4 | 80.8 | 69.5 | 72.77 | + 6.58 | 500 | 658 | 636 | 596 | 80 | 65 | 91 | 77 | Calm | S b E | Calm. | S 13 W | 0.0 | 4.6 | 0.0 | 1.76 | 2.43 | ... | ... |
| 12 | .751 | .701 | — | — | 67.8 | 84.8 | — | — | — | 570 | 674 | — | — | 87 | 58 | — | — | W b N | S b E | S E | S 26 W | 1.8 | 5.0 | 1.3 | 1.59 | 2.45 | ... | ... |
| 13 | .663 | .584 | .592 | .6138 | 70.2 | 85.0 | 73.1 | 76.43 | +10.05 | 609 | 701 | 630 | 649 | 85 | 60 | 86 | 74 | S E | S | S E | S 25 E | 1.0 | 6.0 | 1.0 | 2.88 | 3.05 | ... | ... |
| 14 | .585 | .523 | .509 | .5357 | 69.3 | 83.0 | 73.1 | 75.05 | + 8.63 | 580 | 693 | 618 | 629 | 84 | 63 | 73 | 75 | S E b E | E b S | N W | S 74 E | 1.5 | 2.7 | 0.2 | 2.10 | 2.85 | Inap | ... |
| 15 | .536 | .535 | .525 | .5258 | 71.1 | 81.2 | 69.7 | 73.83 | + 7.35 | 611 | 671 | 595 | 609 | 83 | 65 | 84 | 76 | Calm. | S E b S | N W b W | S 65 E | 0.0 | 3.5 | 0.4 | 0.37 | 1.57 | 0.515 | ... |
| 16 | .534 | .540 | .557 | .5463 | 67.7 | 76.9 | 68.6 | 71.15 | + 4.57 | 615 | 645 | 588 | 618 | 93 | 72 | 87 | 84 | N E E | N | E b S | N N E | 0.4 | 5.8 | 2.2 | 1.91 | 2.45 | Inap | ... |
| 17 | .592 | .548 | .504 | .5162 | 69.3 | 80.2 | 71.4 | 72.90 | + 6.22 | 612 | 733 | 649 | 657 | 88 | 73 | 87 | 81 | E | S S E | Calm. | S 70 E | 0.5 | 1.5 | 0.0 | 1.36 | 1.59 | Inap | ... |
| 18 | .496 | .493 | .442 | .4668 | 65.7 | 83.0 | 75.4 | 76.23 | + 9.57 | 595 | 696 | 699 | 679 | 97 | 63 | 82 | 78 | N E b N | S S W | S W b S | S 14 W | 0.8 | 1.8 | 5.4 | 2.65 | 2.93 | ... | ... |
| 19 | .355 | .272 | — | — | 71.8 | 81.4 | — | — | — | 674 | 715 | — | — | 89 | 69 | — | — | S W b S | S S W | S N W | S 44 W | 2.0 | 10.2 | 5.5 | 4.78 | 7.50 | 0.050 | ... |
| 20 | .312 | .255 | .268 | .2817 | 67.5 | 71.1 | 61.0 | 67.49 | + 0.63 | 574 | 574 | 489 | 533 | 87 | 77 | 91 | 82 | N W b N | S E b S | N W b N | N 31 W | 3.2 | 8.4 | 0.5 | 2.52 | 5.07 | 0.330 | ... |
| 21 | .291 | .297 | .324 | .3077 | 61.2 | 72.0 | 61.2 | 64.77 | − 2.09 | 461 | 517 | 455 | 478 | 88 | 86 | 80 | 80 | N W b N | S W b S | W b S | N 81 W | 5.5 | 8.0 | 4.5 | 3.28 | 5.91 | 0.065 | ... |
| 22 | .371 | .421 | .491 | .4367 | 60.3 | 72.2 | 65.1 | 65.50 | − 1.37 | 465 | 483 | 503 | 488 | 91 | 53 | 89 | 80 | N | E | E b S | W b S | N 81 E | 8.0 | 7.5 | 0.4 | 4.22 | 5.08 | ... | ... |
| 23 | .554 | .584 | .525 | .5495 | 65.7 | 67.1 | 64.2 | 65.93 | − 0.95 | 532 | 516 | 548 | 533 | 87 | 89 | 94 | 86 | N E b E | E S E | N N E | N 23 E | 8.4 | 7.2 | 9.5 | 6.75 | 7.38 | 0.655 | ... |
| 24 | .507 | .530 | .603 | .5530 | 62.4 | 70.0 | 65.0 | 65.22 | − 1.65 | 511 | 611 | 551 | 551 | 91 | 96 | 92 | 93 | E N E | S S W | S W b S | S 9 W | 7.0 | 7.2 | 0.4 | 1.81 | 3.38 | 0.115 | ... |
| 25 | .694 | .713 | .733 | .7187 | 63.1 | 77.3 | 66.9 | 69.73 | + 2.77 | 468 | 764 | 596 | 605 | 83 | 84 | 95 | 85 | S W b S | S b E | S b E | S 10 E | 3.0 | 6.0 | 1.6 | 3.05 | 3.25 | ... | ... |
| 26 | .764 | .735 | — | — | 63.5 | 80.8 | — | — | — | 508 | 721 | — | — | 89 | 71 | — | — | Calm. | S S E | E | S 61 E | 0.0 | 6.1 | 2.4 | 2.78 | 3.29 | ... | ... |
| 27 | .664 | .567 | .497 | .5670 | 68.8 | 82.3 | 75.1 | 76.15 | + 9.17 | 610 | 747 | 669 | 709 | 90 | 71 | 81 | 81 | E b N | S b W | S W b S | S 21 W | 2.8 | 15.4 | 5.5 | 8.07 | 8.61 | ... | ... |
| 28 | .447 | .524 | .622 | .5385 | 71.8 | 72.9 | 61.7 | 68.33 | + 1.37 | 659 | 528 | 413 | 533 | 87 | 67 | 77 | 77 | S W | N W b N | N W | N 18 W | 6.0 | 16.0 | 5.0 | 8.35 | 9.05 | 0.210 | ... |
| 29 | .719 | .705 | .708 | .7093 | 62.4 | 71.5 | 65.8 | 67.37 | + 0.42 | 453 | 490 | 477 | 477 | 82 | 65 | 77 | 73 | N W b N | S E b E | E b N | S 79 E | 1.2 | 9.0 | 3.2 | 3.12 | 4.37 | ... | ... |
| 30 | .646 | .587 | .515 | .5768 | 64.6 | 71.1 | 63.5 | 67.25 | + 0.30 | 545 | 413 | 508 | 512 | 92 | 56 | 89 | 79 | E b N | E | N E b E | N 79 E | 1.4 | 10.8 | 1.0 | 4.58 | 4.74 | ... | ... |
| 31 | .486 | .394 | .457 | .4447 | 67.3 | 73.9 | 69.1 | 65 27 | − 1.68 | 590 | 546 | 478 | 521 | 91 | 67 | 95 | 86 | N W b N | W S W | W N W | S 87 W | 3.5 | 7.4 | 3.8 | 2.93 | 4.66 | 1.260 | ... |
| M | 29.5940 | 29.5813 | 29.5890 | 29.5883 | 63.71 | 73.76 | 64.69 | 67.76 | + 1.51 | .495 | .552 | .505 | .520 | 85 | 67 | 83 | 78 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 3.51 | 7.48 | 3.12 | ... | 4.74 | 3.475 | ... |

Highest Barometer..... 29.848 at 8 a. m., on 10th } Monthly range=
Lowest Barometer ..... 29.255 at 2 p. m., on 20th } 0.593

Self-registing Thermom.
- Maximum Temperature.....86.°6 on p. m., of 13th } Monthly range=
- Minimum Temperature.....47°0 on a. m. of 2nd } 39.°6
- Mean maximum Temperature ..... 76°79 } Mean daily range=
- Mean minimum Temperature ..... 59°32 } 17.47
- Greatest daily range .....24°8 from p. m. of 31st to a. m. of 1st. August.
- Least daily range..... 8°2 from a. m. to p. m. of 23rd.

Warmest day..... 13th ... Mean temperature..... 76°43 } Difference = 21°78.
Coldest day..... 1st ... Mean temperature..... 54.65 }

Maximum Solar.....100°5 on p. m. of 18th, } Monthly range=
Radiation. Terrestrial..... 38°0 on a. m. of 2nd. } 62°5

Aurora observed on 5 nights, viz., 11th, 17th, 22nd, 25th and 28th.
Possible to see Aurora on 22 nights; impossible on 9 nights.

Raining on 15 days,—depth 3.475 inches; duration of fall 43.2 hours.

Mean of cloudiness = 0.46.
Most cloudy hour observed, 6 a. m., mean = 0.55; least cloudy hour observed. 10 p. m., mean, =0.30.

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*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 998.65 | 1227.18 | 1401.33 | 841.14 |

Resultant direction S. 68° E.; Resultant Velocity 0.81 miles per hour.
Mean velocity..... 4.74 miles per hour.
Maximum velocity ..... 17.4 miles from 4 to 5 p. m. on the 28th.
Most windy day..... 1st ...Mean velocity 14.08 miles per hour.
Least windy day ..... 17th...Mean velocity 1.50 ditto.
Most windy hour ... 3 to 4 p. m.....Mean velocity 7.40 ditto. } Difference
Least windy hour ... 9 to 10 p. m.....Mean velocity 2.89 ditto. } 4.51 miles.

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Thunderstorms occurred on the 7th, from 2.30 to 3.30 p.m.; 14th, from 6.30 to 8.30 p.m.; 15th, from 1.45 p.m., continuing most of the afternoon; 20th, from 11.15 a.m. to 5.30 p.m.; 21st, about 3 a.m.; 23rd, at 3 a.m., and on the 31st, from 3 to 4 p.m.

Lightning occurred on the 12th at 10 p.m.; 13th, from 10 to 11 p.m.; 17th, at 10 p.m.; 19th, at 9.30 p.m.; 21st, during the evening; 27th, at midnight, and on the 30th at 9 and 10 p.m.

Meteors numerous on the evenings of the 16th, 24th, and 25th.

Fire Flies very numerous on the 15th, from 9 to 11 p.m. Splendid Rainbow on the 19th at 6 p.m. Very heavy Dew on the 26th at 6 a.m. Halo round the moon at 9.30 p.m. on 27th.

Rain.—The number of days on which rain fell was greater than in any previous July, but the depth on the surface was .087 inches below the average.

Wind.—The resultant direction and velocity for July, from 1848 to 1857 inclusive, were S. 81 W., and 0.20 miles per hour.

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COMPARATIVE TABLE FOR JULY.

| YEAR. | TEMPERATURE. M'n. | Diff. from Aver. | Max. ob'd. | Min. ob'd. | Range. | RAIN. No. of days. | Inch's. | SNOW. No. of days. | Inch's. | WIND. Resultant. Direction. | V'y. | Mean Force or Velocity. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | | | | | | | |
| 1840 | 65.8 | —1.2 | 79.4 | 48.2 | 31.2 | 6 | 5.270 | ... | ... | ... | ... | ..... |
| 1841 | 65.0 | —2.0 | 86.3 | 43.2 | 43.1 | 10 | 8.150 | ... | ... | ... | ... | 0.27 lbs. |
| 1842 | 64.7 | —2.3 | 90.5 | 42.0 | 48.5 | 4 | 3.050 | ... | ... | ... | ... | 0.33 |
| 1843 | 64.5 | —2.5 | 86.1 | 40.2 | 45.9 | 8 | 4.605 | ... | ... | .. | ... | 0.44 |
| 1844 | 66.0 | —1.0 | 86.1 | 40.5 | 45.6 | 12 | 2.815 | ... | ... | ... | ... | 0.19 |
| 1845 | 66.2 | —0.8 | 94.6 | 45.6 | 49.0 | 7 | 2.195 | ... | ... | ... | ... | 0.30 |
| 1846 | 68.0 | +1.0 | 94.0 | 44.9 | 49.1 | 9 | 2.895 | ... | ... | ... | ... | 0.29 |
| 1847 | 68.0 | +1.0 | 87.5 | 43.8 | 43.7 | 8 | 3.355 | ... | ... | ... | ... | 0 19 |
| 1848 | 65.5 | —1.5 | 82.7 | 46.7 | 36.0 | 10 | 1.890 | ... | ... | N 14° W | 0.18 | 4.94 miles |
| 1849 | 68.4 | +1.4 | 89.1 | 51.0 | 38.1 | 4 | 3.415 | ... | ... | S 5° W | 0.76 | 3.52 |
| 1850 | 68.9 | +1.9 | 84.9 | 52.8 | 32.1 | 12 | 5.270 | ... | ... | N 81° E | 0.59 | 4.56 |
| 1851 | 65.0 | —2.0 | 82.7 | 52.1 | 30.6 | 12 | 3.625 | ... | ... | N 60° W | 0.88 | 4.13 |
| 1852 | 66.8 | —0.2 | 90.1 | 49.5 | 40.6 | 8 | 4.025 | ... | ... | N 43° W | 0.93 | 3.33 |
| 1853 | 65.6 | —1.4 | 85.4 | 49.4 | 36.0 | 10 | 0.915 | ... | ... | S 76° E | 0.21 | 3.70 |
| 1854 | 72.5 | +5.5 | 93.6 | 53.0 | 40.6 | 9 | 4.805 | ... | ... | S 38° W | 0.34 | 4.26 |
| 1855 | 67.9 | +0.9 | 88.4 | 53.1 | 35.3 | 13 | 3.245 | ... | ... | S 19° W | 0.73 | 6.47 |
| 1856 | 69.9 | +2.9 | 92.0 | 51.4 | 40.6 | 8 | 1.120 | ... | ... | N 79° W | 1.57 | 5.84 |
| 1857 | 67.8 | +0.8 | 85.4 | 52.4 | 33.0 | 15 | 3 475 | ... | ... | S 68° E | 0.81 | 4.74 |
| M | 67.03. | ... | 87.71 | 47.77 | 39.94 | 9.2 | 3.562 | ... | ... | ... | ... | 4.55miles |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JUNE, 1857.

(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 | 29.522 | 29.344 | 29.439 | 51.1 | 80.1 | 60.6 | .361 | .648 | .499 | .93 | .64 | .95 | NE by E | S by E | S S W | 0.40 | 0.43 | S.37 | ... | 0.200 | ... | Clear. | C. C. Str. 6. | C. Str. 8. |
| 2 | .454 | .254 | .433 | 60.1 | 75.5 | 58.6 | .467 | .667 | .359 | .89 | .71 | .73 | S W by S | S S E | W S W | 6.01 | 2.16 | 12.50 | ... | ... | ... | Cum. Str. 4. | Do. 4. | Clear. |
| 3 | .352 | .319 | .359 | 57.0 | 66.0 | 56.6 | .345 | .416 | .385 | .72 | .65 | .84 | W S W | W S W | S W | 12.10 | 10.50 | 4 02 | ... | Imp. | ... | Do. 2 | Cir. Str. 6. | Cir. Str. 4. |
| 4 | .414 | .502 | .626 | 51.0 | 57.0 | 44.5 | .293 | .355 | .234 | .77 | .74 | .74 | W | W N W | W by S | 0.53 | 16.57 | 9.00 | ... | ... | ... | Clear. | Do. 8. | Clear. F. Au. |
| 5 | .661 | .614 | .560 | 40.5 | 62.3 | 46.6 | .227 | .397 | .226 | .85 | .71 | .70 | N W by W | W by S | W by S | 2 08 | 12.22 | 10.11 | ... | ... | ... | Do. | Do. 6. | C. Str. 4. |
| 6 | .528 | .514 | .437 | 52.2 | 62.3 | 46.2 | .304 | .397 | .291 | .76 | .71 | .89 | W S W | W by S | W | 1.32 | 5.60 | 8.90 | ... | 0.566 | ... | Do. | Do. 4. | Nimb. 10. Ra. |
| 7 | .409 | .420 | .535 | 50.0 | 72.1 | 54.2 | .304 | .473 | .326 | .81 | .61 | .79 | W | W S W | S by W | 0 01 | 0.48 | 0.21 | ... | 0.266 | ... | Do. | Do. 4. | Clear. |
| 8 | .650 | .714 | .796 | 57.0 | 75.1 | 67.5 | .376 | .498 | .366 | .79 | .58 | .55 | W S W | S | S | 0.00 | 0.00 | 0.00 | ... | .. | ... | Do. | Clear. | C. Str. 2. |
| 9 | .712 | .764 | .793 | 55.7 | 78.5 | 62.0 | .351 | .498 | .421 | .79 | .52 | .75 | E | S S E | S S E | 0.00 | 7.56 | 5.49 | ... | ... | ... | C. Str. 4. | C. C. Str. 4. | Do. 6. |
| 10 | .656 | .546 | .515 | 64.1 | 85.5 | 66.5 | .504 | .692 | .544 | .84 | .58 | .85 | S by W | S | S | 0.10 | 0.45 | 0.20 | ... | ... | ... | C. C. Str. 6. | Cirr. 2. | Str. 2. |
| 11 | .348 | .211 | 28.937 | 60.0 | 62.0 | 58.0 | .494 | .528 | .492 | .94 | .91 | .96 | S S E | E S E | S S E | 0.22 | 0.75 | 3.73 | ... | 1.753 | ... | Rain. | Rain. | Rain. |
| 12 | .017 | .163 | 29.259 | 57.5 | 66.1 | 58.5 | .447 | .464 | .437 | .94 | .72 | .89 | W N W | W N W | S W by W | 5.85 | 18.76 | 8.12 | ... | 0.583 | ... | Do. | C. C. Str. 6. | Str. 8. |
| 13 | .317 | .305 | .399 | 54.3 | 73.4 | 52.5 | .349 | .541 | .373 | .81 | .67 | .93 | S S E | W by S | N W | 1.98 | 5.10 | 6.03 | ... | 0.351 | ... | C. Str. 10. | C. Str. 4. | Clear. Thund. |
| 14 | .520 | .639 | .751 | 51.0 | 62.5 | 50.1 | .515 | .421 | .309 | .82 | .75 | .81 | W N W | N W | N by W | 15.22 | 19.77 | 11.17 | ... | ... | ... | Str. 4. | Do. 6. | Do. |
| 15 | .793 | .734 | .745 | 48.7 | 67.7 | 54.6 | .281 | .431 | .349 | .80 | .65 | .81 | N W by W | N W by N | N E by E | 2.80 | 3.01 | 7.70 | ... | ... | ... | Clear. | Clear. | Do. |
| 16 | .813 | .713 | .720 | 51.6 | 65.1 | 53.6 | .293 | .425 | .361 | .76 | .68 | .87 | N E by E | W by S | W | 1.67 | 0.27 | 0.33 | ... | ... | ... | Str. 2. | C. C. Str. 8. | Str. 4. |
| 17 | .692 | .705 | .707 | 51.6 | 58.1 | 53.6 | .337 | .462 | .386 | .87 | .91 | .93 | E by N | S S E | S E | 0.13 | 12.12 | 0.30 | ... | 0.478 | ... | C. Str. 10. | Rain. | Cir. Str. 8. |
| 18 | .630 | .629 | .625 | 53.5 | 59.7 | 55.6 | .394 | .452 | .432 | .96 | .89 | .93 | S S E | E S E | E S E | 5.47 | 7.05 | 3.55 | ... | 0.389 | ... | Rain. | Do. | C. Str. 10. |
| 19 | .565 | .546 | .634 | 57.3 | 72.1 | 60.9 | .447 | .638 | .519 | .91 | .82 | .91 | S S E | S by W | S S W | 2.77 | 3.23 | 8.47 | ... | Imp. | ... | C. Str. 4. | C. Str. 10. | Do. 8. |
| 20 | .656 | .669 | .521 | 65.0 | 78.1 | 65.7 | .560 | .578 | .555 | .90 | .61 | .85 | W by N | W S W | E N E | 1.13 | 3 02 | 1.05 | ... | 0.136 | ... | Cir. Str. 10. | Cum. 1. | Do. 9. |
| 21 | .563 | .818 | .656 | 62.0 | 72.3 | 61.1 | .445 | .555 | .456 | .79 | .71 | .81 | W by S | W by S | S W | 10.22 | 6.72 | 3.41 | ... | 0.186 | ... | Cum. 4. | C. C. Str. 2. | Cir. Au. Bor. |
| 22 | .565 | .514 | .446 | 56.9 | 72.5 | 59.0 | .449 | .550 | .479 | .96 | .71 | .95 | E by S | E by S | N E by N | 0 01 | 4.01 | 3.03 | ... | 0.183 | ... | C. Str. 10. | Do. 4. | Rain. |
| 23 | .425 | .597 | .663 | 56.5 | 63.1 | 55.0 | .432 | .461 | .372 | .94 | .79 | .81 | N N W | N W by W | N W by W | 15.75 | 19.00 | 15.70 | ... | 1.230 | ... | Rain. | Cir. Str. 8. | Cir. Str. 10. |
| 24 | .625 | .714 | .729 | 50.0 | 71.6 | 63.1 | .314 | .532 | .461 | .83 | .70 | .79 | N W by W | N W by W | W by N | 14.96 | 8.36 | 17.32 | ... | ... | ... | Clear. | Clear. | Clear. |
| 25 | .624 | .622 | .627 | 60.0 | 71.7 | 64.5 | .416 | .588 | .504 | .79 | .78 | .84 | S W by S | W by S | N W | 5.10 | 1.96 | 24.07 | ... | Imp. | ... | C. C. Str. 6. | Cir. Str. 4. | C. Str. 4. D. Th. |
| 26 | .612 | .615 | .701 | 62.0 | 74.8 | 61.5 | .445 | .532 | .362 | .79 | .64 | .66 | N N W | N W | N W by W | 0.30 | 8.80 | 9.08. | ... | ... | ... | Clear. | Clear. | Str. 4. |
| 27 | .695 | .680 | .812 | 57.0 | 83.3 | 65.6 | .376 | .681 | .527 | .79 | .61 | .85 | N W | S W | S | 0.87 | 4.72 | 1.52 | ... | ... | ... | Do. | Do. | Clear. |
| 28 | .831 | .767 | .779 | 60.6 | 83.4 | 64.6 | .416 | .617 | .476 | .79 | .56 | .79 | E S E | S E by E | S E | 2.13 | 3.26 | 0.46 | ... | ... | ... | Do. | Do. | Do. |
| 29 | .655 | .608 | .640 | 60.1 | 78.9 | 64.0 | .381 | .578 | .476 | .73 | .61 | .79 | E | E | E N E | 4.85 | 8.81 | 8.17 | ... | ... | ... | Do. | Str. 4. | C. Str. 8. |
| 30 | .709 | .646 | .567 | 63.0 | 64.0 | 57.5 | .435 | .476 | .447 | .75 | .79 | .93 | S S E | S S E | S E by E | 5.17 | 7.43 | 1.21 | ... | 0.130 | ... | C. Str. 8. | C. Str. 10. | Do. 10. |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JULY, 1857.

(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. | | | 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 | 29.670 | 29.712 | 29.846 | 77.3 | 70.0 | 58.0 | .447 | .628 | .462 | .94 | .86 | .94 | S E b S | S S E | S S E | 2.86 | 1.40 | 2.68 | ... | 0.066 | ... | C. Str. 10. | C. Str. 4. | C. St. S. |
| 2 | 29.941 | 30.000 | 29.948 | 63.0 | 80.0 | 60.0 | .461 | .681 | .467 | .79 | .68 | .88 | S S E | S by E | S | 0.27 | 2.09 | 0.23 | ... | ... | ... | Do. 2. | Clear. | Do. 2. |
| 3 | .909 | 29.814 | .728 | 59.0 | 80.0 | 66.8 | .426 | .588 | .456 | .84 | .58 | .84 | W S W | S by W | S by W | 0.10 | 2.97 | 1.71 | ... | ... | ... | Clear. | C. Str. 2. | Do. 2. |
| 4 | .726 | .712 | .862 | 60.5 | 78.9 | 52.0 | .441 | .492 | .393 | .84 | .52 | .76 | W N W | W N W | N W | 1.76 | 6.26 | 6.33 | ... | ... | ... | Cirr. 2. | Clear. | Clear. |
| 5 | .912 | .885 | .994 | 44.6 | 80.5 | 61.5 | .241 | .588 | .456 | .79 | .58 | .84 | S S E | W | S W | 0.07 | 0.06 | 0.07 | ... | ... | ... | Clear. | Do. | Do. |
| 6 | .883 | .872 | .755 | 50.8 | 85.1 | 66.5 | .319 | .628 | .544 | .93 | .53 | .85 | S W | W b S | S W b S | 0.01 | 0.22 | 0.67 | ... | ... | ... | C. C. Str. 4. | C. Str. 2. | Do. |
| 7 | .638 | .615 | .667 | 65.8 | 74.1 | 62.9 | .499 | .681 | .445 | .80 | .82 | .79 | W S W | S W b W | W by E | 3.13 | 12.20 | 8.91 | ... | 1mapp | ... | Ligt. Cirri. | C. Str. 10. | Do. |
| 8 | .862 | .794 | .738 | 55.5 | 81.7 | 62.0 | .331 | .638 | .397 | .74 | .61 | .71 | N W b W | N W b N | S W b W | 7.73 | 1.83 | 8.40 | ... | ... | ... | Clear. | Clear. | Do. |
| 9 | .956 | .934 | .968 | 60.9 | 84.5 | 64.4 | .371 | .638 | .504 | .71 | .56 | .84 | S W | S W | S W | 0.20 | 0.15 | 1.80 | ... | ... | ... | Do. | C. C. Str. 4. | Str. 4. |
| 10 | .853 | .905 | .967 | 60.0 | 85.5 | 68.5 | .491 | .692 | .613 | .90 | .58 | .85 | S by E | S W | S S E | 0.22 | 2.83 | 0.01 | ... | ... | ... | C. Str. 6. | C. Str. S. | Cirr. 1. |
| 11 | .898 | .885 | .802 | 64.9 | 93.4 | 73.6 | .527 | .854 | .628 | .85 | .53 | .78 | W S W | W S W | S W b S | 0.23 | 0.85 | 4.43 | ... | ... | ... | Clear. | Clear. | Clear F. Aur. Bor. |
| 12 | .805 | .744 | .777 | 74.1 | 90.0 | 72.4 | .648 | .776 | .670 | .78 | .56 | .85 | S W b W | W | E | 0.63 | 0.77 | 1.23 | ... | ... | ... | Do. | C. St. 9. | C. C. Str. D. Thun. |
| 13 | .772 | .725 | .730 | 77.6 | 88.6 | 76.0 | .681 | .925 | .727 | .74 | .71 | .82 | S S W | S S W | S b W | 0.12 | 1.38 | 0.41 | ... | ... | ... | Fog. | C. C. St. S. | Dis. Thun. Clear. |
| 14 | .828 | .772 | .697 | 74.0 | 97.6 | 73.4 | .681 | .986 | .692 | .82 | .51 | .83 | S S W | S by W | S b W | 0.10 | 2.43 | 0.32 | ... | ... | ... | Clear. | C. St. 6. | Clear. |
| 15 | .714 | .666 | .702 | 77.1 | 94.3 | 73.5 | .648 | 1.136 | .692 | .71 | .68 | .86 | S W | S by E | S W b W | 0.22 | 3.13 | 4.40 | ... | ... | ... | Do. | C. St. 4. | C. St. 4 L't in NW. |
| 16 | .711 | .709 | .740 | 75.1 | 90 0 | 67.8 | .670 | .896 | .646 | .78 | .65 | .94 | S b W | S by W | S | 0.08 | 0.89 | 3.10 | ... | 0.180 | ... | Do. | C. C. St. Th. | C. Str. 10. |
| 17 | .711 | .704 | .725 | 69.5 | 86.0 | 71.6 | .668 | .955 | .715 | .92 | .78 | .94 | S E b E | W S W | N E b N | 0.83 | 0.83 | 7.83 | ... | 0.499 | ... | Rain. | C. St. 10. | Do. 9. |
| 18 | .666 | .570 | .607 | 66.4 | 92.3 | 73.6 | .605 | .896 | .727 | .91 | .59 | .90 | S | W by S | S S W | 0.10 | 0.13 | 1.80 | ... | ... | ... | C. Str. 9. | C. C. St. 4. | Clear. |
| 19 | .526 | .518 | .471 | 73.0 | 70.3 | 70.4 | .692 | .715 | .715 | .86 | .91 | .93 | S W | N by W | S | 1.10 | 3.05 | 4.40 | ... | 1.056 | ... | D. S. Thunder. | Rain. | Str. 3. |
| 20 | .438 | .431 | .492 | 74.2 | 79.0 | 68.8 | .715 | .763 | .646 | .86 | .78 | .91 | S W b W | S W b W | S by W | 6.66 | 1.03 | 0.10 | ... | ... | ... | C. to 10. | C. St. 10. | C. C. Str. 4. |
| 21 | .476 | .514 | .475 | 66.1 | 73.0 | 67.0 | .574 | .327 | .626 | .89 | .90 | .94 | N E by E | E S E | E N E | 0.52 | 4.12 | 1.06 | ... | 0.800 | ... | Do. | Do. 9. | Do. 4. Thunder. |
| 22 | .556 | .610 | .782 | 68.0 | 71.8 | 58.0 | .650 | .588 | .412 | .96 | .78 | .81 | E N E | E N E | E N E | 7.16 | 12.92 | 15.40 | ... | ... | ... | Do. 10. | Do. 4. | Do. 9. |
| 23 | .820 | .826 | .814 | 57.0 | 86.4 | 59.0 | .376 | .698 | .478 | .79 | .53 | .95 | N E by E | N E by E | E b N | 20.56 | 13.70 | 12.56 | ... | 1.106 | ... | Do. 10. | C C. St. S. | Cir. Str. 10. |
| 24 | .786 | .787 | .747 | 60.7 | 63.5 | 63.0 | .411 | .578 | .546 | .84 | .96 | .94 | E by N | N W b W | S E b E | 5.47 | 2.07 | 1.48 | ... | 0.096 | ... | Cir. Str. 4. | Rain. | Str. 4. |
| 25 | .812 | .793 | .849 | 62.2 | 81.0 | 68.0 | .528 | .739 | .613 | .94 | .71 | .89 | S | W S W | S W | 1.17 | 5.92 | 2.12 | ... | 0.170 | ... | Cir. Str. 9. | Cir. Str. 4. | Str. 4. Thunder. |
| 26 | .882 | .787 | .861 | 69.5 | 89.0 | 70.6 | .634 | .868 | .628 | .90 | .65 | .86 | S W b W | W S W | S W b S | 5.25 | 7.17 | 2.22 | ... | ... | ... | Str. 2. | Do. 4. | Clear. |
| 27 | .843 | .754 | .704 | 68.6 | 92.0 | 72.7 | 613 | .670 | .701 | .89 | .44 | .90 | S W b S | S W | S S W | 0.65 | 2.36 | 0.28 | ... | ... | ... | Clear. | Do. 2. | Str. 4. |
| 28 | .557 | .612 | .726 | 75.5 | 79.7 | 66.7 | .739 | .628 | .574 | .86 | .64 | .89 | S W b S | S W b S | S W b S | 3.45 | 6.40 | 12.73 | ... | 1mapp | ... | C. to 6. | Do. 4. | C. C. Str. 4. |
| 29 | .754 | .799 | .963 | 59.3 | 74.1 | 64.8 | .478 | .617 | .551 | .93 | .74 | .89 | N N W | N W | S W | 5.92 | 3.25 | 0.01 | ... | ... | ... | Clear. | Do. 2. | Clear. |
| 30 | .947 | .836 | .855 | 62.0 | 83.0 | 64.0 | .528 | .617 | .534 | .93 | .56 | .89 | S E | S S E | S | 1.14 | 4.22 | 3.07 | ... | ... | ... | Do. | C. C. Str. 4. | Cirr. Str. 4. |
| 31 | .731 | .614 | .548 | 63.0 | 70.9 | 63.3 | .516 | .715 | .546 | .89 | .71 | .94 | S S E | S by E | S b E | 6.12 | 6.47 | 9.31 | ... | 0.902 | ... | C. C to S. | C. St. 6. | Cirr. Str. 10. |

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

| | | |
|---|---|---|
| Barometer..... | Highest, the 21st day | 29.818 |
| | Lowest, the 11th | 28.937 |
| | Monthly Mean | 29.615 |
| | Monthly Range | 0.881 |
| Thermometer... | Highest, the 10th day | 85°.9 |
| | Lowest, the 6th day | 39°.2 |
| | Monthly Mean | 61°44 |
| | Monthly Range | 46°7 |
| Greatest intensity of the Sun's Rays | | 121°.9 |
| Lowest point of Terrestial Radiation | | 36°.1 |
| Mean of Humidity | | .786 |
| Amount of Evaporation | | 3.430 |

Rain fell on 16 days amounting to 6.212 inches; it was raining 61 hours 58 minutes, and was accompanied by thunder on two days.

The most prevalent wind was the W by S.

The least prevalent wind E.

The most windy day the 23rd; mean miles per hour 16.81.

Least windy day the 8th: mean miles per hour 0.00.

The Aurora Borealis visible on 2 nights.

The electrical state of the Atmosphere has indicated moderate intensity.

Ozone was in moderate quantity.

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

| | | |
|---|---|---|
| Barometer ..... | Highest the 2nd day | 30.000 |
| | Lowest the 20th day | 29.431 |
| | Monthly Mean | 29.754 |
| | Monthly Range | 0.569 |
| Thermometer..... | Highest the 14th day | 98°7 |
| | Lowest the 8th day | 46°.8 |
| | Monthly Mean | 71°57 |
| | Monthly Range | 41°9 |
| Greatest Intensity of the Sun's Rays | | 122°0 |
| Lowest Point of Terrestrial Radiation | | 44°.6 |
| Mean of Humidity | | .800 |
| Amount of Evaporation | | 2.85 |

Rain fell on 11 days, amounting to 5.755 inches; it was raining 29 hours and 57 minutes and was accompanied by thunder on 7 days.

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

Most windy day, the 23rd day; mean miles per hour, 15.60.

Least windy day, the 5th day; mean miles per hour, 0.06.

Aurora Borealis visible on 1 night.

The electrical state of the atmosphere has indicated constant and high tension.

Ozone was in small quantity.

## ABSTRACT OF METEOROLOGICAL REGISTER, KINGSTON, CANADA WEST, 1856.

*Latitude, 44 deg. 13.30 min. North. Longitude, 76 deg. 30. min. West. Height above Sea 280 Feet.*

| 1856. | Barometer at 32° corrected. | | Thermom. | | Thermom. during 24 hours. | | Tension of Vapor. | | Humidity. | | Clouds. | | Direction of Wind. | | Pressure in lbs. avoirdupois. | | Rain in inches. | Snow in inches. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 9 A.M. | 3 P.M. | 9 A.M. | 3 P.M. | Max. | Min. | 9 A.M. | 3 P.M. | 9 A.M. | 3 P.M. | 9 A.M. | 3 P.M. | 9 A.M. | 3 P.M. | 9 A.M. | 3 P.M. | | | |
| January.... | 29.689 | 29.624 | 12.9 | 18.4 | 20.0 | 7.9 | .086 | .102 | .786 | .803 | 6.5 | 6. | N W | N W | .66 | .56 | ..... | 17.0 | Bay frozen over on 4th January. |
| February.. | 29.510 | 29.479 | 13.6 | 21.0 | 23.0 | 8.6 | .082 | .094 | .744 | .740 | 5.4 | 5.6 | N N W | W S W | .66 | .84 | ..... | 2.5 | |
| March ..... | 29.582 | 29.561 | 20.9 | 27.5 | 28.3 | 14.8 | .100 | .127 | .729 | .759 | 4.9 | 4.7 | N N W | W S W | 66 | .8 | ..... | 18.0 | Ice in Bay broken up on 11th April. |
| April..... | 29.688 | 29.624 | 41.4 | 43.7 | 49.8 | 34.0 | .221 | .271 | .803 | .747 | 5.6 | 5.2 | S S W | S S W | .542 | .546 | .86 | ..... | |
| May ..... | 29.666 | 29.586 | 51.0 | 55.7 | 62.6 | 42.4 | .304 | .357 | .776 | .780 | 6.1 | 5.01 | N E | S W | .492 | .5 | 4.04 | ..... | Steamer St. Lawrence went down the river on the 17th. |
| June..... | 29.593 | 29.548 | 62.7 | 68.2 | 70.89 | 55.64 | .447 | .407 | .813 | .707 | 5.63 | 5.7 | S W by S | S S W | .33 | .38 | 1.84 | ..... | |
| July ..... | 29.657 | 29.596 | 71.7 | 78.16 | 77.6 | 64.5 | .600 | .738 | .866 | .769 | 4.6 | 4.36 | S S W | S W | .16 | .132 | 1.245 | ..... | |
| August..... | 29.594 | 29.544 | 66.2 | 71.1 | 72.9 | 60.7 | .587 | .629 | .877 | .865 | 5.3 | 6.5 | S W | S S W | .28 | .475 | 2.048 | ..... | Steamer Kingston left for Toronto on the 22nd. |
| September. | 29.674 | 29.588 | 58.8 | 64.6 | 67.7 | 52.9 | .441 | .509 | .884 | .868 | 5.46 | 5.8 | S W | S W | .316 | .663 | 4.512 | ..... | |
| October.... | 29.748 | 29.724 | 46.7 | 52.1 | 55.0 | 41.2 | .306 | .346 | .920 | .909 | 5.0 | 4.5 | S W | S W | .371 | .37 | .71 | ..... | |
| November. | 29.712 | 29.655 | 35.9 | 38.7 | 42.0 | 30.5 | .207 | .224 | .902 | .887 | 7.0 | 8.4 | N W | W | .64 | .8 | .64 | ..... | |
| December.. | 29.747 | 29.634 | 16.82 | 22.14 | 28.29 | 12.37 | .099 | .116 | .761 | .816 | 6.35 | 6.65 | W N W | W | .854 | 1.018 | .854 | ..... | Total rain in inches 17.965; snow 37.5, or taking 6 in. of snow, 1 in. of rain, 24.155 inches of rain. |
| Means ..... | 29.655 | 29.597 | 41.55 | 46.77 | 49.83 | 35.46 | .290 | .331 | .822 | .804 | 5.65 | 5.7 | | | .497 | .592 | 17.905 | 37.5 | |
| Gen. Means | 29.626 | | 44.16 | | 42.14 | | | .310 | | .813 | 5.67 | | | | | .544 | | | |

Barometer maximum, December 18th,..... 30.526
Do minimum, December 14th,..... 28.610
Thermometer maximum, August 2nd,..... 88.5
Do minimum, February 13th, ..... 18.9
Maximum wind, November 12th, ..... 12¼ lbs. per square foot.
Prevailing winds S.W. in summer, N.W. and N.E. in winter.
Thunder and lightning on twelve days.

University of Queen's College, Kingston, 10th August, 1857.